Dr. Chunmei Wang
Texas Tech

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

MAR 2 2 2019

[redacted]

Subject: Recommendation to Terminate NSF Award DMS-1905195 to Texas Tech University (OIG Case I-16-0064-O)

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I. INTRODUCTION

OIG recommends that NSF terminate award DMS-1905195 to Texas Tech University (Texas Tech), which has been in effect as a transfer award since October 5, 2018. The original award, DMS-1522586, was made to Georgia Institute of Technology (Georgia Tech) on July 22, 2015 in the amount of $98,621 with Dr. Chunmei Wang as the PI, for research on "Innovative Weak Galerkin Finite Element Methods with Application in Fluorescence Tomography." On May 16, 2016, the award was subsequently transferred to Texas State University (TSU) as DMS-1648171, with Dr. Wang continuing as the PI and with an unexpended amount of $63,998. A remaining award balance of $14,549.21 was transferred to Texas Tech on October 5, 2018. To date, award DMS-1905195 maintains an unexpended amount of $14,204.84.

As set forth below, OIG has obtained evidence that Dr. Wang applied for and received award funding for three awards through her affiliation with Nanjing Normal University (NJNU) in China. The three Chinese awards, which were not disclosed to NSF or Georgia Tech, remained active between June 2015 and July 2018, while NSF awards DMS-1522586 and DMS-1648171 were also in effect (July 2015- to September 2018). Our investigation revealed that the research funded by the foreign entities was largely duplicative of the research funded by Dr. Wang's NSF award.

II. OIG INVESTIGATION

We initiated our case to investigate whether Dr. Wang's Chinese awards duplicated the research under her NSF award. As part of our investigation, we contacted Dr. Wang and learned that she received three awards through her affiliation with NJNU in China:

- National Natural Science Foundation of China (NSFC) BK20150538 (proposed March 2015, awarded June 2015, through June 2018; 180,000 renminbi; topic "Study on weak finite element method of fluorescence molecular tomography model and its application")
- NSFC 11526113 (2016 Tian Yuan Special Fund of NSFC) (proposed February 2015, awarded December 2015, through December 2016; 30,000 renminbi; topic "A Weak Finite Element Method for the Bi-elliptic Equation")
- Jiangsu Key Lab for NSLCS 201602 (proposed November 2015, awarded December 2015, through December 2017; 30,000 renminbi; topic "Research on the weak finite element method for solving the problem of elastic interface")

Our comparison of the award periods for these awards with that of DMS-1522586 (July 2015-August 2016), and the apparent similarity of the research topics, lent credence to the allegation. When we inquired about the similarities, Dr. Wang stated:

> "I just explained to you about my NSF grant, and then in the China grant, it is, it is still doing research about the model arising from fluorescent tomography, but the difference is very big. The difference is in the NSF grant, grant, I need to do the inverse problem using the method, OSKCA method, to use, to use the OSKCA method to solve the inverse problem. So this is my NSF grant. And – but in China, that grant was [inaudible in transcript] on fast dissolver because I still need something about fast dissolver because I, I do have some pub-publication about fast dissolver. So they both use the same model, but the materials are different."

Elsewhere, she stated:

> "The overlap is they are the same model. I'm using the sa- - they are – we are all doing research for the fluorescent tomography model. That's the overlap. But what I'm doing is different."

To more fully address our concerns regarding duplicative funding, we asked Dr. Wang to provide documentation related to her three foreign awards. We then enlisted the assistance of an NSF subject matter expert with fluency in reading Mandarin Chinese. In reviewing the award documents for NSF DMS-1522586 and NSFC Award BK20150538, the expert determined the following:

> "The primary focus of the two proposals are [*sic*] identical. The goals are identical with slightly different three-year research plan. The NSF proposal has more details about mathematics and FT model. The Chinese proposal is shorter due to page limit. The NSF proposal mentions adding correction function in the kernel space so that the final solution of the FT model fulfills other regularity and physical requirements, which is not explicitly

> mentioned in the Chinese proposal. However, OSKCA stands for Orthogonal Solution and Kernel Correction Algorithm. So kernel correction has to be considered in the Chinese proposal approach as well."

Based on these findings, we requested further expert review of award documents for NSF DMS-1522586 and NSFC 11526113 (2016 Tian Yuan Special Fund of NSFC). The expert provided the following analysis:

> "The goals of the two proposals (NSFC and DMS-1522586) are very similar, although the deliverables in the NSFC proposal are a subset of the those in DMS-1522586. For example, developing a software package is one of the aims in DMS-1522586, but it is not mentioned in the NSFC proposal. The NSFC proposal is for one year with the following plan, which is a part of the plan of DMS-1522586:
>
> First half of the year: Design WG algorithm for solving the bielliptic differential equation; provide stability and convergence analysis; propose hybrid WG algorithm.
>
> Second half of the year: Study WG/HWG algorithm using domain decomposition (FETI-DP and multi-grid) for fast and stable numerical method to improve the computation time for FT application. The PI will collaborate with [redacted], and [redacted] at GTech to combine WG method and [OSKCA] for FT."

According to our expert, the research projects in DMS-1522586, BK20150538, and 11526113 are either identical or so similar as to constitute the same research, meaning NSF funded a level of research effort without the opportunity to adjust that funding in light of outside support for the same research. Most of the original funding for DMS-1522586 has been spent during the life of the award at Georgia Tech, TSU, and Texas Tech, and it would he impractical to attempt to recover funds already expended as the award made its way through multiple institutions. Under the circumstances, termination of the current award and recovery of the remaining unspent award funds are the only practical options available to NSF to recoup NSF monies that were not, because of the presence of undisclosed outside funding, needed for the NSF-awarded research.

III. RECOMMENDATION

For the reasons set forth herein, OIG recommends that NSF terminate award DMS-1905195. It would be helpful to be cc'd on any action you take in response to this memorandum by April 12, 2019.

[redacted]

cc: [redacted]

Dr. Xiang-Qiang Chu
Wayne State University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

JUN 2 0 2018

[redacted]

Subject: Recommendation to Suspend NSF Award MCB-1616008 to Wayne State University (OIG Case No. I-18-0047-O)

I. Introduction

OIG recommends that NSF suspend award MCB-1616008, entitled *Investigation of Protein Dynamics on Multiple Timescales by Neutron Scattering and Molecular Dynamics Simulations*, (the Award) made to Wayne State University (WSU). The Principal Investigator (PI) is Dr. Xiang-qiang Chu. The Award, totaling $428,271, began July 1, 2016, and is expected to end June 30, 2019. As of June 14, 2018, $239,366.61 in award funds have not yet been distributed.

As set forth below, OIG has obtained evidence that Dr. Chu and WSU failed to provide NSF advance notice of two long-term absences for Dr. Chu. OIG has also obtained evidence that Dr. Chu failed to provide NSF information concerning her additional active employment in China.

II. Background and Factual Summary

OIG is investigating allegations that an abstract referencing the Award listed only individuals with Chinese affiliations; specifically, Dr. Chu was listed with an affiliation at the Graduate School of China Academy of Engineering Physics, not awardee WSU (See Tab 1). Per an interview with the Program Officer for the Award, this abstract was subsequently withdrawn.

OIG determined that Dr. Chu was overseas from approximately August 2017-February 2018 and from early March 2018-present. Documentation OIG obtained from WSU indicated Dr. Chu requested an unpaid leave of absence from WSU for the Fall 2017 and Winter 2018 semesters allegedly due to family concerns. This request was subsequently approved (See Tab 2). On June 10, 2018, Dr. Chu submitted an annual report for the Award noting, "The PI is on an unpaid leave status that has been approved by the department and college" and that Dr. Chu had been on international travel in China for one year (See Tab 3). Neither Dr. Chu nor WSU had previously notified NSF that she had been in this status. The NSF Proposal and Award Policies and Procedures Guide (PAPPG), effective January 25, 2016, prior to the Award start date, stated the following concerning "Long-Term Disengagement of PI/PD or co-PI/co-PD:"

> In the event the PI/PD or co-PI/co-PD will be disengaged from the project for a period greater than three months (e.g. sabbatical leave) but intends to return, arrangements for oversight of the project must be signed and submitted by the AOR via use of NSF's electronic systems. This information must be provided at least 30 days before departure or as soon as practicable after the prospective disengagement is known. The cognizant NSF Program Officer will provide written approval to the grantee if the arrangements are satisfactory, but no formal amendment to the grant will be made. If the arrangements are not satisfactory to NSF, the grant may be terminated as prescribed in AAG Chapter VII.A. [1]

Since approximately August 2017, Dr. Chu has had two long-term absences exceeding three months without any formalized arrangement or explanation for how the Award would be managed during those periods.

OIG has also determined through correspondence with Dr. Chu that she has current employment in China. This position appears to be with the Graduate School of China Academy of Engineering Physics, as that institution's website lists Dr. Chu as a Researcher (Translated using Google Translate; See Tab 4). Neither this position in China nor collaboration in China was referenced in the most recent annual report submitted on June 10, 2018.

III. Recommendation

Based on the information set forth above, OIG recommends that NSF suspend the Award pending OIG's investigation. In order to effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by July 13, 2018.

[redacted]

[1] See PAPPG, Part II, Chapter II.B.2.a.

Attachments

Tab 1: American Physical Society Abstract
Tab 2: Unpaid Leave of Absence Request
Tab 3: Award Annual Report Submitted June 10, 2018
Tab 4: Chinese Website Bio

National Science Foundation • Office of Inspector General
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APR 18 2019

[redacted]

Subject: Recommendation to prohibit Dr. Xiang-qiang Chu as an NSF reviewer or panelist (OIG Case I-18-0047-O)

NOTICE: This memorandum is provided to you for official use only. This report may be further disclosed within NSF only to individuals who must have knowledge of its contents to facilitate NSF's assessment and resolution of this matter. Please take appropriate precautions handling this memorandum.

I. INTRODUCTION

OIG recommends that NSF prohibit Dr. Xiang-qiang Chu, formerly of Wayne State University (WSU), from serving as a reviewer or panelist for three years and send her a letter notifying her of such.

II. FACTUAL SUMMARY

This case was initiated from information we received concerning an American Physical Society (APS) abstract that referenced NSF award MCB-1616008 ("the award"), but listed all authors as having affiliations with Chinese institutions (See Attachment 1). The PI for the award, Dr. Chu, formerly an Associate Professor in the Department of Physics and Astronomy at WSU, is listed in the abstract with a "Graduate School of China Academy of Engineering Physics" affiliation. However, the award did not mention international collaboration with China. The award was effective from July 1, 2016 to June 30, 2019, but was terminated effective September 20, 2018. The APS abstract was eventually withdrawn.

We found that Dr. Chu had two extended overseas absences during the award: one from August 18, 2017 to February 20, 2018, and one starting on March 9, 2018. We initially found no notification of Dr. Chu's absences to NSF, contrary to guidance in the NSF Proposal and Award

Policies and Procedures Guide (PAPPG), effective January 25, 2016, concerning "Long-Term Disengagement of PI/PD or co-PI/co-PD" (See PAPPG, Part II, Chapter II.B.2.a.)

We subpoenaed WSU for documentation and learned that Dr. Chu requested "an unpaid leave of absence for fall semester 2017 and winter semester 2018." Concerning her reason for the requested leave, Dr. Chu wrote: "I would like to spend the time with my parents in China. My parents are both in bad health condition, and I am the only child of them" (See Attachment 2). We also learned that Dr. Chu and her husband sold their home in Novi, Michigan in July 2017. Publicly-available information indicated Dr. Chu had other employment as a researcher at the Graduate School of China Academy of Engineering Physics (See Attachment 3); the website for this entity also listed Dr. Chu as a Thousand Talents member (See Attachment 4). Other open source information indicated Dr. Chu was selected as a Thousand Talents member as of approximately December 29, 2016.

We also subpoenaed Dr. Chu for information related to her employment outside of WSU, but she declined to provide documentation in response. Specifically, Dr. Chu wrote the following to us in a June 13, 2018 email: "The situation appears to be that, my employer in China does not allow me to submit any documentation to you regarding my employment, since everything is confidential. Therefore, I cannot provide anything to you" (See Attachment 5). Dr. Chu has provided no responsive documentation to date in response to the subpoena.

Dr. Chu did not disclose her overseas employment to either NSF or WSU. Neither of the annual reports under MCB-1616008, submitted on April 17, 2017 and June 10, 2018, noted international collaboration. While the April 17, 2017 report did not note international travel, the June 10, 2018 report noted, "The PI is on an unpaid leave status that has been approved by the department and college" and that Dr. Chu had been on international travel in China for one year. The abstract referenced in the original allegation was not listed in either annual report discussed above. Dr. Chu was on the NSF MB Theoretical & Predictive Biophysics Panel (P180592)" in her WSU capacity from March 1-2, 2018 in between the two extended overseas absences referenced above (See Attachment 6). On June 19, 2018, before we recommended suspension of the award on the following day, Dr. Chu sent an email to the award's cognizant Program Officer requesting two months of summer salary, also without disclosing that she had employment elsewhere (See Attachment 7).

After NSF accepted our recommendation to suspend the award, WSU agreed to terminate it, resulting in $239,366.61 of unspent award funds put to better use. WSU also agreed to return $52,802.09 to NSF, which represented the expenditures WSU made on the award beginning with the start of Dr. Chu's first extended overseas absence. WSU also took corrective action to ensure its Sponsored Program Administration office is informed when a faculty member is granted a leave of absence. WSU informed us that Dr. Chu is no longer employed with the university. We subsequently referred the case to the U.S. Attorney's Office for the Eastern District of Michigan for potential criminal prosecution, but the case was declined.

III. RECOMMENDATION

OIG recommends that NSF prohibit Dr. Chu from serving as a reviewer or panelist for three years and send her a letter notifying her of NSF's decision.

[redacted]

UNPAID LEAVE OF ABSENCE REQUEST

Dear [redacted] June 13, 2017

I am hereby requesting permission to take an unpaid leave of absence for fall semester 2017 and winter semester 2018. I understand that an unpaid leave of absence may not be granted for a period of more than 12 months. I also understand that, if I am a 12-month bargaining-unit member, then I must exhaust my vacation bank prior to beginning the unpaid leave of absence.

The professional or personal reason(s) why I wish to take this leave are as follows.

I would like to spend the time with my parents in China. My parents are both in bad health condition, and I am the only child of them.

I recognize that Article XIII.A.1.e of the collective bargaining agreement between Wayne State University and the AAUP-AFT provides as follows:

> A member of the bargaining unit may exercise his/her option (in writing) for continuance of medical and life insurance coverage at the full group rate cost, and without University subsidy, for the period of the leave, not to exceed a maximum of two (2) years. For those individuals who are eligible for the University's long-term disability insurance coverage and who are engaged in full-time study for an advanced degree, or active work in the field of education or research (such as Fulbright, foundation grant, or governmental project), long-term disability insurance coverage shall be extended for the period of the leave, not to exceed two (2) years.

I further acknowledge that, If I wish to exercise this option, I must submit to Total Compensation and Wellness a written declaration of my intention to pay my medical and/or life insurance at the full group rate cost (without subsidy) for the period of the unpaid leave, and that if I do not make such arrangements with Total Compensation and Wellness my benefits will discontinue.

[redacted]

Xiang-qiang Chu

Requestor's Signature Printed Name

I recommend the granting of this request for an unpaid leave of absence:

[redacted]

14 June 2017

[redacted] Date

I concur.

[redacted]

21/06/2017

[redacted] Date

Request for [redacted]

Approved by: [redacted]

Dr. An Chen
Iowa State University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

JUN 25 2019

[redacted]

Subject: Recommendation to Suspend NSF Awards CMMI-1562992 and DUE-1712049 to Iowa State University (OIG Case No. I-18-0039-O)

I. Introduction

OIG recommends that NSF suspend awards CMMI-1562992, entitled *Collaborative Research: Multifunctional structural panel for energy efficiency and multi-hazards mitigation* (Award 1), and DUE-1712049, entitled *Collaborative Research: Transforming Teaching of Structural Analysis through Mobile Augmented Reality* (Award 2), (collectively, the Awards) made to Iowa State University (ISU). The Principal Investigator (PI) is Dr. An Chen. Award 1, totaling $215,030, began August 1, 2016, and is expected to end July 31, 2020. Award 2, totaling $239,246, began August 15, 2017, and is expected to end July 31, 2020. As of June 14, 2019, $118,451.57 in award funds have not yet been distributed under the Awards.

As set forth below, OIG has obtained evidence that Dr. Chen has not produced all requested information related to his outside affiliations in response to an OIG subpoena. Dr. Chen, through his attorneys, has declined to state that his subpoena production is complete or explain the steps he has taken to comply with the subpoena. Dr. Chen may have not disclosed outside affiliations to both NSF and ISU.

II. Background and Factual Summary

OIG received information that Dr. Chen was selected as a Thousand Talents Program member through Beihang University on or around February 10, 2015 (See Tab 1). Dr. Chen was identified as an NSF awardee PI who did not disclose membership in this program, or with Beihang University, in subsequent NSF proposal submissions for the Awards in his biosketches or Current and Pending Support (See Tabs 2-3).

On April 30, 2018, OIG served Dr. Chen with a subpoena demanding, "All documents related to positions of employment and/or consulting…outside of Iowa State University…" from January 1, 2014-present (See Tab 4). OIG received 12 documents from Dr. Chen in response to the subpoena, only one of which related to a foreign position: a partial Thousand Talents Program application

for Dr. Chen through Beihang University, which requested three million RMB in research funding (See Tabs 5a and 5b; as of May 30, 2019, three million RMB was approximately $434,657 USD). Dr. Chen also provided his curriculum vitae as of March 16, 2018 in response to the subpoena, but the document did not disclose membership in the Thousand Talents Program or a position at Beihang University. Through a subpoena to ISU, OIG found that Dr. Chen consistently answered "No" to the annual ISU conflict of interest question, "Do you have any other situations, external activities, affiliations or employment that could be perceived to be a conflict of interest or commitment?"

Despite the absence of information in disclosures to NSF and ISU concerning the Thousand Talents Program/Beihang University, open source information from Chinese websites suggests Dr. Chen may have affiliations during the period covered under the subpoena:

- On or around January 26, 2015, Dr. Chen was listed as "Professor appointed under the Outstanding Hundred Talents Program" (See Tabs 6a and 6b).
- On or around June 24, 2015, Dr. Chen was highlighted for giving a "...a lecture under the 'Civil Engineering Lectures by Eminent Teacher" Program' on June 12. Dr. Chen is identified as "...an assistant professor at the Iowa State University in the United States, a professor appointed under the Excellent Hundred Talents Program for the Department of Civil and Airport Engineering of Beihang University, a scholar included in the Thousand Talents Program of the Organization Department of the Central Committee of the Communist Party of China..." (See Tabs 7a and 7b).
- On or around June 6, 2016, Dr. Chen was highlighted for giving another lecture and was identified as "One of the talents included in the 'Thousand Young Talents Program' of the Organization Department of the Central Committee of the Communist Party of China." (See Tabs 8a and 8b).
- On or around November 28, 2016, Dr. Chen was listed on the "Scholar Team" at Beihang University's School of Transportation Science and Engineering under "Thousand Young Talents" (See Tabs 9a and 9b).

Through his attorneys, Dr. Chen: (1) asserts that his listing on the website discussed in Tabs 9a and 9b above related to a position he was offered in response to the application in Tab 5a above, not to any employment or an ongoing association with Beihang University; (2) believes he has produced what he has; and (3) has both declined to state that his subpoena production is complete or explain the steps he has taken to comply with the subpoena.

III. Recommendation

Based on the information set forth above, OIG recommends that NSF suspend the Awards pending OIG's investigation. In order to effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by July 17, 2019.

[redacted]

[redacted]

Attachments

[redacted]

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JAN 0 8 2020

[redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-18-0039-O)

Attached is our investigation report concerning Dr. An Chen.

In order to protect the government, we recommend that NSF debar Dr. Chen for three years. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for the subject(s):

Dr. An Chen
[redacted]

[redacted]

Attachments

[redacted]

Recommendation for Governmentwide Debarment

OIG Case Number I-18-0039-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

January 7, 2020

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NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case Number I-18-0039-O
January 7, 2020

WHAT WE FOUND

We received information that Dr. An Chen, formerly an Assistant Professor at Iowa State University (ISU), was affiliated with the Chinese government's Thousand Talents Program and a Chinese university. We subpoenaed Dr. Chen for information related to his positions outside of ISU. Dr. Chen only provided a partial Thousand Talents application in response to the subpoena and through his attorney, denied having a position at the Chinese university. During the course of our investigation, we identified additional open source information indicating Dr. Chen was affiliated with both the Chinese government's Thousand and Hundred Talents Programs, as well as a Chinese university. When we made it clear to Dr. Chen and his attorney that we would enforce the subpoena in U.S. District Court, Dr. Chen left the U.S. for China, and he subsequently resigned from ISU. As a result, we have not received some of the documents we sought in our subpoena.

WHAT WE RECOMMEND

Based on Dr. Chen's conduct, pursuant to 2 C.F.R. § 180 *et. seq.* and based upon the facts described herein, we recommend that NSF debar Dr. Chen for three years.

[redacted]

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Factual Background and Summary

Dr. An Chen is a former Assistant Professor, Civil, Construction and Environmental Engineering at Iowa State University (ISU). While at ISU, Dr. Chen was also Principal Investigator (PI) on two NSF awards: CMMI-1562992, entitled *Collaborative Research: Multifunctional structural panel for energy efficiency and multi-hazards mitigation*, and DUE-1712049, entitled *Collaborative Research: Transforming Teaching of Structural Analysis through Mobile Augmented Reality*, (collectively, the Awards). As set forth below, OIG has obtained evidence that Dr. Chen has not produced all requested information related to his outside affiliations in response to an IG subpoena. Dr. Chen, through his attorney, declined to state that his subpoena production was complete or explain the steps he took to comply with the subpoena. Rather than comply with the IG subpoena, Dr. Chen left the U.S. for China and resigned from ISU. As a result, we have not received some of the documents we sought in our subpoena.

OIG Investigation

We received information that Dr. Chen was selected as a Thousand Talents Program member on or around February 10, 2015, through Beihang University.[1] Dr. Chen was identified as an NSF awardee PI who did not disclose membership in this program, or with Beihang University, in subsequent NSF proposal submissions for the Awards in his biosketches or Current and Pending Support.[2]

On April 30, 2018, we served Dr. Chen with an IG subpoena requesting, "All documents related to positions of employment and/or consulting…outside of Iowa State University" from January 1, 2014-present.[3] We received 12 documents from Dr. Chen in response to the subpoena, only one of which related to a foreign position: a partial Thousand Talents Program application for Dr. Chen through Beihang University, which requested 3 million RMB in research funding.[4] Dr. Chen also provided his curriculum vitae as of March 16, 2018 in response to the subpoena, but the document did not disclose membership in the Thousand Talents Program or a position at Beihang University. Through a subpoena to ISU, we found that Dr. Chen consistently answered "No" to the annual ISU conflict of interest question, "Do you have any other situations, external activities, affiliations or employment that could be perceived to be a conflict of interest or commitment?"

Despite the absence of information in disclosures to NSF and ISU concerning the Thousand Talents Program/Beihang University, open source information from Chinese websites suggests Dr. Chen may have affiliations during the period covered under the subpoena:

- On or around January 26, 2015, Dr. Chen was listed as "Professor appointed under the Outstanding Hundred Talents Program."[5]

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[1] Tab 1
[2] Tabs 2-3
[3] Tab 4
[4] Tabs 5a and 5b; as of as of November 8, 2019, three million RMB was approximately $428,816 USD.
[5] Tabs 6a and 6b

- On or around June 24, 2015, Dr. Chen was highlighted for giving a "lecture under the 'Civil Engineering Lectures by Eminent Teacher' Program" on June 12. Dr. Chen is identified as "an assistant professor at the Iowa State University in the United States, a professor appointed under the Excellent Hundred Talents Program for the Department of Civil and Airport Engineering of Beihang University, [and] a scholar included in the Thousand Talents Program of the Organization Department of the Central Committee of the Communist Party of China."[6] We noted that during our investigation, the link including this information was "revoked,"[7] but we were able to identify the images through Google.[8]
- On or around June 6, 2016, Dr. Chen was highlighted for giving another lecture and was identified as "One of the talents included in the 'Thousand Young Talents Program' of the Organization Department of the Central Committee of the Communist Party of China."[9]
- On or around November 28, 2016, Dr. Chen was listed on the "Scholar Team" at Beihang University's School of Transportation Science and Engineering under "Thousand Young Talents."[10] This information appears to have subsequently been moved to a different page, without reference to "Thousand Young Talents."[11]

Through his attorney, Dr. Chen: (1) asserted that his listing on the website discussed above related to a position he was offered in response to the partial application discussed above, not to any employment or an ongoing association with Beihang University; (2) stated that he believed he already produced responsive documentation; and (3) declined to state that his subpoena production was complete or explain the steps he took to comply with the subpoena.

Because we received so little documentation related to Dr. Chen's apparent foreign affiliations in response to our subpoena, we coordinated with the U.S. Department of Justice (DOJ), which informed Dr. Chen via his attorney that we would seek enforcement of the subpoena in U.S. District Court. We also recommended that the awards be suspended pending the subpoena enforcement proceeding,[12] a recommendation NSF accepted.[13]

Following suspension of the Awards, the following occurred:

1. Dr. Chen left the United States for China.
2. Dr. Chen resigned from ISU.
3. ISU notified NSF of Dr. Chen's resignation and proposed requesting replacement PIs for Dr. Chen.[14]

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[6] Tabs 7a and 7b
[7] Tabs 7c and 7d
[8] Tab 7e
[9] Tabs 8a and 8b
[10] Tabs 9a and 9b
[11] Tabs 9c and 9d
[12] Tab 10a
[13] Tab 10b
[14] Tab 11

4. We interviewed the former and current Department Chairs in Dr. Chen's former department at ISU, neither of whom was aware of any issue regarding Dr. Chen and Beihang University. The former Department Chair reviewed Dr. Chen's COI disclosures from 2014-2018, which did not include any disclosures of a position at Beihang University; the former Department Chair believed such a position should have been disclosed to ISU. The current Department Chair did not know whether a position at Beihang University would need to be disclosed to ISU and if disclosed, the current Department Chair would have asked additional questions concerning the position.

Following our interviews of the former and current Department Chairs at ISU, we recommended the award suspensions be lifted,[15] a recommendation NSF also accepted.[16]

We also noted that Beihang University is listed on the U.S. Department of Commerce, Bureau of Industry and Security Entity List.[17] Per the Federal Register, "The Entity List (15 CFR, Subchapter C, part 744, Supplement No. 4) identifies entities reasonably believed to be involved, or to pose a significant risk of being or becoming involved, in activities contrary to the national security or foreign policy interests of the United States. The Export Administration Regulations (EAR) (15 CFR parts 730-774) impose additional license requirements on, and limits the availability of most license exceptions for, exports, reexports, and transfers (in country) to listed entities."[18]

Department of Justice Coordination

In addition to the actions NSF has taken in this matter, as described above, we have also coordinated with DOJ. While DOJ declined this matter for criminal prosecution, we worked with DOJ on preparing to enforce the subpoena. Once Dr. Chen left the country, he was beyond the jurisdiction of the court that potentially would have enforced the subpoena.

OIG Assessment

Grounds for Debarment

NSF has authority to debar an individual for "Conviction…for [c]ommission of embezzlement, theft, [or] making false statements"[19] or "Any other cause of so serious or compelling a nature that it affects (the Subject's) present responsibility."[20]

In this case, Dr. Chen's conduct falls within the above-referenced section of 2 C.F.R. § 180.800(d).

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[15] Tab 12a
[16] Tab 12b
[17] Tab 13
[18] See https://www.federalregister.gov/documents/2019/10/09/2019-22210/addition-of-certain-entities-to-the-entity-list.
[19] 2 C.F.R. § 180.800(a)(3)
[20] 2 C.F.R. § 180.800(d)

Burden of Proof

In debarment actions, the burden of proof rests with NSF to demonstrate by a preponderance of the evidence that a cause for debarment exists.[21] We believe that, as evidenced by the facts of this case, this burden has been met.

Relevant Factors

The debarment regulation lists 19 mitigating and aggravating factors that the debarring official may consider when determining whether to impose debarment and the length of the debarment period.[22]

The following factors are pertinent to this case.

1. **Actual or Potential Harm or Impact**[23]

As a PI of two NSF awards, Dr. Chen should reasonably be expected to cooperate with the funding agency and the funding agency's OIG. Presently, Dr. Chen has effectively fled the country in an attempt to evade compliance with an IG subpoena. We do not know when or if Dr. Chen will return to the U.S., but his conduct in response to an IG subpoena is contrary to the expectations placed upon individuals who accept taxpayer-funded research dollars from the U.S. government.

2. **Frequency of Incidents and/or Duration of the Wrongdoing**[24]

We served Dr. Chen with an IG subpoena on April 30, 2018. To date, over 18 months later, we have still not received all responsive records sought in the subpoena.

3. **Role in Wrongdoing**[25]

The subpoena was served to Dr. Chen in-person approximately 18 months ago. Dr. Chen refused to comply and provide all existing documents responsive to the subpoena, or to fully explain the extent of his affiliations outside of the U.S. Additionally, Dr. Chen refused to provide us with a signed statement of production indicating he produced all responsive documents within his possession.

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[21] 2 C.F.R. § 180.850(a)
[22] 2 C.F.R. § 180.860
[23] 2 C.F.R. § 180.860(a)
[24] 2 C.F.R. § 180.860(b)
[25] 2 C.F.R. § 180.860(f)

4. Acceptance of Responsibility for Wrongdoing and Recognition of Seriousness of the Misconduct[26]

Rather than comply with the subpoena or submit to the legal process by which he could be compelled to comply with the subpoena, Dr. Chen chose to leave the U.S. and resign from his ISU position.

5. Cooperation of the Subject[27]

While Dr. Chen, through two different counsels, provided some records in response to the subpoena, it is reasonable to assume he has not provided all of the requested records, as indicated by the evidence discussed above. Again, rather than have the subpoena enforced in U.S. District Court, Dr. Chen chose to leave the U.S., and resign from his ISU position.

6. Position Held by Subject[28]

At the time Dr. Chen was subpoenaed and throughout the period when we sought to obtain records under the subpoena, Dr. Chen was PI on two NSF awards. Dr. Chen was also a teacher and advisor to Ph.D. students. While Dr. Chen is no longer employed by ISU, he retains the ability to return to the U.S. for employment with another academic institution, a position which could place upon him the trust of students, academic colleagues, and the U.S. taxpayer.

OIG Recommendation

In order to protect the interests of the public and NSF, OIG recommends that NSF debar Dr. Chen for three years. Such a period of time is necessary to ensure federal funds are safeguarded.

[26] 2 C.F.R. § 180.860(g)
[27] 2 C.F.R. § 180.860(i)
[28] 2 C.F.R. § 180.860(k)

Attachments

TAB 1 - Excerpts of Thousand Talents Selection Information
TAB 2 - CMMI-1562992 Proposal Excerpts
TAB 3 - DUE-1712049 Proposal Excerpts
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TAB 5a - Partial Thousand Talent Application
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TAB 7c - 2015 Lecture Recap, Site Visited 07-08-19
TAB 7d - 2015 Lecture Recap, Site Visited 07-08-19 (Translated)
TAB 7e - 2015 Lecture Recap Images
TAB 8a - 2016 Lecture Recap
TAB 8b - 2016 Lecture Recap (Translated)
TAB 9a - Beihang University Website Information, Site Visited 10-05-18
TAB 9b - Beihang University Website Information, Site Visited 10-05-18 (Translated)
TAB 9c - Beihang University Website Information, Site Visited 07-09-19
TAB 9d - Beihang University Website Information, Site Visited 07-09-19 (Translated)
TAB 10a - Awards Suspension Recommendation
TAB 10b - Awards Suspension Notice
TAB 11 - NSF Email Correspondence with ISU
TAB 12a - Awards Unsuspension Recommendation
TAB 12b - Awards Unsuspension Notice
TAB 13 - Beihang University Search Result on DOC BIS Entity List

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SEP 27 2019

[redacted]

Subject: Update to Recommendation to Suspend NSF Awards CMMI-1562992 and DUE-1712049 to Iowa State University (OIG Case No. I-18-0039-O)

I. Introduction

On July 25, 2019, we recommended that NSF suspend awards CMMI-1562992, entitled *Collaborative Research: Multifunctional structural panel for energy efficiency and multi-hazards mitigation* (Award 1), and DUE-1712049, entitled *Collaborative Research: Transforming Teaching of Structural Analysis through Mobile Augmented Reality* (Award 2), (collectively, the Awards) made to Iowa State University (ISU) (See Tab 1). The Principal Investigator (PI) is Dr. An Chen; Award 1 has a Co-PI while Award 2 has three Co-PIs. Award 1, totaling $215,030, began August 1, 2016, and is expected to end July 31, 2020. Award 2, totaling $239,246, began August 15, 2017, and is expected to end July 31, 2020. As of the date of this memorandum, $104,815.21 in award funds have not yet been distributed under the Awards. In response to our recommendation, NSF suspended the Awards effective July 3, 2019 (See Tab 2), pending completion of our investigation.

II. Background and Factual Summary

As discussed in our previous recommendation, we received information that Dr. Chen was selected as a Thousand Talents Program member through Beihang University on or around February 10, 2015. Dr. Chen was identified as an NSF awardee PI who did not disclose membership in this program, or with Beihang University, in subsequent NSF proposal submissions for the Awards in his bio sketches or Current and Pending Support. When we subpoenaed Dr. Chen for "All documents related to positions of employment and/or consulting…outside of Iowa State University…" from January 1, 2014-present, we received only one related to a foreign position: a partial Thousand Talents Program application for Dr. Chen through Beihang University.

Through a subpoena to ISU, we found that Dr. Chen consistently answered "No" to the annual ISU conflict of interest (COI) question, "Do you have any other situations, external activities,

affiliations or employment that could be perceived to be a conflict of interest or commitment?" Despite the absence of information in disclosures to NSF and ISU concerning the Thousand Talents Program/Beihang University, open source information from Chinese websites suggested Dr. Chen may have an affiliation/position with both the Thousand Talents Program and Beihang University, as well as the Hundred Talents Program, during the period covered under the subpoena. Because we received so little documentation related to Dr. Chen's apparent foreign affiliations in response to our subpoena, we coordinated with the United States Department of Justice, which informed Dr. Chen via his attorney that we would seek enforcement of the subpoena.

Since the Awards were suspended, the following has occurred:

1. Dr. Chen left the United States.
2. Dr. Chen resigned from ISU.
3. ISU notified NSF of Dr. Chen's resignation and proposed requesting replacement PIs for Dr. Chen (See Tab 3).
4. We interviewed the former and current Department Chairs in Dr. Chen's former department at ISU, neither of whom was aware of Dr. Chen having a position at Beihang University. The former Department Chair reviewed Dr. Chen's COI disclosures from 2014-2018, which did not include any disclosures of a position at Beihang University; the former Department Chair believed such a position should have been disclosed. The current Department Chair did not know whether a position at Beihang University would need to be disclosed to ISU and, if disclosed, the current Department Chair would have asked additional questions concerning the position.

III. Recommendation

Based on the information set forth above, we recommend that NSF lift the suspensions on the Awards pending NSF's approval of the replacement PIs. Please copy us on any actions taken in response to this memorandum.

[redacted]

Attachments

Tab 1: Original Award Suspension Recommendation
Tab 2: Award Suspension Notice
Tab 3: NSF Email Correspondence with ISU

[redacted]

[redacted]

来源：千人计划网 发布时间：2015/2/11 16:23:36 选择字号：小 中 大

第十一批“千人计划”青年人才名单公示

本次各用人单位共申报2241人，根据《青年海外高层次人才引进工作细则》的规定，经形式审查、通信评审、面试评审，共667名人选通过评审，现予公示。公示期7天，从2015年2月11日—2015年2月17日。公示期间，对人选的资格条件等如有异议，请于2015年2月18日之前将有关意见发至专项办邮箱（zhuanxiangban@1000plan.org）。

海外高层次人才引进工作专项办公室

2015年2月10日

序号	姓名	性别	出生日期	申报单位	落地省份	回国前任职单位	专业技术职务	学科分组	毕业院校	学位
1	胡又凡	女	1980/7/10	北京大学	北京	[美国]佐治亚理工学院[美国]GeorgiaInstituteofTechnology	研究科学家ResearchScientist	信息科学	2008年07月毕业于[中国]北京大学2008年07月毕业于[中国]PekingUniversity	博士
2	杨玉超	男	1984/12/23	北京大学	北京	[美国]密歇根大学安娜堡分校[美国]UniversityofMichigan, AnnArbor	高级研究员SeniorResearchFellow	信息科学	2010年09月毕业于[中国]清华大学2010年09月毕业于[中国]TsinghuaUniversity	博士
3	张史梁	男	1984/5/8	北京大学	北京	[美国]NEC美国加州实验室[美国]NECLaboratoriesAmerica, Inc., Cupertino, CA	博士后科学家PostdoctoralScientist	信息科学	2012年07月毕业于[中国]中国科学院计算技术研究所2012年07月毕业于[中国]InstituteofComputingTechnology, ChineseAcademyof	博士
4	董彬	男	1981/7/23	北京大学	北京	[美国]亚利桑那大学[美国]UniversityofArizona	助理教授AssistantProfessor(Tenure-Track)	数理科学	2009年06月毕业于[美国]加州大学洛杉矶分校2009年06月毕业于[美国]UniversityofCalifornia, LosAngeles	博士
5	方博汉	男	1984/8/2	北京大学	北京	[美国]哥伦比亚大学[美国]ColumbiaUniversity	助理教授AsstAssistantProfessor	数理科学	2010年06月毕业于[美国]西北大学2010年06月毕业于[美国]NorthwesternUniversity	博士
6	黄辉	男	1982/4/18	北京大学	北京	[美国]迈阿密大学[美国]UniversityofMiami	博士后PostdocAssociate	数理科学	2010年12月毕业于[美国]马里兰大学巴部分校2010年12月毕业于[美国]UniversityofMaryland, BaltimoreCounty	博士
7	林伟	男	1980/9/9	北京大学	北京	[美国]宾夕法尼亚大学[美国]UniversityofPennsylvania	博士后PostdoctoralResearcher	数理科学	2011年08月毕业于[美国]南加州大学2011年08月毕业于[美国]UniversityofSouthernCalifornia	博士
8	武鹏	男	1983/9/18	北京大学	北京	[美国]布鲁克海文国家实验室[美国]Brookhaven	研究助理ResearchAssociate	数理科学	2010年07月毕业于[中国]中国科学院物理研究所2010年07月毕业	博士

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						h, SantaBarbar a			cityofGroninge n	
184	赵立东	男	1979/3/29	北京航空航天大学	北京	[美国]西北大学 [美国]NorthwesternUniversity	博士后 Postdoctor	工程与材料科学	2009年01月毕业于[中国]北京科技大学 2009年01月毕业于[中国]UniversityofScienceandTechnologyBeijing	博士
185	陈安	男	1974/6/22	北京航空航天大学	北京	[美国]爱荷华州立大学 [美国]IowaStateUniversity	助理教授，博士生导师 Tenure-trackAssistantProfessor	工程与材料科学	2004年12月毕业于[美国]西弗吉尼亚大学 2004年12月毕业于[美国]WestVirginiaUniversity	博士
186	徐坤	男	1981/5/2	北京航空航天大学	北京	[美国]宾夕法尼亚大学 [美国]UniversityofPennsylvania	博士后研究员 PostdocFellow	工程与材料科学	2012年05月毕业于[美国]耶鲁大学 2012年05月毕业于[美国]YaleUniversity	博士
187	张辉	男	1984/5/6	北京航空航天大学	北京	[美国]俄亥俄州立大学汽车研究中心 [美国]CenterforAutomotiveResearch, TheOhioStateUniversity	副研究工程师 ResearchAssociateEngineer	工程与材料科学	2012年06月毕业于[加拿大]维多利亚大学 2012年06月毕业于[加拿大]UniversityofVictoria	博士
188	周安楠	男	1982/12/9	北京航空航天大学	北京	[澳大利亚]皇家墨尔本理工大学 [澳大利亚]ROYALMELBOURNEINSTITUTEOFTECHNOLOGY	讲师 TENUREDLECTURER	工程与材料科学	2011年08月毕业于[澳大利亚]纽卡斯尔大学 2011年08月毕业于[澳大利亚]THEUNIVERSITYOFNEWCASTLE	博士
189	洪家旺	男	1981/8/14	北京理工大学	北京	[美国]美国橡树岭国家实验室 [美国]OakRidgeNationalLaboratory	博士后 ResearchAssociatePostdoctoral	工程与材料科学	2010年01月毕业于[中国]清华大学 2010年01月毕业于[中国]TsinghuaUniversity	博士
190	谢彦博	男	1984/4/16	西北工业大学	陕西	[荷兰]特文特大学 [荷兰]UniversityofTwente	Researcher 研究人员	信息科学	2013年09月毕业于[荷兰]特文特大学 2013年09月毕业于[荷兰]UniversityofTwente	博士
191	张飞宇	男	1977/6/8	西北工业大学	陕西	[美国]德州大学阿灵顿分校 [美国]UniversityofTexasatArlington	研究助理教授 ResearchAssistantProfessor	信息科学	2009年07月毕业于[中国]清华大学 2009年07月毕业于[中国]TsinghuaUniversity	博士
192	王洪强	男	1981/5/26	西北工业大学	陕西	[德国]马普学会胶体与界面研究所 [德国]MaxPlanckInstituteofColloidsandInterfaces	洪堡学者 AlexandervonHumboldtFellow	工程与材料科学	2008年07月毕业于[中国]中国科学院合肥物质科学研究院 2008年07月毕业于[中国]HefeiInstituteofPhysicalScience, ChineseAcademy	博士
193	李晓强	男	1978/9/20	西北工业大学	陕西	[法国]巴黎第十一大学及法国国家研究中心 [法国]UniversityParis-Sud&CNRS	研究员 Researcher	工程与材料科学	2009年05月毕业于[比利时]根特大学 2009年05月毕业于[比利时]GhentUniversity	博士
194	任洋	男	1976/12/12	哈尔滨工业大学	黑龙江	[美国]普林斯顿等离子体物理实验室 [美国]PrincetonPlasmaPhysicsLaboratory	研究员 StaffResearchPhysicist	数理科学	2007年01月毕业于[美国]普林斯顿大学 2007年01月毕业于[美国]PrinctonUniversity	博士
195	黄鑫	男	1981/5/25	哈尔滨工业大学	黑龙江	[英国]布里斯托大学 [英国]UniversityofBristol	玛丽居里学者 MarieCurieResearchFellow	工程与材料科学	2009年07月毕业于[中国]吉林大学 2009年07月毕业于[中国]JilinUniversity	博士
196	安亮	男	1983/2/16	哈尔滨工业大学	黑龙江	[中国香港]香港科技大学 [中国香港]TheHongKongUniversi	访问学者 VisitingScholar	工程与材料科学	2012年08月毕业于[中国香港]香港科技大学 2012年08月毕业于[中国香港]Th	博士

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2415 Eisenhower Avenue, Alexandria, VA 22314

JUN 25 2019

[redacted]

Subject: Recommendation to Suspend NSF Awards CMMI-1562992 and DUE-1712049 to Iowa State University (OIG Case No. I-18-0039-O)

I. Introduction

OIG recommends that NSF suspend awards CMMI-1562992, entitled *Collaborative Research: Multifunctional structural panel for energy efficiency and multi-hazards mitigation* (Award 1), and DUE-1712049, entitled *Collaborative Research: Transforming Teaching of Structural Analysis through Mobile Augmented Reality* (Award 2), (collectively, the Awards) made to Iowa State University (ISU). The Principal Investigator (PI) is Dr. An Chen. Award 1, totaling $215,030, began August 1, 2016, and is expected to end July 31, 2020. Award 2, totaling $239,246, began August 15, 2017, and is expected to end July 31, 2020. As of June 14, 2019, $118,451.57 in award funds have not yet been distributed under the Awards.

As set forth below, OIG has obtained evidence that Dr. Chen has not produced all requested information related to his outside affiliations in response to an OIG subpoena. Dr. Chen, through his attorneys, has declined to state that his subpoena production is complete or explain the steps he has taken to comply with the subpoena. Dr. Chen may have not disclosed outside affiliations to both NSF and ISU.

II. Background and Factual Summary

OIG received information that Dr. Chen was selected as a Thousand Talents Program member through Beihang University on or around February 10, 2015 (See Tab 1). Dr. Chen was identified as an NSF awardee PI who did not disclose membership in this program, or with Beihang University, in subsequent NSF proposal submissions for the Awards in his biosketches or Current and Pending Support (See Tabs 2-3).

On April 30, 2018, OIG served Dr. Chen with a subpoena demanding, "All documents related to positions of employment and/or consulting…outside of Iowa State University…" from January 1, 2014-present (See Tab 4). OIG received 12 documents from Dr. Chen in response to the subpoena, only one of which related to a foreign position: a partial Thousand Talents Program application

for Dr. Chen through Beihang University, which requested three million RMB in research funding (See Tabs 5a and 5b; as of May 30, 2019, three million RMB was approximately $434,657 USD). Dr. Chen also provided his curriculum vitae as of March 16, 2018 in response to the subpoena, but the document did not disclose membership in the Thousand Talents Program or a position at Beihang University. Through a subpoena to ISU, OIG found that Dr. Chen consistently answered "No" to the annual ISU conflict of interest question, "Do you have any other situations, external activities, affiliations or employment that could be perceived to be a conflict of interest or commitment?"

Despite the absence of information in disclosures to NSF and ISU concerning the Thousand Talents Program/Beihang University, open source information from Chinese websites suggests Dr. Chen may have affiliations during the period covered under the subpoena:

- On or around January 26, 2015, Dr. Chen was listed as "Professor appointed under the Outstanding Hundred Talents Program" (See Tabs 6a and 6b).
- On or around June 24, 2015, Dr. Chen was highlighted for giving a "...a lecture under the 'Civil Engineering Lectures by Eminent Teacher" Program' on June 12. Dr. Chen is identified as "...an assistant professor at the Iowa State University in the United States, a professor appointed under the Excellent Hundred Talents Program for the Department of Civil and Airport Engineering of Beihang University, a scholar included in the Thousand Talents Program of the Organization Department of the Central Committee of the Communist Party of China..." (See Tabs 7a and 7b).
- On or around June 6, 2016, Dr. Chen was highlighted for giving another lecture and was identified as "One of the talents included in the 'Thousand Young Talents Program' of the Organization Department of the Central Committee of the Communist Party of China." (See Tabs 8a and 8b).
- On or around November 28, 2016, Dr. Chen was listed on the "Scholar Team" at Beihang University's School of Transportation Science and Engineering under "Thousand Young Talents" (See Tabs 9a and 9b).

Through his attorneys, Dr. Chen: (1) asserts that his listing on the website discussed in Tabs 9a and 9b above related to a position he was offered in response to the application in Tab 5a above, not to any employment or an ongoing association with Beihang University; (2) believes he has produced what he has; and (3) has both declined to state that his subpoena production is complete or explain the steps he has taken to comply with the subpoena.

III. Recommendation

Based on the information set forth above, OIG recommends that NSF suspend the Awards pending OIG's investigation. In order to effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by July 17, 2019.

[redacted]

[redacted]

Attachments

Tab 1: Thousand Talents Selection Information
Tab 2: CMMI-1562992 Proposal Excerpts
Tab 3: DUE-1712049 Proposal Excerpts
Tab 4: NSF-OIG Subpoena No. S-2018-058 to Dr. Chen
Tab 5a: Partial Thousand Talent Application
Tab 5b: Partial Thousand Talent Application (Translated)
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Tab 6b: Hundred Talents Selection Information (Translated)
Tab 7a: 2015 Lecture Recap
Tab 7b: 2015 Lecture Recap (Translated)
Tab 8a: 2016 Lecture Recap
Tab 8b: 2016 Lecture Recap (Translated)
Tab 9a: Beihang University Website Information
Tab 9b: Beihang University Website Information (Translated)

Dr. Franklin Tao
University of Kansas Center for Research Inc.

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

AUG 2 3 2019

[redacted]

Subject: Recommendation to Suspend NSF Awards CHE-1800577, CHE-1462121 and OIA-1539105 (OIG Case No. I-19-0078-O)

I. Introduction, Background and Factual Summary

We recommend that NSF suspend awards CHE-1800577, entitled "Understanding the restructuring of model metal catalysts in reactant gases" (Award 1); CHE-1462121, entitled "CAREER: Catalysis on Singly Dispersed Bimetallic Catalytic Sites" (Award 2); and OIA-1539105, entitled "RII Track-2 FEC: Catalysis for Renewables: Applications, Fundamentals and Technologies (CRAFT)." Both Awards 1 and 2 were made to the University of Kansas Center for Research Inc., with Dr. Franklin Tao (Dr. Tao) serving as the PI. Award 3 was made to the University of Kansas Center for Research Inc., with Dr. Tao serving as the co-PI.

Award 1 was funded in the amount of $305,084, with a start date of September 15, 2018 and an expiration date of August 31, 2021. As of August 23, 2019, $77,987.78 has been disbursed for Award 1. Award 2 was funded in the amount of $598,329, with a start date of September 1, 2014 and an expiration date of June 30, 2019. As of August 23, 2019, $594,161.93 has been disbursed for Award 2. Award 3 was funded in the amount of $4,000,000, with a start date of August 1, 2015 and an expiration date of July 31, 2020. As of August 23, 2019, $3,918,270.50 has been disbursed for Award 3.

Dr. Tao was indicted by a federal grand jury on August 21, 2019 for one count of Wire Fraud and three counts of Program Fraud. Two of the three program fraud counts, namely Count 2 and Count 4 of the Indictment, refer to salary Dr. Tao received under NSF grants (see attachment).

II. Recommendation

Based on the information set forth above, we recommend that NSF suspend Award 1, Award 2, and Award 3, pending completion of our investigation. To effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by September 13, 2019.

[redacted]

Attachment: Indictment, Case No. 19-20052-JAR/JPO

[redacted]

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF KANSAS
(Kansas City Docket)

UNITED STATES OF AMERICA

Plaintiff,

v. Case No. * 19-20052-JAR/JPO

FENG TAO,
a/k/a "Franklin Tao,"

Defendant.

SEALED INDICTMENT

The Grand Jury charges:

At all times material to this indictment:

Introduction

1. The University of Kansas (KU, or the University) is a public research university with campuses located in Lawrence, Kansas; Kansas City, Kansas; and Overland Park, Kansas; with the main campus being located in Lawrence. It is a Kansas Board of Regents institution.

2. A component of KU is the Center for Environmentally Beneficial Catalysis (CEBC), which is located at the Life Science Research Lab (LSRL) Building B, 1501 Wakarusa Drive, Lawrence, Kansas. CEBC's research focuses on sustainable technology to conserve natural resources and energy. The CEBC performs proprietary research as well as United States Government (USG) funded research, including research under grants from the United States Department of Energy (DOE) and the National Science Foundation (NSF).

3. Feng Tao (a/k/a Franklin Tao) has been an associate professor and researcher at the CEBC since August 2014. In his capacity as a KU employee, he almost immediately began conducting research under USG funded programs. As of May 2019, in his capacity as a KU

employee, Tao was conducting research under two DOE contracts and four NSF contracts. Tao's research included studies utilizing ambient pressure x-ray photoelectron spectroscopy (AP-XPS), which is a surface chemical analysis technique. The research is funded by DOE.

4. Fuzhou University (Fuzhou) is a university located in Fuzhou, China. It was established by the Chinese Ministry of Education in 1958 and is recognized for its studies of science and technology.

5. The Changjiang Professorship is a talent program sponsored by the Chinese government. The term "Chinese Talent Plans" refers collectively to various diverse plans designed by the Chinese government to attract, recruit, and cultivate high-level scientific talent in furtherance of China's scientific development, economic prosperity, and national security.

6. The Kansas Board of Regents has a policy requiring faculty and staff of Regents institutions (including KU) to file a conflict of interest report upon employment and at least annually thereafter. According to the Regents policy on conflicts of interest, employment outside the University can result in real or apparent conflicts of interest regarding commitment of time or effort. As an employee of the University, Tao was required to file these reports.

The Scheme

7. Beginning on or about May 1, 2018, Tao signed a five-year "Changjiang Scholar Distinguished Professor Employment Contract." The contract required Tao to be a "full time" employee at Fuzhou University. As Tao well knew, the Changjiang employment contract was a conflict of interest as it related to his KU contract. Tao did not disclose the Changjiang contract to KU; and, even after accepting the Changjiang Professorship at Fuzhou, Tao certified to KU that he did not labor under any conflict of interest. By not disclosing his position at Fuzhou, and certifying an absence of conflict, Tao was able to continue his employment with KU. His

employment with KU allowed Tao to have continued access to U.S. government grant or contract funds, which included funds not only for research but also for Tao's salary.

COUNT 1
(Wire Fraud)

8. Paragraphs 1 through 7 are incorporated herein by reference.

9. From on or about May 1, 2018, to the date of this Indictment, defendant Feng Tao, a/k/a Franklin Tao, devised and intended to devise a scheme to defraud the University of Kansas, and to obtain money and property by means of materially false and fraudulent pretenses, representations and promises. It was part of the scheme that Tao knowingly and intentionally submitted to the University false statements concerning his lack of a conflict of interest.

10. On or about September 25, 2018, in the District of Kansas, the defendant,

FENG TAO,
A/K/A/ FRANKLIN TAO,

for the purpose of executing the scheme described above, caused to be transmitted by means of wire communication in interstate commerce an online certification that he (1) read and understood the Kansas Board of Regents policy concerning conflicts of interest, (2) understood that any external personal professional activities in which he engaged that take time away from the University must not interfere with him meeting his faculty teaching and research responsibilities at the University, and (3) agreed to secure approval prior to engaging in any such external activities; all of which was in violation of Title 18, United States Code, Section 1343.

COUNT 2
(Program Fraud)

11. Paragraphs 1 through 10 are incorporated herein by reference.

12. Beginning on or about May 1, 2018, and continuing up to on or about June 30, 2019, in the District of Kansas and elsewhere, the defendant,

FENG TAO,
A/K/A/ FRANKLIN TAO,

being an agent of the University of Kansas (a State agency), said agency receiving in the one year period beginning May 1, 2018, benefits in excess of $10,000 under a Federal grant sponsored by the National Science Foundation for studies of catalysis on singly dispersed bimetallic catalytic sites, embezzled, stole, and obtained by fraud, property worth at least $5,000 that was under the care, custody and control of such agency, that is, approximately $21,235 in salary, in violation of Title 18, United States Code, Section 666(a)(1)(A).

COUNT 3
(Program Fraud)

13. Paragraphs 1 through 10 are incorporated herein by reference.

14. Beginning on or about May 1, 2018, and continuing until on or about the date of this Indictment, in the District of Kansas and elsewhere, the defendant,

FENG TAO,
A/K/A/ FRANKLIN TAO,

being an agent of the University of Kansas (a State agency), said agency receiving in the one year period beginning May 1, 2018, benefits in excess of $10,000 under a Federal grant sponsored by the United States Department of Energy for studies of catalysis on early transition metal oxide-based catalysts through exploration of surface structure and chemistry during catalysis using in-situ approaches, embezzled, stole, and obtained by fraud, property worth at least $5,000 that was under the care, custody and control of such agency, that is, approximately $11,271 in salary, in violation of Title 18, United States Code, Section 666(a)(1)(A).

COUNT 4
(Program Fraud)

15. Paragraphs 1 through 10 are incorporated herein by reference.

16. Beginning on or about May 1, 2018, and continuing until on or about the date of this Indictment, in the District of Kansas and elsewhere, the defendant,

FENG TAO,
A/K/A/ FRANKLIN TAO,

being an agent of the University of Kansas (a State agency), said agency receiving in the one year period beginning May 1, 2018, benefits in excess of $10,000 under a Federal grant sponsored by the National Science Foundation for studies of catalysis for renewables: applications, fundamentals and technologies ("CRAFT"), embezzled, stole, and obtained by fraud, property worth at least $5,000 that was under the care, custody and control of such agency, that is, approximately $5,060 in salary, in violation of Title 18, United States Code, Section 666(a)(1)(A).

FORFEITURE ALLEGATION

17. The allegations contained in paragraphs 1 - 14 of this Indictment are hereby realleged and incorporated by reference for the purpose of alleging forfeitures pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c).

18. Upon conviction of the offenses identified in Counts 1 through 3, the defendant,

FENG TAO,
A/K/A FRANKLIN TAO,

shall forfeit to the United States, pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c), any property, real or personal, which constitutes or is derived from proceeds traceable to the offenses, including, but not limited to, the following:

A. A forfeiture money judgment in an amount equal to the amount of proceeds that the defendant obtained from the commission of Count 1; and

B. A forfeiture money judgment in an amount equal to the amount of proceeds that the defendant obtained from the commission of Count 2.

19. If any of the property described above, as a result of any act or omission of the defendant:

A. cannot be located upon the exercise of due diligence;

B. has been transferred or sold to, or deposited with, a third party;

C. has been placed beyond the jurisdiction of the court;

D. has been substantially diminished in value; or

E. has been commingled with other property which cannot be divided without difficulty,

the United States of America shall be entitled to forfeiture of substitute property pursuant to Title 21, United States Code, Section 853(p) and Title 28, United States Code, Section 2461(c); all pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c).

A TRUE BILL.

Dated: August 21, 2019

s/Foreperson
FOREPERSON

[redacted]

(It is requested that trial of the above captioned case be held in Kansas City, Kansas.)

PENALTIES:

Ct. 1: 18 U.S.C. § 1343

- NMT 20 Years Imprisonment,
- NMT $250,000 Fine,
- NMT 3 Years Supervised Release
- $100 Special Assessment, and
- Forfeiture Allegation

Cts. 2 – 4: 18 U.S.C. § 666

- NMT 10 Years Imprisonment,
- NMT $250,000 Fine,
- NMT 3 Years Supervised Release
- $100 Special Assessment, and
- Forfeiture Allegation.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF KANSAS
(Kansas City Docket)

UNITED STATES OF AMERICA

Plaintiff,

v.

Case No. 19-20052-JAR/JPO

FENG TAO,
a/k/a "Franklin Tao,"

Defendant.

SECOND SUPERSEDING INDICTMENT

The Grand Jury charges:

At all times relevant to this indictment:

Introductory Allegations

The Defendant's Employment at the University of Kansas

1. The University of Kansas (KU) was a public research university governed by the Kansas Board of Regents (KBOR) with a campus in Lawrence, Kansas.

2. The Center for Environmentally Beneficial Catalysis (CEBC) was a component of KU, located at the Life Science Research Lab in Lawrence, Kansas. CEBC's research focused on sustainable technology to conserve natural resources and energy. Among other things, the CEBC performed research funded by grants from the United States Government (USG).

3. Since in or about August 2014, the defendant, **FENG TAO** (a/k/a **FRANKLIN TAO**), a citizen of the People's Republic of China (PRC), was a full-time professor and researcher at KU who worked in the CEBC on projects involving renewable energy, including shale gas.

4. In his capacity as a researcher at KU, **TAO** was responsible for submitting USG

grant proposals through KU and for managing USG-funded research projects at KU. As described below, between at least in or about December 2017 and August 2019, **TAO** obtained funds from the U.S. Department of Energy (DOE) and the National Science Foundation (NSF) to support his research at KU, while concealing his participation in a PRC "talent plan," his employment at a PRC research university, and his PRC-funded research.

University Of Kansas Conflict Policies

5. As a KU employee, **TAO** owed a fiduciary duty and a duty of truthfulness to KU. KBOR and KU policies required **TAO** to disclose any current or prospective situations that involved potential conflicts of interest or time as soon as they became known.

6. The policies further required **TAO** to disclose conflicts of interest or time on an annual basis using KU's "Institutional Responsibilities" form. Among other things, the form required **TAO** to certify that (1) his statements were true, correct, and complete to the best of his knowledge and belief; (2) he had read and complied with KBOR and KU policies; (3) he agreed to secure approval prior to engaging in any external personal, professional activities; and (4) he agreed to report any changes as soon as they become known to him and no later than 30 days after acquiring a new significant financial interest.

7. KU used the information, in part, to determine whether **TAO** had any financial interests or commitments of time that conflicted with his responsibilities to manage USG-funded research projects.

8. At various times between in or about August 2014 and August 2019, **TAO** certified that he read and understood KBOR and KU's conflict policies and that he had made all necessary disclosures. Further, in connection with his USG grant proposals, **TAO** assured KU that he would take the steps necessary to ensure that others involved with the proposed research

read and understood and complied with all relevant conflict policies.

U.S. Department of Energy Grant

9. DOE was a federal agency whose mission was to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. Within DOE, the Office of Science supported research in the physical sciences and fundamental scientific research for America's energy future by funding such research through grants. DOE programs were a crucial part of America's national security apparatus.

10. On or about December 11, 2017, **TAO** caused KU to submit an application to DOE's Office of Science for renewed funding to support his ongoing research at KU. As part of the application, DOE required **TAO** to identify his institutional affiliations and his current and pending support, to include funding from foreign governments and institutions. **TAO** identified his affiliation with KU and only his USG funding sources. Relying on **TAO's** representations, KU certified, under penalty of law, that the statements contained in the application were true and accurate. On or about July 10, 2018, while **TAO's** grant application was under review, DOE asked **TAO** to update his current and pending support, to include any submissions planned in the future. Thereafter, on or about July 16, 2018, in response to DOE's request, **TAO** provided DOE with a document identifying only his USG funding sources.

11. On or about September 18, 2018, relying on **TAO's** representations, DOE's Office of Science awarded the grant to KU and agreed to continue funding **TAO's** research at KU through at least September 2019.

National Science Foundation Grants

12. NSF was a federal agency that was created by Congress to promote the progress

of science; to advance the national health, prosperity, and welfare; and to secure the national defense of the United States. NSF's mission was to support all fields of fundamental science and engineering (except for medical sciences) and to keep the United States at the leading edge of discovery. NSF fulfilled its mission by funding research and education through grants and cooperative agreements.

13. In order to receive its funds, NSF required KU to maintain a written, enforceable conflict of interest policy. Among other things, KU's policy had to ensure that researchers like **TAO** made all necessary disclosures at the time they submitted their proposals and that they updated their disclosures during the period of the award, either on an annual basis or as new reportable conflicts became known. NSF further required KU to manage, reduce, or eliminate all conflicts of interest for each grant before the expenditure of the grant funds. KBOR and KU's policies, as described above, complied with NSF's requirements.

14. Between in or about July 2013 and August 2014, while employed by the University of Notre Dame, **TAO** applied for an NSF grant and obtained NSF funding. In or about September 2014, after being hired by KU, **TAO** caused KU to submit a request to NSF to transfer the grant from Notre Dame to KU. On or about December 1, 2014, NSF approved the grant transfer and agreed to fund **TAO's** research at KU through June 2019.

15. On or about October 2, 2017, **TAO** caused KU to submit a separate grant application to NSF to fund his research at KU. As part of the application, **TAO** identified his affiliation with KU and his current and pending USG funding sources. Relying on **TAO's** representations, KU certified, under penalty of law, that the statements contained in the application were true and accurate. On or about June 28, 2018, relying on **TAO's** representations, NSF awarded the grant to KU and agreed to fund **TAO's** research at KU from in

or about September 2018 through August 2021.

The People's Republic of China's Talent Plans

16. The People's Republic of China (PRC) was the most populous country in the world. In recent years, the PRC Government invested heavily in growing its economy, especially industrial sectors it considered important to its autonomy and national security.

17. The PRC achieved rapid economic growth, in part, through "talent plans," which were designed to encourage the transfer of original ideas and intellectual property from U.S. universities to PRC Government institutions. Talent plans offered competitive salaries, state-of-the-art research facilities, and honorific titles to entice experts to bring their knowledge and experience to the PRC to enhance the PRC's economic prosperity and national security.

18. The PRC's talent plans typically required applicants to have experience in cutting-edge science or engineering research; a degree from a prestigious university; and several years of overseas work or research experience at prestigious universities, research institutes, corporations, or well-known enterprises.

19. To entice high-caliber applicants, the PRC Government generally provided talent plan participants with significant financial and social incentives. For example, participants typically drew a salary from a PRC employing entity, such as a university, laboratory, or research organization, which sponsored or facilitated the participants' applications. Because of the nature of the PRC political system, these employing entities were, functionally, extensions of the PRC Government and the Chinese Communist Party.

20. Participants typically entered into contracts covering their involvement in the talent plans. These contracts obligated the participants to work for a specified time in the PRC and often detailed the specific research the participants would perform or the businesses the

participants would develop. The contractual obligation closely resembled or replicated the work the participants performed or continued to perform for their U.S. or non-PRC employers. In many cases, talent plan contracts required participants to identify additional overseas talent to join their research teams in the PRC. Further, rather than merely conducting scientific research, participants were frequently obligated contractually to perform services for the PRC in support of its strategic national development goals and economic revitalization.

21. The Chang Jiang Scholar Program, also known as the Yangtze River Scholar Program, was one such talent plan sponsored by the PRC Government. The PRC Government used the Chang Jiang Scholar Program to attract talented academics to bolster the PRC's scientific and technical knowledge and for the benefit of the PRC. Individuals accepted into the Chang Jiang Scholar Program received the title of Chang Jiang Distinguished Professor at their universities in the PRC, as well as other benefits.

Defendant's PRC Talent Plan Applications

22. In 2016, **TAO** applied to the Chang Jiang Scholar Program through Xiamen University in the PRC. He was not selected at that time. Between on or about May 23, 2017, and July 2, 2017, **TAO** communicated with individuals affiliated with Xiamen University about a different PRC talent plan known as the Thousand Talents Program. In those communications, **TAO** expressed his intention to apply to the Thousand Talents Program through Xiamen University and asked that the individuals keep his intention confidential due to his full-time employment at KU.

23. Around the same time, between on or about June 9 and July 1, 2017, **TAO** traveled from the United States to the PRC, where he met with the head of Fuzhou University's (FZU) Chemistry Department who encouraged **TAO** to apply to the Chang Jiang Scholar

Program through FZU.

24. In or about July 2017, **TAO** applied to the Chang Jiang Scholar Program with the expectation that he would join the faculty and staff at FZU, in the PRC, while maintaining his employment at KU, obtaining USG grant funds, and concealing his FZU and PRC affiliations from KU and the USG.

25. Between on or about November 18 and November 24, 2017, **TAO** traveled to FZU in the PRC to prepare the materials necessary to defend his Chang Jiang Scholar Program application before the PRC's Ministry of Education. He then returned to the PRC to defend his application between on or about December 6 and 13, 2017.

26. In or about the end of December 2017, **TAO** was accepted into the Chang Jiang Scholar Program with the understanding that he would be employed full time at FZU, where he would conduct research involving renewable energy for the benefit of the PRC. At no time did **TAO** disclose this information to KU or any USG agency.

Defendant's Employment at Fuzhou University

27. FZU was a university located in Fuzhou, in the PRC, that was established by the PRC's Ministry of Education to research science and technology. The State Key Laboratory of Photocatalysis on Energy and Environment was a component of FZU. The PRC's Ministry of Education continued to manage FZU jointly with the Fuzhou Provincial Government through at least in or about August 2019.

28. Between in or about January and February 2018, **TAO** negotiated an employment contract with FZU. On or about January 23, 2018, an FZU representative invited **TAO** to the PRC to discuss the terms of his contract, including his salary and benefits. Between on or about February 1 and February 20, 2018, **TAO** traveled to the PRC to meet with FZU representatives,

including the head of FZU's Chemistry Department.

29. In or around March 2018, **TAO** entered into a contract with FZU to serve as a Chang Jiang Distinguished Professor for a period of five years from May 1, 2018, to April 30, 2023. The contract included the following terms:

(A) **TAO** agreed to perform the following duties, among other things: 1) teach chemistry at FZU; 2) support the PRC's strategic needs by, for example, conducting major scientific research projects for the PRC; 3) recruit post-doctoral researchers to FZU; 4) actively apply for the PRC's major scientific research projects and host three such projects; and 5) publish at least 60 research articles identifying FZU as his primary employer.

(B) FZU agreed to provide **TAO** with the following, among other things: 1) a salary every year, some of which would come from the PRC's Ministry of Education; 2) research funds; 3) post-doctoral researchers and a secretary to facilitate research; 4) lab space and equipment, a residence, and relocation expenses; and 5) to strengthen **TAO's** ideological and emotional identity, patriotism, ambition for a strong PRC and his dedication to the service of the PRC.

30. Between on or about May 5 and May 8, 2018, **TAO** traveled to the PRC. At or around that time, TAO formally started his employment at FZU as a Chang Jiang Distinguished Professor, without disclosing to KU or the USG that he was engaged in such employment.

31. At various times between in or about May 2018 and December 2018, and for the majority of time between on or about December 11, 2018, and August 20, 2019, **TAO** traveled to the PRC. During that period, **TAO** fulfilled his contractual obligations to FZU, while remaining employed by KU and obtaining USG grant funds. For example, **TAO** attempted to recruit and

did recruit post-doctoral researchers to work for him at FZU. As another example, **TAO** applied for grants from the National Natural Science Foundation of China to fund his research at FZU, including an application submitted on or about March 17, 2019. At no time did **TAO** disclose his affiliation with FZU to KU or any USG agency.

The Defendant's Scheme to Defraud

32. From in or about May 2017 through on or about August 21, 2019, **TAO** engaged in a scheme to defraud KU and the USG to obtain money and property from KU, DOE, and NSF, to include USG grant funds and his KU salary.

Purpose of the Scheme

33. The purposes of the scheme were for **TAO** to benefit the PRC by participating in a "talent plan," to obtain USG grant funds and his KU salary under false pretenses, and to conceal the scheme.

Manners and Means of the Scheme

34. As part of the scheme to defraud KU and the USG, **TAO** provided FZU and the PRC with technical training, scientific expertise, and research as a Chang Jiang Distinguished Professor at FZU, while purporting to remain loyal to KU, his employer.

35. It was a further part of the scheme to defraud KU and the USG that **TAO** traveled to the PRC for a significant period of time between May 2018 and August 2019 to fulfill his contractual obligations to FZU, while remaining employed by KU and obtaining USG grant funds through that employment.

36. It was a further part of the scheme to defraud KU and the USG that **TAO**, having a duty to disclose, concealed from KU and USG agencies his affiliation with FZU, his participation in the PRC's Chang Jiang Scholar Program, and the associated financial and other benefits.

37. It was a further part of the scheme to defraud KU and the USG that **TAO** fraudulently maintained his employment with KU to obtain access to KU's research facilities and equipment and USG grant funds.

38. It was a further part of the scheme to defraud KU and the USG that **TAO** caused KU to rely on his material misrepresentations and omissions to request funds from DOE and NSF for expenditures associated with his USG-funded research at KU.

39. It was a further part of the scheme to defraud KU and the USG that **TAO** made the following material misrepresentations and omissions, among others:

(A) On or about January 9, 2018, **TAO** falsely stated on his 2018 Institutional Responsibilities form that he did not have any conflicts of interest or time; when in truth, as **TAO** then knew, he had been selected for the Chang Jiang Scholar Program at FZU, and he intended to work at FZU and receive funding from FZU and the PRC, in addition to other financial benefits.

(B) On or about January 29, 2018, in connection with a proposal for funds to perform work at the National Renewal Energy Laboratory (a USG-owned, contractor-operated facility funded through DOE) **TAO** falsely certified to KU that he had made all relevant financial and other disclosures as required by KBOR, KU, and DOE policies; when in truth, as **TAO** then knew, he had been selected for the Chang Jiang Scholar Program at FZU, and he intended to work at FZU and receive funding from FZU and the PRC, in addition to other financial benefits.

(C) On or about May 17, 2018, **TAO** submitted a proposal to KU for a collaborative research project with FZU, to be funded by FZU, and thereafter requested to use part of the project's budget to absolve him from his KU teaching responsibilities

for the Spring 2019 semester. In doing so, **TAO** concealed his employment by FZU and his plan to travel to the PRC to fulfill his contractual obligations to FZU between in or about December 2018 and August 2019.

(D) On or about July 16, 2018, in connection with the above-described DOE grant, **TAO** falsely represented to DOE that he was only receiving, and only expected to receive, USG funding; when in truth, as **TAO** then knew, he was working for FZU as a Chang Jiang Distinguished Professor and was receiving, and expected to receive, funding from FZU and the PRC.

(E) On or about September 25, 2018, **TAO** falsely stated on his 2019 Institutional Responsibilities form that he did not have any conflicts of time or interest; when in truth, as **TAO** then knew, he was working for FZU as a Chang Jiang Distinguished Professor and was receiving, and expecting to receive, funding from FZU and the PRC, in addition to other financial benefits.

(F) On or about June 15, 2019, in connection with the above-described DOE grant, **TAO** submitted a Progress Report to DOE's Office of Science, in which he falsely represented that he had no changes to his current support; when in truth, as **TAO** then knew, he was working for FZU as a Chang Jiang Distinguished Professor and was receiving, and expected to receive, funding from FZU and the PRC.

COUNTS ONE THROUGH SEVEN
(Wire Fraud)

40. Paragraphs 1 to 39 are incorporated herein by reference.

41. From in or about May 2017 through on or about August 21, 2019, in the District of Kansas and elsewhere, the defendant, **FENG TAO**, did knowingly, and with intent to defraud, devise and intend to devise a scheme and artifice to defraud, and to obtain money and property

by means of materially false and fraudulent pretenses, representations, promises, and half-truths, and by omissions and concealment of material facts with a duty to disclose.

42. On or about the dates set forth below, in the District of Kansas and elsewhere, the defendant, for the purpose of executing such scheme and artifice and attempting to do so, transmitted, and caused to be transmitted, by means of wire communication in interstate and foreign commerce, writings, signs, and signals, to wit, the wire communications described below:

COUNT	DATE	DESCRIPTION OF WIRE
ONE	November 11, 2017	Email from Kansas to the Consulate General of the People's Republic of China in Illinois regarding **TAO's** travel to Fuzhou University
TWO	December 11, 2017	Electronic submission of **TAO's** U.S. Department of Energy grant application from Kansas to a location outside Kansas
THREE	January 9, 2018	Electronic submission of **TAO's** 2018 Institutional Responsibilities form from Kansas to a location outside Kansas
FOUR	June 26, 2018	Email from outside the United States to the University of Kansas regarding **TAO's** proposal for a collaborative research project with Fuzhou University
FIVE	July 16, 2018	Email from outside the United States, through Kansas, to the U.S. Department of Energy regarding **TAO's** updated current and pending support
SIX	September 25, 2018	Electronic submission of **TAO's** 2019 Institutional Responsibilities form from Kansas to a location outside Kansas
SEVEN	March 17, 2019	Email from outside the United States, through Kansas, to a location outside Kansas regarding **TAO's** application for National Natural Science Foundation of China funding

Each count a separate offense, in violation of Title 18, United States Code, Sections 1343 and 2.

COUNTS EIGHT AND NINE
(False Statements)

43. Paragraphs 1 to 39 are incorporated herein by reference.

44. On or about the dates set forth below, in the District of Kansas and elsewhere, the defendant, **FENG TAO**, willfully and knowingly made materially false, fictitious, and fraudulent statements, representations, and omissions in a matter within the jurisdiction of the executive branch of the United States Government, to wit: through his submission of an Institutional Responsibilities form, **TAO** falsely represented to the University of Kansas, an institution that requested and received funds from the U.S. Department of Energy and the National Science Foundation, that he had no conflicts of time or interest; when in truth, as **TAO** then knew, he was affiliated with FZU as a Chang Jiang Distinguished Professor and was receiving financial and other benefits, which he had a duty to disclose.

COUNT	DATE	DESCRIPTION OF FALSE STATEMENT
EIGHT	January 9, 2018	**TAO's** 2018 Institutional Responsibilities form
NINE	September 25, 2018	**TAO's** 2019 Institutional Responsibilities form

Each count a separate offense, in violation of Title 18, United States Code, Sections 1001 and 2.

COUNT TEN
(False Statements)

45. Paragraphs 1 to 39 are incorporated herein by reference.

46. On or about July 16, 2018, in the District of Kansas and elsewhere, the defendant, **FENG TAO**, willfully and knowingly made materially false, fictitious, and fraudulent statements, representations, and omissions in a matter within the jurisdiction of the executive branch of the United States Government, to wit: in connection with a University of Kansas grant application, **TAO** falsely represented to the U.S. Department of Energy that he was receiving, and expected to receive, funding from U.S. Government agencies only; when in truth, as **TAO**

then knew, he was receiving, and expected to receive, funding from the People's Republic of China and Fuzhou University.

In violation of Title 18, United States Code, Sections 1001 and 2.

FORFEITURE NOTICE

47. The allegations contained in paragraphs 1 to 46 of this Superseding Indictment are hereby re-alleged and incorporated by reference for the purpose of alleging forfeitures pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c).

48. Upon conviction of the offenses identified in Counts 1 through 7, the defendant,

FENG TAO,
A/K/A FRANKLIN TAO,

shall forfeit to the United States, pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c), any property, real or personal, which constitutes or is derived from proceeds traceable to the offenses, including, but not limited to, the following:

A forfeiture money judgment for each Count in amounts equal to the amount of proceeds that the defendant obtained from Counts 1 through 7 in the Second Superseding Indictment.

49. If any of the property described above, as a result of any act or omission of the defendant:

A. cannot be located upon the exercise of due diligence;

B. has been transferred or sold to, or deposited with, a third party;

C. has been placed beyond the jurisdiction of the court;

D. has been substantially diminished in value; or

E. has been commingled with other property which cannot be divided without difficulty,

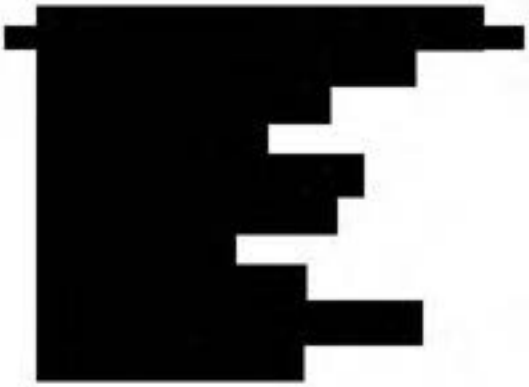
the United States of America shall be entitled to forfeiture of substitute property pursuant to Title 21, United States Code, Section 853(p) and Title 28, United States Code, Section 2461(c).

All pursuant to Title 18, United States Code, Section 981(a)(1)(C) and Title 28, United States Code, Section 2461(c).

A TRUE BILL.

Dated: June 24, 2020

s/Foreperson
FOREPERSON



(It is requested that trial of the above captioned case be held in Kansas City, Kansas.)

PENALTIES:

Cts. 1 - 7: 18 U.S.C. § 1343

- NMT 20 Years Imprisonment,
- NMT $250,000 Fine,
- NMT 3 Years Supervised Release
- $100 Special Assessment, and
- Forfeiture

Ct. 8 - 10: 18 U.S.C. § 1001

- NMT 5 Years Imprisonment,
- NMT $250,000 Fine,
- NMT 3 Years Supervised Release, and
- $100 Special Assessment

CUI//PRVCY//PRIVILEGE

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

To: [redacted]

From: [redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-19-0078-O)

Attached is our investigation report concerning Dr. Feng "Franklin" Tao (Dr. Tao), a University of Kansas (KU) associate professor and principal investigator. Dr. Tao was convicted of violating 18 U.S.C. § 1001 for failing to properly disclose information about foreign awards and an appointment at a foreign University on the requisite KU forms and ensuing NSF proposals. Dr. Tao's conduct impacted multiple proposals to NSF over 5 years as well as other federal agencies. He was subsequently sentenced in federal court to 2 years supervised release and time served.

In order to protect the government, we recommend that NSF debar Dr. Tao for 3 years. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for the subject(s) and his attorneys:

Dr. Feng Tao
[redacted]

Recommendation for Governmentwide Debarment

OIG Case Number I-19-0078-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

April 25, 2023

CUI Contact: [redacted]

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CUI/PRVCY/PRIVILEGE

AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case Number I-19-0078-0
April 25, 2023

WHAT WE FOUND

We received an allegation that Dr. Feng "Franklin" Tao (Tao), a University of Kansas associate professor and the principal investigator of two NSF awards over a 6-year period, failed to properly include information about foreign awards and an appointment at a foreign University on numerous NSF proposals. As the result of a jury trial, Dr. Tao was found guilty of three counts of wire fraud (18 U.S.C. § 1343), and one count of making false statements (18 U.S.C. § 1001). After the jury trial, the Court granted Dr. Tao's Motion for Judgment of Acquittal on the wire fraud charges. Consequently, only the false statement count remained. The Court sentenced Dr. Tao to 2 years of supervised release and time served.

WHAT WE RECOMMEND

Based on the severity of the Dr. Tao's conduct, his pattern and practice of omitting his foreign awards on NSF proposals and his felony conviction, pursuant to 2 C.F.R. § 180 *et. seq.* and based upon the facts described herein, we recommend that NSF debar Dr. Tao governmentwide for a period of 3 years.

[redacted]

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Factual Background

We received an allegation that Dr. Feng "Franklin" Tao (Tao), an NSF Principal Investigator (PI), purposefully omitted information in his NSF proposals, specifically in the "Current and Pending Support" (CPS) sections. On July 8, 2014, Dr. Tao received an NSF Faculty Early Career Development Program (CAREER) award (Award 1)[1] as a faculty member of University of Notre Dame, his former University. In September 2014, he transferred Award 1 to University of Kansas (KU) after becoming a full-time faculty member there. In his capacity as a faculty member and researcher, Dr. Tao submitted proposals through KU to NSF, and other federal agencies in support of his research. Between July 2014 and October 2017, NSF funded a total of three awards for over $4M on which Dr. Tao worked (Award 1, Award 2, [2] and Award 3[3]). Dr. Tao was the PI of Award 1 and Award 3; he was a co-PI of Award 2. Between March 2011 and October 2017, as PI, Dr. Tao also submitted 18 proposals which NSF did not fund.[4]

NSF requires certain information to be included in the CPS section of each proposal. The CPS requirements are contained in the Proposal and Award Policies and Procedures Guide (PAPPG) in effect at the time a proposal is submitted to NSF. Award 1 was governed by PAPPG 13-1[5] and Award 3 by PAPPG 17-1.[6] The basic CPS requirements in both PAPPG's are the same, and state,

> This section of the proposal calls for required information on all current and pending support for ongoing projects and proposals, including this project, and any subsequent funding in the case of continuing grants. *All current project support from whatever source (e.g., Federal, State, local or foreign government agencies, public or private foundations, industrial or other commercial organizations) must be listed.* The proposed project and all other projects or activities requiring a portion of time of the PI and other senior personnel must be included, even if they receive no salary support from the project(s).[7]

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[1] Attachment 1 - Award 1, CHE-1462121, entitled "CAREER: Catalysis on Singly Dispersed Bimetallic Catalytic Sites" a continuing award which had been funded for $598,329 for the period of September 1, 2014, through June 30, 2019. The original award number was CHE-1352516, which was changed after Dr. Tao and the award transferred to KU. The transfer information is at Attachment 2 - Award 1 Transfer to KU.

[2] Attachment 3 – Award 2, OIA-1539105, entitled "RII Track-2 FEC: Catalysis for Renewables: Applications, Fundamentals and Technologies (CRAFT)," a cooperative agreement funded for $4M for August 1, 2015, through July 31, 2020.

[3] 0 Award 3, CHE-1800577, entitled "Understanding the restructuring of model metal catalysts in reactant gases" a standard award funded for $305,084 from September 15, 2018, through August 31, 2021. It is a collaborative proposal; KU's coversheet is on p. 4.

[4] 0 Table of Dr. Tao's Unfunded Awards

[5] 0 PAPPG 13-1 -Selections. PAPPG 13-1 was effective for proposals submitted after 1/14/2013 and can be found at https://www.nsf.gov/pubs/policydocs/pappguide/nsf13001/nsf13_1.pdf

[6] 0 PAPPG 17-1 Selections. PAPPG 17-1 was in effective for proposals submitted after 1/30/2017 and can be found at https://www.nsf.gov/pubs/policydocs/pappg17_1/index.jsp

[7] 0 PAPPG 13-1 Sections, p. 3 (Emphasis added) and 0, PAPPG 17-1 Sections, p. 3

Consequently, on every NSF proposal he was PI or senior personnel, Dr. Tao was supposed to list ongoing or proposed federal projects as well as any other projects or activities requiring a portion of his time.[8]

OIG Investigation

Undisclosed Funding

As part of a multi-agency investigation team, we determined that prior to submitting the proposal for NSF Award 3, Dr. Tao applied for two talent plans offered by the People's Republic of China (PRC).[9] The PRC's talent plans, including the Thousand Talents Plan (TTP) and the Chang Jiang Scholar Program (CJSP), are designed to encourage the transfer of original ideas and intellectual property from U.S. universities to PRC government institutions to enhance the PRC's economic prosperity and national security.[10] Dr. Tao worked on his first CJSP application in 2016 but was not selected.[11] He worked on a second CJSP application in the late Spring/early Summer of 2017. In July 2017, Dr. Tao submitted his application for the CJSP, knowing that, if awarded, he would be required to join Fuzhou University (FZU) as faculty/staff.[12] To this end, he also traveled to the PRC in July 2017 to speak to the head of the Department with whom he would work.[13] In May 2018, Dr. Tao became a 2017 CJPS Distinguished Professor at FZU.[14]

A review of an English-language summary of materials collected for his applications to the CJSP and TTP, contains references to Dr. Tao's NSF and other federal awards. It also notes timeframes for three of his awards from PRC's National Natural Science Foundation (NNSF), specifically the periods of 2011-2015, 2013-2016, and 2014-2019.[15]

NSF Proposals

Dr. Tao's NNSF awards were not disclosed in CPS sections of any proposals to NSF. The proposal for Award 1 was submitted in July 2013. At that time, at least one of his NNSF awards was active. Award 1 was a continuing grant and received an increment of $260,340 in July 2015. Dr. Tao had a duty to include all CPS from whatever source as part of the initial proposal. He also had a duty to disclose "any subsequent funding in the case of continuing grants."[16] He did not.[17]

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[9] 0 Second Superseding Indictment
[10] 0 Second Superseding Indictment, p. 5
[11] 0 Second Superseding Indictment, p. 6
[12] 0 Second Superseding Indictment, pp. 5-6
[13] 0 Second Superseding Indictment, p.6
[14] 0 May 2018 CJSP Certificate (translated)
[15] 0 TTP and CJSP Applications Drafts, English Summary, p. 3, 4, 6, 7
[16] 0 PAPPG 13-1 Sections, p. 3 and 0, PAPPG 17-1 Sections, p. 3
[17] Attachment 1 - Award 1, p. 38

On February 20, 2015, Dr. Tao submitted the NSF proposal for Award 2.[18] While at least two of the three NNSF awards were active at that time, Dr. Tao did not disclose them in Award 2's CPS section. Similarly, he submitted the proposal for Award 3 and two other proposals (not funded) in October 2017, and although one of Dr. Tao's NNSF awards was active at that time, it was not mentioned in the CPS section of the October proposals.[19] In total, Dr. Tao submitted 21 NSF proposals (3 funded and 18 unfunded) during the periods of his NNSF awards. There is nothing in the CPS on any of his NSF proposals that notes his NNSF awards.[20]

Travel

On July 2017, Dr. Tao submitted a CJSP application. Subsequently, Dr. Tao signed a contract with FZU beginning May 1, 2018, for a period of 5 years.[21] Dr. Tao traveled to PRC often during the latter half of 2018. The travel appears to be in conjunction with his obligations to FZU. He spent 116 days out of the United States, going to and from China.[22]

Dates of Foreign Travel – 2018

Dates Left U.S.	Date Returned	Days Away	Workdays Away
February 1, 2018 (Thurs)	February 20, 2018 (Tues)	19	12
May 5, 2018 (Sat)	May 8, 2018 (Tues)	3	1
May 26, 2018 (Sat)	August 1, 2018 (Wed)	67	45
August 15, 2018 (Wed)	August 18, 2018 (Sat)	3	3
October 25, 2018 (Thurs)	October 29, 2018 (Mon)	4	2
December 11, 2018 (Tues)	December 31, 2018 (Mon)	20	11
TOTALS		**116**	**74**

Dr. Tao left the United States on December 11, 2018, and did not return until March 28, 2019.[23] The trip is broken up by calendar year.

Dates of Foreign Travel – 2019

Dates Left U.S.	Date Returned	Days Away	Workdays Away
January 1, 2019 (Tues)	March 28, 2019 (Thurs)	86	59
April 12, 2019 (Fri)	April 27, 2019 (Sat)	15	11
May 11, 2019 (Sat)	June 1, 2019 (Sat)	21	14
June 7, 2019 (Fri)	June 23, 2019 (Sun)	16[24]	11
July 7, 2019 (Sun)	July 23, 2019 (Tues)	16	11

[18] Attachment 3 – Award 2, OIA-1539105, p. 1(date received) and p. 73 (Dr. Tao's CPS)
[19] 0 Award 3, p. 46; and 0 Unfunded Covers and CPSs, pp. 88-92
[20] 0 Unfunded Cover Pages and CPSs
[21] 0 CJSP Contract with FZU excerpt and Dr. Tao's FZU page.
[22] 0 Subject Border Crossings which includes departing and arriving airport information.
[23] December 11, 2018 – March 28, 2019 consisted of 107 calendar days and 71 workdays.
[24] June 7, 2019 – June 15, 2019 consisted of 8 calendar days and 6 workdays.

August 4, 2019 (Sun)	August 20, 2019[25] (Tues)	17	12
TOTALS		**171**	**118**

According to the KU audit records,[26] Dr. Tao certified that approximately 20% of his effort was spent on NSF Award 1 and 80% to other sources between December 30, 2018, and June 15, 2019.[27] However, he was out of the country 91 of the approximately 116 workdays during the audited period and only in the country for 25 days. That means the most he could have worked for NSF is 5 days; Award 1 was charged $11,993 during the period.

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

The U.S. Attorney's Office for the District of Kansas presented the case to a federal grand jury. Initially, Dr. Tao was indicted by the grand jury for one count of wire fraud (18 U.S.C. § 1343) and three counts of program fraud (18 U.S.C. § 666). The second superseding indictment charged Dr. Tao with seven counts of wire fraud (counts 1-7) and three counts of false statements (18 U.S.C. § 1001) (counts 8-10).[28] Subsequently, one count of wire fraud and one count of false statements were dismissed without prejudice.[29] In March 2022, following a jury trial, Dr. Tao was found guilty of three counts of wire fraud, and one count of making false statements.[30] Prior to sentencing, the Court granted Dr. Tao's Motion for Judgement of Acquittal on three of the wire fraud counts (4,6, and 7); counts 3 and 8 were dismissed on motion of the United States. At sentencing, the only remaining count was count 9, which pertained to Dr. Tao's 2019 Institutional Responsibilities form to KU. On the form, Dr. Tao "willfully and knowingly made materially false, fictitious, and fraudulent statements, representations, and omissions," namely that he had no conflicts of time or commitments, and which caused KU to make false statements to NSF and other federal agencies.[31] The Court sentenced Dr. Tao to 2 years supervised release and time served.[32]

After Dr. Tao's initial indictment by a federal grand jury, we recommended[33] and NSF concurred[34] that Award 1, Award 2, and Award 3 be suspended, thereby safeguarding NSF funds. Subsequently, KU requested that Dr. Tao be removed as co- PI on Award 2 due to his long-term absence from KU. NSF approved and subsequently lifted the suspension on Award 2.[35]

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[25] Dr. Tao was indicted on August 21, 2019.
[26] 0 KU Effort Audit Report 12-30-18 to 6-15-19
[27] The period of December 20, 2018 to June 15, 2019 consists of 167 calendar days and 116 workdays. Dr. Tao was out of the country for 91 workdays during the same period.
[28] 0 Second Superseding Indictment
[29] 0 Order to Dismiss Charges
[30] 0 Jury Verdict
[31] 0 Second Superseding Indictment, p. 13
[32] 0 Judgement
[33] 0Recommendation to Suspend Awards
[34] 0 Notice of Awards Suspension
[35] 0 Notice to Lift Award 2 Suspension

Both NSF and KU submitted victim impact statements before sentencing.[36] NSF's statement described NSF's fundamental "values such as openness and transparency, accountability and honesty, impartiality and objectivity, and merit-based competition for research support.... Undisclosed or concealed external funding and affiliations can significantly impair the integrity and objectivity of scientifical and technological research,"[37] because, "NSF can only fund approximately twenty percent of the proposals it receives. An applicant's concealment of or failure to disclose other funding or affiliations that are tied to the applicant's research skews NSF's assessment of that applicant's need for financial support." Once funded, "Dr. Tao changed the manner in which the money was being used by buying out teaching duties so that he could travel overseas to do research."[38] Further, Dr. Tao's actions call into question the validity, scientific integrity, and objectivity of his research," suggesting that the over $4M NSF spent on Dr. Tao's awards did not result in research the scientific community can use.[39] NSF also lost the opportunity to fund more worthy proposals.

Similarly, KU noted in its statement, that it measured the impact in part in "dollars lost." Specifically, KU calculated it lost "nearly $460,000 because of [Dr. Tao]."[40] KU also calculated that federal sponsors lost more than $1.2M in expenditures[41] for research for which the final reports were never finished, thus there will be no societal benefit for the research.[42]

OIG Assessment

Grounds for Debarment

NSF has authority to debar an individual for "Conviction...for [c]ommission of embezzlement, theft, [or] making false statements"[43] or "Any other cause of so serious or compelling a nature that it affects (the Subject's) present responsibility."[44] Dr. Tao's conviction and sentencing under 18 U.S.C. § 1001 is sufficient grounds upon which to debar him. We include additional relevant factors below.

Burden of Proof

"In any debarment action, the Federal agency must establish that there is cause for debarment by a preponderance of the evidence."[45] However, "if the proposed debarment is based upon a conviction or civil judgment, the standard of proof is met."[46] Since this proposed debarment is based on Dr. Tao's

[36] 0 NSF Victim Impact Statement and 0 Attachment 22 – KU Victim Impact Statement
[37] 0 NSF Victim Impact Statement, p. 1
[38] Attachment 22 – NSF Victim Impact Statement, p. 1
[39] 0 NSF Victim Impact Statement, p. 2. NSF funded Award 1 for $598,329, Award 2 for $4M, and Award3 for $305,084.
[40] 0 KU Victim Impact Statement, p. 1
[41] Attachment 22 – KU Victim Impact Statement, p. 16. $82,879 is associated with NSF awards.
[42] 0 KU Victim Impact Statement, p. 1
[43] 2 C.F.R. § 180.800(a)(3)
[44] 2 C.F.R. § 180.800(d)
[45] 2 C.F.R. § 180.850; 2 C.F.R. § 180.855
[46] 2 C.F.R. § 180.850(b)

felony conviction discussed above, the burden of proof is met. Even without conviction, the factors below illustrate sufficient information to warrant debarment.

Relevant Factors

The debarment regulation lists 19 factors for the debarring official to consider. The following factors are pertinent to this case.

1. Actual or Potential Harm or Impact[47]

NSF relies on universities and scientists to honestly disclose time commitments and affiliations by providing accurate and complete information to NSF. NSF required CPS on new proposals and ongoing disclosure of other support on continuing awards. Dr. Tao did not disclose his NNSF awards, which spanned from 2011 – 2019, to KU impacting 21 proposals submitted to NSF during that time. Namely, he did not disclose his affiliation, time commitments, or contractual obligations under the NNSF, the CJSP and with FZU on the three proposals he submitted in October 2017.[48] Thus, KU was unable to disclose them to NSF. KU stated that it lost over $460,000 due to Dr. Tao's actions, and the federal government will not get final reports for over $1.2M in federally funded research of which $682,879 is associated with NSF awards.[49]

2. Frequency of Incidents and/or Duration of Wrongdoing[50]

Dr. Tao received NNSF funding as early as 2011, the same year he was a co-PI on an NSF award. In the intervening years he has submitted 20 additional NSF proposals as PI or co-PI, including his NSF CAREER award. None of those proposals included his NNSF awards in the CPS nor did they mention his PRC talent applications or his subsequent agreement with FZU.

3. Pattern or Prior History of Wrongdoing[51]

Dr. Tao has a history of wrongdoing stemming from 2011 when he submitted an NSF proposal as PI without disclosing his NNSF funding to his indictment in August 2019.

4. Role in Wrongdoing[52]

Dr. Tao was the primary actor in the wrongdoing. Neither NSF, other federal agencies, nor KU were aware of his PRC-based activities. By obscuring and omitting his time commitments and foreign funding in his NSF proposals' CPS, he made it impossible for NSF to fairly evaluate his availability to

[47] 2 C.F.R. § 180.860(a)
[48] Award 3 and two unfunded awards, *See* 0 Table of Dr. Tao's Unfunded NSF awards, p. 5.
[49] 0 KU Victim Impact Statement, p.1, footnote 3. $594,841 from Award 1 and $87,038 from Award 3.
[50] 2 C.F.R. § 180.860(b)
[51] 2 C.F.R. § 180.860(c)
[52] 2 C.F.R. § 180.860(f)

perform NSF-funded research. He also used NSF funds to buy out teaching time which allowed him to travel to China to fulfil his PRC commitments.

5. Acceptance of Responsibility[53]

Dr. Tao did not accept responsibility for his actions. He took steps to affirmatively hide his affiliations.

6. Repayment[54]

Dr. Tao was not ordered to, nor has he provided, repayment.

7. Cooperation with Federal Agencies During the Investigation[55]

Dr. Tao did not cooperate with federal agencies during the investigation.

8. Position Held by Subject[56]

Dr. Tao was an associate professor at FZU. He has been the PI/co-PI on three NSF awards and received funding from other federal government agencies. He was convicted of falsely representing to KU that he has no conflict of time or interests when he knew he was a recipient of 3 NNSF awards, and a CJSP Distinguished Professor contractually obligated to work for FZU. His actions caused KU to provide the same false statements to NSF and other federal agencies.

9. Whether Principals Tolerated the Offense[57]

KU cooperated with investigators and initially put Dr. Tao on administrative leave as soon as he was indicted. KU also notes in its victim impact statement that Dr. Tao's actions "have directly caused the [KU] to suffer financial and reputational harm."[58]

OIG Recommendation

In order to protect the interests of the public and NSF, OIG recommends that NSF debar Dr. Tao for 3 years. Such a period of time is necessary to ensure federal funds are safeguarded.

[53] 2 C.F.R. § 180.860(g)
[54] 2 C.F.R. § 180.860(h)
[55] 2 C.F.R. § 180.860(i)
[56] 2 C.F.R. § 180.860(k)
[57] 2 C.F.R. § 180.860(m)
[58] 0 KU Victim Statement

Attachments

Attachment 1 – Award 1
Attachment 2 – Award 1 Transfer to KU
Attachment 3 – Award 2
Attachment 4 – Award 3
Attachment 5 – Table of Subject's Unfunded NSF Proposals
Attachment 6 – PAPPG 13-1 Selections
Attachment 7 – PAPPG 17-1 Selections
Attachment 8 – Unfunded Covers and CPSs (Bookmarked)
Attachment 9 – Second Superseding Indictment
Attachment 10 – May 2018 CJSP Certificate (translated)
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Attachment 20 – 1-30-2020 - Notice to Lift Award 2's Suspension
Attachment 21 – NSF Victim Impact Statement
Attachment 22 – KU Victim Impact Statement

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Hu “Tiger” Tao
University of Texas-Austin

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

JAN 0 8 2020

[redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-18-0115-O)

Attached is our investigative report concerning allegations that Hu "Tiger" Tao failed to disclose to NSF, and to his university, a dual employment with the Shanghai Institute of Microsystems and Information Technology of the Chinese Academy of Sciences, and a membership in the Chinese Ten Thousand Youths program. This matter was referred to the U.S. Attorney's Office for the Western District of Texas, which declined to pursue a criminal prosecution of the case because Tao currently resides in China and his university returned all grant funds to NSF.

In order to protect the government, we recommend that NSF debar Tao for three (3) years. The basis for our recommendation is described in detail in the report.

To the best of our knowledge, Tao currently resides in China, however his wife remains in the United States. We have the following contact information on file:

[redacted]

Recommendation for Governmentwide Debarment

OIG Case Number I-18-0115-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

January 7, 2020

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AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case Number I-18-0115-O
January 7, 2020

WHAT WE FOUND

A University contacted NSF to report that the Principal Investigator (PI) on one of its NSF awards failed to disclose to the University and to NSF, an affiliation with Shanghai University in China. An FBI investigation further confirmed that the PI was a member of the Chinese Ten Thousand Youths Program since at least 2014 and failed to disclose that information to the University. In July 2018, after learning about the PI's undisclosed affiliations, the University contacted the PI via email to set up a meeting to discuss those affiliations. The PI declined the requested meeting because he was leaving the United States the same day for China, where he purportedly went to visit his parents. Shortly thereafter, and while still in China, the PI resigned from the University via email and has not return to the United States. In September 2018, the University voluntarily terminated the award, which had been scheduled to end in May 2019, and returned the funds in full to NSF.

WHAT WE RECOMMEND

We conclude that the PI lacks present responsibility and recommend a three (3) year debarment to safeguard NSF and federal government funds.

[redacted]

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Factual Background

On July 20, 2018, a University[1] notified NSF that it recently learned that the Principal Investigator (PI)[2] on one of its NSF awards (the Award)[3] failed to disclose to the University and to NSF a dual employment with Shanghai University in China.[4] The University initially requested a change in PI on the Award, but ultimately determined that because of the PI's dishonesty, it could not be confident that the Award had been administered properly. Therefore, the University volunteered to terminate the Award and return the expended award funds to NSF.[5]

OIG Investigation

We, along with the FBI, investigated the University's allegations against the PI. On June 26, 2018, the University received an email advising that the PI had a full-time position in both China and the United States.[6] Included in the e-mail were several links with supporting documents, including the PI's homepage for the University, which failed to mention his position in China, and the PI's homepages in China, which failed to mention his position at the University.[7] After receiving the email, the University asked to meet with the PI. The PI responded that he was unavailable to meet that day because he was leaving for a "two week vacation reunion" with his parents in China.[8] Alternatively, the PI suggested a meeting by phone, if it was urgent, or an in-person meeting when he returned.[9] On June 29, 2018, the PI emailed the University to resign his position, citing his intention to move on to future plans.[10] The PI's resignation was accepted by the University on June 30, 2018.[11] On July 5, 2018, the University contacted the FBI regarding the PI's resignation.

The PI began working at the University in January 2015 as an Associate Professor.[12] According to publicly available information, the PI joined the Shanghai Institute of Microsystems and Information Technology of the Chinese Academy of Sciences (SIMIT) as a researcher in January 2014[13], a year prior to joining the University, and continued working at SIMIT through the date of his resignation from the University. The same publicly available information describes the PI as a member of the Central Organization's "Ten Thousand Youths" program.[14] As part of his application package to the University, the PI provided a

[1] The University of Texas-Austin
[2] Hu "Tiger" Tao
[3] CMMI-1563422
[4] Tab 1
[5] *Id.*
[6] Tab 2
[7] *Id.*
[8] Tab 3
[9] *Id.*
[10] Tab 4
[11] *Id.*
[12] Tab 5
[13] Tab 6
[14] *Id.*

resume, which did not list his position as a researcher with SIMIT or his affiliation with the Ten Thousand Youths program.[15] The PI also failed to disclose his affiliation with the SIMIT in his annual financial interest disclosures to the University.[16]

On March 26, 2016, NSF made the Award to the University for $150,000 with an anticipated end date of May 31, 2019. The PI had also submitted five other award proposals to NSF through the University, each of which had been declined.[17] The five declined proposals sought a combined $1,812,728 from NSF. We reviewed the PI's curricula vitae (CV) submitted with the Award[18] and with the declined proposals and confirmed that they also failed to disclose any affiliation with SIMIT or any other foreign entity or talent plan.

We interviewed the Branch Chief of NSF's Division of Grants and Agreements in the Office of Budget, Finance, and Award Management.[19] He confirmed that the entirety of what had been drawn down on the Award had been returned by the University and NSF was in the process of terminating the Award.[20] He also advised us that the Award had a collaborative award[21] to another university, for which it was the lead, and therefore the companion award would also have to be terminated. NSF terminated the Award on October 12, 2018. We also interviewed the Award's Program Manager (PM).[22] The PM confirmed that he did not know about the PI's appointment at SIMIT and would have expected it to be included in the CV which the PI submitted in the Award proposal.[23] The PM also confirmed that had he known that the PI had additional time commitments, it would have affected his decision to recommend the Award for funding.[24]

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

We referred this matter to the United States Attorney's Office for the Western District of Texas, which declined to pursue a criminal prosecution of the case because (1) the PI is physically absence from the United States and there is no extradition treaty with China; (2) the University had returned all the grant money to NSF; and (3) administrative remedies could be pursued.

---

[15] Tab 7
[16] Tab 8
[17] CMMI-1538468, ECCS-1710901, CMMI-1809358, ECCS-1809358, and CMMI-1825307
[18] Tab 9
[19] [redacted]
[20] Tab 10
[21] CMMI-1562915 to SUNY Stonybrook
[22] [redacted]
[23] Tab 11
[24] *Id.*

OIG Assessment

Grounds for Debarment

NSF has authority to debar an individual for "Conviction…for [c]ommission of embezzlement, theft, [or] making false statements"[25] or "Any other cause of so serious or compelling a nature that it affects (the Subject's) present responsibility."[26]

Burden of Proof

"In any debarment action, the Federal agency must establish that there is cause for debarment by a preponderance of the evidence."[27] However, "if the proposed debarment is based upon a conviction or civil judgment, the standard of proof is met."[28]

Relevant Factors

The debarment regulation lists 19 factors for the debarring official to consider. The following factors are pertinent to this case.

1. Actual or Potential Harm or Impact[29]

   The PI's actions in concealing his appointment at SIMIT caused actual financial harm to both NSF and to the University. The PI's omissions were material and therefore caused NSF to make the Award for $150,000 to the University. Although NSF received from the University the entire $71,000 which had been drawn down, that $71,000 was a financial loss to the University. NSF also had to terminate the companion award and therefore lost what it had invested in that award. In addition to financial harm, the PI's conduct caused actual scientific harm by causing the termination of the research project which the Award and its companion had been funding. Finally, although they were ultimately not funded, the PI had sought approximately $1.8 million in additional research funds from NSF which potentially would have been impacted by his untruthful behavior had any of those proposals been funded by NSF.

2. Frequency of Incidents and/or Duration of the Wrongdoing[30]

   The PI did not disclose his appointment with SIMIT for over 4 years. The PI did not disclose his appointment with SIMIT in early 2014 when he first applied and interviewed for his

[25] 2 C.F.R. § 180.800(a)(3)
[26] 2 C.F.R. § 180.800(d)
[27] 2 C.F.R. § 180.850; 2 C.F.R. § 180.855
[28] 2 C.F.R. § 180.850(b)
[29] 2 C.F.R. § 180.860(a)
[30] 2 C.F.R. § 180.860(b)

position at the University. The PI then filed annual financial interest disclosures with the University and did not disclose his appointment with SIMIT thereon. From 2015 through 2019, the PI submitted six proposals to NSF through the University and each did not disclose any affiliation with SIMIT or any other foreign entity or talent plan.

3. Pattern of Wrongdoing[31]

   The PI's actions constitute a clear pattern of wrongdoing. As noted, this is not one instance of an omission which could be attributed to carelessness or a misunderstanding. Rather, the PI failed to disclose his appointment with SIMIT or his membership in the Ten Thousand Youths program for more than 4 years and across various documents submitted to both the University and NSF. This behavior demonstrates a purposeful and deliberate pattern of dishonesty wherein the PI attempted to conceal his appointment and affiliations with SIMIT and the Ten Thousand Youths program.

4. Role in Wrongdoing[32]

   The PI is solely responsible for his actions. His conduct cannot be attributed to the University or another individual.

5. Acceptance of Responsibility[33]

   The PI has not accepted any responsibility for his actions in this matter. The University, and subsequently NSF, only learned of the PI's untruthfulness through a third-party allegation. The PI has not admitted to any wrongdoing on his part. In fact, when the PI's omissions were discovered, rather than meet with the University as it requested, the PI resigned his position via email and remained in China. Furthermore, the PI's resignation did not contain an admission of wrong doing but only purportedly to move on to future plans.

6. Repayment[34]

   The PI has not made any repayments to the University or NSF. However, neither NSF nor any other Federal agency has contacted the PI seeking any repayments.

[31] 2 C.F.R. § 180.860(c)
[32] 2 C.F.R. § 180.860(f)
[33] 2 C.F.R. § 180.860(g)
[34] 2 C.F.R. § 180.860(h)

7. Cooperation of the Subject[35]

The PI resigned rather than meet with the University to discuss his misconduct. There has been no opportunity to cooperate with NSF or any other Federal agency because the PI has not been made aware of the investigation.

OIG Recommendation

In order to protect the interests of the public and NSF, OIG recommends that NSF debar the PI for three (3) years. Such a period of time is necessary to ensure federal funds are safeguarded.

[35] 2 C.F.R. § 180.860(i)

Attachments

TAB 1 – University Emails to NSF
TAB 2 – June 26, 2018 Allegation Email to UT-Austin
TAB 3 - June 26, 2018 Email Conversation with Tao
TAB 4 – Tao Resignation Email
TAB 5 – UT-Austin Offer Letter to Tao
TAB 6 – Tao's SIMIT Homepage and Bio
TAB 7 – Tao UT-Austin Application Package
TAB 8 – UT-Austin Financial Disclosures
TAB 9 - Tao Curriculum Vitae
TAB 10 – [redacted]
TAB 11 – [redacted]

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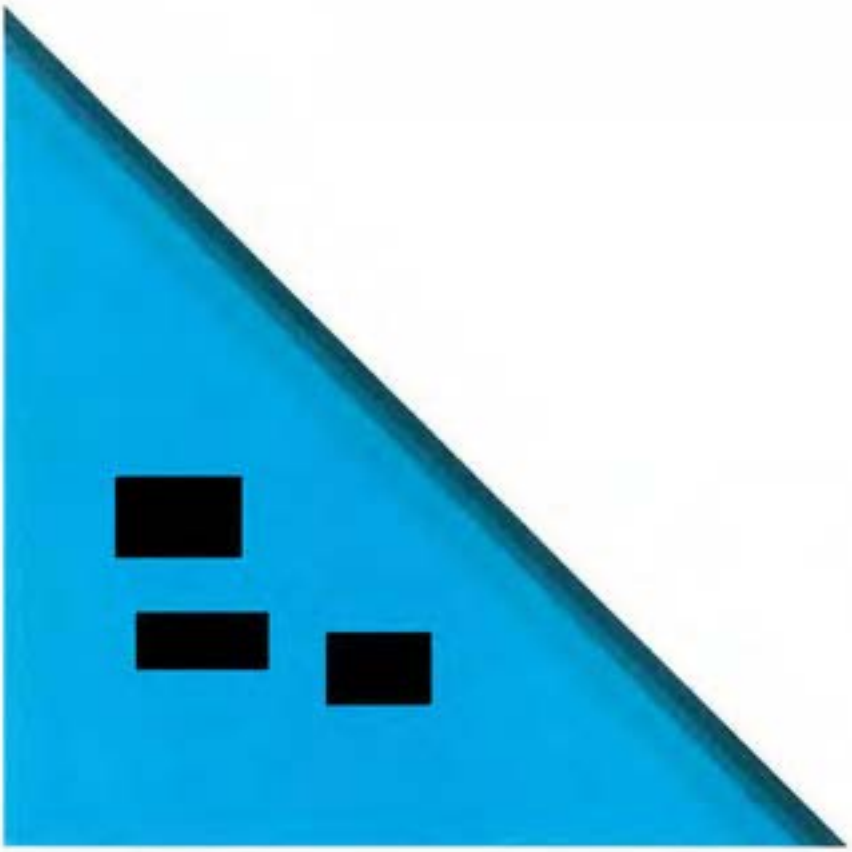

Education: Doctoral student mailing address: [redacted]
phone: [redacted] Postal code: [redacted]
fax: [redacted] e-mail: Tiger@mail.sim.ac.cn

resume:

Tao Hu, researcher, doctoral tutor, and the " Ten Thousand Youths " of the Central Organization Department . Research interests: terahertz detection and imaging technology, metamaterials, large-scale green micro-nano processing, nano-scale infrared characterization, degradable micro-nano photoelectric sensors and micro-systems.

In 2003 , he graduated from the Department of Precision Instruments and Precision Machinery of the University of Science and Technology of China. He graduated from the Institute of Electronics, Chinese Academy of Sciences, and is engaged in the research of miniature electric field sensors (2003-2006). He graduated from Boston University (Boston University , 2006-2010), based on the new research THz micro-nanofabrication of metamaterials technology and devices. During the post-doctoral period (2010-2011) and research assistant professors (2012-2014), at the University of Tufts, Tufts University , the company is engaged in human implantable and controllable micro-nano photoelectric sensors and micro-system research. In 2009 , he won the "National Outstanding Self-financed Scholarship" and in 2010 won the Best Doctoral Thesis Award from Boston University School of Engineering. In January 2014 , he was selected as a researcher by the Shanghai Institute of Microsystems and Information Technology of the Chinese Academy of Sciences.

Researcher Tao Hu has been engaged in the research and development of sensitive materials and micro-nano sensors for innovative sensitive principles and effects. He has published more than 50 academic papers in internationally renowned journals and top conferences , including Science (cover cover), Nature , Nature Photonics (cover article), Nature Nanotechnology (cover article), Nature Communications , PNAS , Advanced Materials (3 cover articles and A special review), Physical Review Letters , Small (cover article), Optics Express, etc. Published articles in recent 5 years ISI total citations up to 1000 times. A number of innovation frontiers bave received extensive attention and evaluation from international peers. He bas been invited to give special lectures at internationally renowned universities and research institutions such as Harvard University, Duke University, MIT Lincoln Laboratory, and Los Alamos National Laboratory. The research results have been reported manv times bv top international iournals such as Science. Nature. Nature Materials. etc.. and

Chinese Academy of Sciences University
[中文] (/~0041226) [English] (/~0041226?language=en)

- 1. Admissions information
- 2. Education background
- 3. Work experience
- 4. Teaching courses
- 5, patents and rewards
- 6, publishing information
- 7. Research activities
- 8. Cooperation
- 9, guiding students

Basic Information

Tao Hu Male Ph.D. Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences
[redacted]

Research area

Admissions Information

Admissions profession

080903-Microelectronics and Solid State Electronics
085208-Electronics and Communication Engineering

Enrollment direction

Micro-nano electromechanical system

Education background

2006-09--2010-05 Boston University, USA Mechanical Engineering, PhD
2003-09--2006-07 Institute of Electronics, Chinese Academy of Sciences Physical Electronics, MS
1998-09--2003-07 University of Science and Technology of China Mechanical Engineering, Bachelor

Education

Bachelor of Science

work experience

resume

2014-05~Now, Shanghai Institute of Microsystems, Chinese Academy of Sciences, Researcher
2012-01~2014-04, Tufts University, Biomedical Engineering, Research Assistant Professor
2010-05~2011-12, Tufts University, Biomedical Engineering, Postdoctoral
2006-09~2010-05, Boston University, Mechanical Engineering, PhD
2003-09~2006-07, Institute of Electronics, Chinese Acedemy of Sciences, Physical Electronics, Master
1998-09~2003-07, University of Science and Technology of China , Mechanical Engineering, Bachelor

Social work

Teaching Courses

Patents and rewards

Reward information

(1) Youth Thousand Talents Program, First Prize, National Level, 2014

Patent achievement

(1) A silk protein bone nail and a preparation method thereof, 2015, 1st author, Patent No.: 201510766615.X
(2) A silk protein implant tooth and a preparation method thereof, 2015, 1st author, Patent No.: 201510766677.0
(3) A silk protein implant and its preparation method, 2015, 1st author, Patent No.: 201510766678.5
(4) A central venous pressure automatic monitoring system, 2015, 1st author, patent number: 201510766678.5

Publishing information

Published papers

(1) Advanced Healthcare Materials, A Silk Cranial Fixation System for Neurosurgery, 2018, 11th Author
(2) Advanced Materials, Protein Bricks: 2D and 3D Bio-Nanostructures with Shape and Function on Demand, 2018, 11th Author
(3) Advanced Science, Multicolor T-Ray Imaging Using Multispectral Metamaterials, 2018, 11th Author
(4) Advanced Materials, Engineering the Future of Silk Materials through Advanced Manufacturing, 2018, 11th Author
(5) Advanced Materials, The Use of Functionalized Silk Fibroin Films as a Platform for Optical Diffraction-Based Sensing Applications, 2017, 11th Author
(6) Nature Communications, Nanoscale probing of electron-regulated structural transitions in silk proteins by near-field IR imaging and nano-spectroscopy, 2016, 11th author
(7) Advanced Materials, Inkjet Printing of Functional Silk Fibroin Inks: From Printable Forms to Printable Functions, 2015, 1st Author
(8) Proceedings of the National Academy of Sciences, PNAS, Silk-based resorbable electronic devices for remotely controlled therapy and In vico infection abatement, 2014, 1st author

Publication

Research activities

Research Project

(1) Research on green nano-lithography technology based on biological protein, hosted, national level, 2016-01--2019-12
(2) Research and development of eco-friendly polymer bio-photoresist based on silk protein, hosted, Provincial level, 2014-07--2017-06
(3) Multi-mode super-diffraction near-field terahertz spectrometer, presided over, ministry level, 2018-01--2019-12
(4) Accurate controllable dissolved transient electronic technology Research, Hosting, Ministries, 2017-01--2019-12
(5) Shanghai "Excellent Academic Leader", hosted, Provincial, 2018-01--2019-12

Participate in the meeting

Cooperation situation

Project collaboration unit

Guiding students

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TAO Hu

TAO Hu received his Ph.D. in mechanical engineering from Boston University in 2010, winning the Best Dissertation Award. His research interests have primarily focused on terahertz metamaterials using micro-electromechanical systems technology. After graduating, Tao joined the Department of Biomedical Engineering at Tufts University as a postdoctoral associate, and later advanced to research assistant professor.

In 2014, he was appointed as a Thousand Young Talents Plan professor at SIMIT where his research focuses on green nanotechnology and micro/nanotechnology-enhanced novel electronic and photonic devices for biomedical applications. Tao has published over 50 papers in peer-reviewed scientific journals including *Science* (cover), *Nature*, *Nature Photonics* (cover), *Nature Nanotechnology* (cover), *Nature Communications*, *Proceedings of the National Academy of Sciences of the United States of America*, *Advanced Materials* (cover), *Small* (cover), and *Physical Review Letters*.

PHOTO: (JOHN CLARKE) PEG SKORPINSKI

Dr. Chenzhong Li
Florida International University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

May 15, 2020

To: [redacted]

From: [redacted]

Subject: Recommendation for Governmentwide Suspension (OIG Case I-19-0054-O)

Attached is our investigation report concerning allegations that Chenzhong Li, an NSF Program Director formerly on temporary assignment to NSF, engaged in a pattern and practice of deception in repeatedly failing to disclose material information regarding his sources of compensation, foreign affiliations and/or employment on (1) his Questionnaire for a Public Trust position, (2) his financial disclosure forms, (3) his proposals to NSF for funding, and (4) other official documents. The wrongdoing is serious and material and has put federal funds at immediate risk. We have referred this matter to the U.S. Attorney's Office for the Eastern District of Virginia, where it has been accepted for further criminal investigation and possible criminal prosecution.

In order to protect the federal government, we recommend that NSF suspend Chenzhong Li governmentwide while our investigation is ongoing. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for the subject and his attorney:

Chenzhong Li [redacted]

[redacted]

Recommendation for Governmentwide Suspension

OIG Case Number I-19-0054-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

May 7, 2020

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

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AT A GLANCE

Recommendation for Governmentwide Suspension

OIG Case Number I-19-0054-O
May 7, 2020

WHAT WE FOUND

This investigation originated following a review of open source materials related to former NSF Program Director Chenzhong Li. Li was working at NSF as a temporary Intergovernmental Personnel Act employee on loan from Florida International University in Miami, Florida until December 10, 2019. Li was interviewed as a witness during two other NSF OIG investigations and answers he provided raised red flags that led to a review of his background and experience. That review found evidence that Li has been affiliated with and/or employed by multiple organizations that were not disclosed to the Federal government on multiple official documents. These undisclosed organizations include Liaocheng University, Shanxi University, Shaanxi Normal University, the Taishan Scholars Program, the Macao Scholars Cooperative Research Fund, the Society for Personalized Nano Medicine, Elsevier Inc., Begell House Inc., and the journal *Research*. Documents obtained from NSF, HHS, and other sources show that Li did not disclose these associations going back at least as far as 2014 to the present. Li did not disclose his affiliations on grant proposals to NSF and HHS, a Questionnaire for a Public Trust position, his financial disclosure forms, proposals to NSF for funding, and other official documents.

Based upon the information developed during an NSF OIG and HHS OIG joint investigation of Li, the case was referred to the U.S. Attorney's Office for the Eastern District of Virginia, which accepted the matter for further criminal investigation.

WHAT WE RECOMMEND

OIG recommends that NSF suspend Chenzhong Li governmentwide pending conclusion of the ongoing criminal investigation and proceedings to protect the United States from further fraud.

[redacted]

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Factual Background

Dr. Chenzhong Li, a native of China, is a naturalized U.S. citizen, currently residing in Miami, Florida. According to publicly available biographical information, Li received his Ph.D. in Bioengineering from Kumamoto University in Japan in 2000. Li was employed at NSF since September 2017, first as a Visiting Scholar, Engineer or Educator (VSEE) and then, as an Intergovernmental Personnel Act (IPA) appointee from Florida International University (FIU). Li's IPA appointment was originally due to expire in August 2020 but was terminated on December 10, 2019 following an OIG recommendation. At NSF, Li was a Program Director who oversaw the review of proposals and award of NSF funds in his area of expertise. During his tenure at NSF, Li reviewed over 300 proposals and made recommendations to fund approximately 45 awards, valued at over $12 million.

As a federal employee paid by NSF, Li was subject to the same rules that govern the conduct of all federal employees, including ethics requirements and conflict of interest and bribery laws. NSF's website[1] provides background on the ethical standards NSF staff are held to, as well as why those standards exist: "All members of the NSF staff are expected to adhere to high standards of ethical conduct. This includes civil service employees; visiting scientists, engineers, and educators; and those working at NSF under the Intergovernmental Personnel Act. The success of the NSF in performing its functions depends on the effectiveness and evenhandedness of its decision-making processes. If judgments are warped or biased because of conflicting outside interests, the decision-making process is compromised. NSF must continually earn the public's confidence in its integrity. To do so, each NSF staff member must endeavor to avoid even the appearance of impropriety."

Li is also a professor in the Department of Biomedical Engineering and an affiliated professor in the Department of Immunology at the College of Medicine at FIU, in Miami, Florida, where Li also maintains a permanent residence. Prior to Li's appointment as a VSEE in 2017, Li was named as the PI or Co-PI on more than 30 proposals submitted to NSF, had been the PI or Co-PI on 5 grants made by NSF, and served as a panelist responsible for reviewing and scoring pending NSF proposals on multiple occasions. In addition, Li was the PI or Co-PI on two grants to FIU made by the U.S. Department of Health and Human Services (HHS).

OIG Investigation

In 2018, we interviewed Li regarding a PI who had traveled to China and charged foreign travel expenses to NSF without prior budgetary authorization or sufficient justification or documentation. The PI was listed on a website as a professor at Tianjin University and our interviewers raised a concern that the PI was getting a dual salary from NSF funding and the Chinese university. Li was interviewed for his perspective on the issue as an NSF program officer.

[1] https://www.nsf.gov/policies/conflicts.jsp

We identified a second PI who did not disclose his participation in a Chinese Talent Plan[2] and his related affiliation with Qingdao University in NSF grant proposals. Because Li was the awarding program officer for one of this PI's grants, we interviewed Li in November of 2018 in order to determine his perspective on the allegations.

After reviewing Li's responses and assertions during these interviews, which were inconsistent with the NSF rules and regulations, we conducted open source internet searches on Li to assess his background and experience. Online articles identified Li as a Taishan Scholar or affiliated with Liaocheng University. According to a statement from the Shandong Provincial government website on December 20, 2018, the Taishan Scholars Program is designed to select and financially support high-level innovative talents in China and abroad in 2019.[3]

Taishan Scholars Program

Further review of the same Shandong Provincial government website revealed the general rules, standard conditions, and procedures for selection of Taishan Scholars in Shandong Province, including the selection of 300 high-level talents in China and abroad from years 2015-2020. Further criteria include: the selected individuals are "high-level innovative talents engaged in scientific research in the front line at home and abroad;" the Communist Party of China and its regional provincial affiliates run the program; the commitment is five years; priority is given to talents who are approximately 45 years old; talents should have a doctoral degree from a well-known university and research institution in China and abroad, have "a senior-level professional and technical position, or hold a professional and technical position equivalent to associate professor or above in well-known overseas universities and research institutions"; talents should "have high academic achievements; have published a specific number of high-level academic papers in the past five years"; have completed "key" provincial-level scientific research projects, or "significant overseas scientific research projects." Part-time talents must work for more than 2 months per year; part-time selectees and their teams are guaranteed 100,000[4] yuan as a "talent allowance" and 100,000[5] yuan for research. If part-time selectees sign an employment contract for five years or more, they receive a "one-time talent allowance of 1 million yuan."[6]

Liaocheng University and Other Affiliations

Liaocheng University is in Shandong Province, China. Open source website review indicates that it participates in China's Talent Plan Program by recruiting and employing participants in Talent

[2] The Chinese Talent Plans are programs established by the Chinese government to recruit individuals with access to or knowledge of foreign technology, intellectual property, or individuals in a position to influence others. Through these plans, the Chinese government has created a significant financial incentive for foreign, talented individuals to transfer international technology and intellectual property to China, licitly or otherwise; to conduct influence operations on behalf of the Communist Party of China; and to recruit others to do the same. The goal is to further China's national ambitions and security.

[3] TAB 1 - Taishan Scholars website

[4] Based on the exchange rate as of November 14, 2019, this is approximately $14,245.00 in U.S. currency.

[5] Based on the exchange rate as of November 14, 2019, this is approximately $14,245.00 in U.S. currency.

[6] Based on the exchange rate as of November 14, 2019, this is approximately $142,435.00 in U.S. currency.

Plans, to include the Taishan Scholars Plan.[7] The website classifies various Talent Plan participants into "levels" depending upon the affiliations of the participants, such as being a member of the Chinese Academy of Sciences or the Taishan Scholars Plan, first and third level talents respectively. Individuals participating in this are categorized as "high-level talent." As high-level talent, they are offered salary, a recruiter's fee, relocation housing and "research start-up funds" by Liaocheng University that can be valued in excess of 2,600,000 yuan.[8] These Liaocheng University funds would be in addition to funds received under any Talent Plan, including the Taishan Scholar Plan.

We checked to see if Li had disclosed his affiliation with Liaocheng University or the Taishan Scholar Plan to NSF. We also checked various sources, including his biosketches from Li's own NSF proposals, his biography on the NSF website, and his *curriculum vitae* on the FIU website. We found no disclosure of any of these affiliations in those documents or websites. Following this discovery, we initiated an investigation of Li. During the investigation, we identified additional publications reflecting Li's affiliation with Liaocheng University, including one online publication that listed Li under the headings Liaocheng University Master Teachers," "National Excellent Teachers," "Experts who enjoy the special government allowance of the State Council," and "Taishan Scholars."[9] Li is also listed as a Taishan Scholar in a publicly availahle website published in Chinese characters.[10] In addition, on April 23, 2013, the provincial government of QuanZhou, China published a "Notice of Recruitment" highlighting a list of "overseas talents" which included Li's name and contact information. In all, there are at least 22 publications Li has co-authored since he started working at NSF which acknowledge Chinese funding sources, some of which reference funding from the Taishan Scholars Research Fund, as would be required under a Taishan Scholars contract. During Li's tenure at NSF, there are also eight articles that reflect an affiliation with Liaocheng University, two that list an affiliation with Shaanxi Normal University or Shanxi University,[11] and one that shows Li and another professor receiving 1.8 million yuan in funding from the "International/Overseas and Hong Kong/Macau Scholars Cooperative Research Fund."[12]

Failure to Disclose Foreign Affiliations and Funding Sources

Beginning around 2006, Li submitted more than 30 research proposals to NSF through FIU and other academic institutions and was a PI or Co-PI on 5 successful NSF awards valued at over $1.3 million. Li also served as an NSF panelist at least twice. However, by 2014, none of his biosketches listed any Chinese appointments or positions even though articles about the research he conducted publicized such affiliations as far back as April of 2013 and continued through late 2018. In addition, approximately eight of ten proposals that Li submitted after April 2013 required the PI and Co-PI to submit current and pending support (i.e., funding) information. A

[7] TAB 2 - Liaocheng University website
[8] Based on the exchange rate as of November 14, 2019, this is approximately $370,000.
[9] http://www.lcu.edu.cn/szdw/index.htm
[10] http://img.sdchina.com/UsersFiles/file/2014tsxz01.xlsx
[11] Shaanxi Normal University and Shanxi University are different institutions located in adjacent Chinese provinces.
[12] http://klascc.snnu.edu.cn/info/1079/1645.htm

review of those eight proposals revealed that Li did not disclose any current and pending support from any Chinese source although the articles he authored or co-authored did so.

As part of his application for employment at NSF, on August 25, 2017, Li submitted an SF-85P and disclosed employment as a professor at FIU from August 2006 to the present; employment at FIU as a Research Officer from January 2004 to July 2006; and as a Research Associate at FIU from January 1, 2002 to December 2003. He did not disclose any other employment activities, including those previously indicated on his scientific publications for which he was credited as a co-author. Li certified that "[m]y statements on this form and any attachments to it, are true, complete, and correct to the best of my knowledge and belief and are made in good faith. I understand that a knowing and willful false statement on this form can be punished by fine or imprisonment or both. (See section 1001 of title 18, United States Code)."

After being hired, on approximately October 20, 2017, Li filed the required initial Office of Government Ethics (OGE) Form 450 but did not disclose on it any of the above-referenced affiliations with Liaocheng University, Shaanxi Normal University and Shanxi University he held, at least as recently as the months of January, February and March 2017, preceding his arrival at NSF.[13] Li certified that the OGE Form 450 and the statements made therein were "true, complete and correct to the best of my knowledge."

In addition to not disclosing his foreign affiliations on the OGE Form 450, Li also omitted any reference to his involvement with the Society for Personalized NanoMedicine ("SPNM"), a Florida-based non-profit organization. SPNM's website[14] includes an image of Li and lists him by name with four other individuals as members of SPNM's Executive Committee. Earlier versions of the SPNM website indicate that Li's position on SPNM's Executive Committee went back at least as far as October 2016. SPNM's bylaws, also available on the organization's website, state, in part, "The society shall have five officers, President, President-elect, Past President, Secretary, and Treasurer. These officers along with founding President shall comprise the EXECUTIVE COMMITTEE of SPNM and the President will serve as chair. The Executive Committee, in consultation with the Council (see below), shall be responsible for the day-to-day operation of the Society and the entire executive committee must approve all actions taken by individual members of the committee. The executive committee will also serve as the BOARD OF DIRECTORS of the Corporation."

Li did disclose a variety of editorial positions he actively and previously held with various publishing organizations in his initial OGE Form 450, including at *Springer, Hindawi Journal of Sensors,* and *PLOS ONE*. After reviewing his submission, an NSF Ethics Official emailed Li on October 31, 2017 with NSF's requirements for holding such outside positions, including that the work must be independent from his NSF duties; he could not be named on any proposal submitted by the organization for federal funding; he could not use his NSF title or affiliation and must advise his outside organizations not to do so; and he was required to report the

[13] Li did disclose the receipt of $30,000.00 in income from a visiting professorship at the Japan Society for the Promotion of Sciences, a position he indicated he no longer held.
[14] s-pnm.org/our-society.html

positions, compensation and travel reimbursements on his OGE Form 450.[15] Following receipt of the October 31, 2017 email, and prior to his submission of his second OGE Form 450 on February 8, 2019, Li sought and obtained two additional outside editorial positions: one with *Begell House Publishers* and the other with *Elsevier Publications*.

The terms of Li's agreement with *Elsevier* included that he was to receive an annual honorarium of $4,000 in equal quarterly installments in February, May, August, and November of each calendar year during the term into the Editor's designated bank account. The agreement identified Li's physical address as his NSF office. As recently as October 2019, Li was identified on the *Elsevier* website as Editor of *Biosensors and Bioelectronics*.[16]. Despite the guidance an NSF Ethics Official gave Li in the October 31, 2017 email to not use his NSF title or affiliation with outside organizations, Li's profile on the *Elsevier* site names him as "the current program director of Biosensing program at the National Science Foundation (NSF) of USA."

Li filed a second OGE Form 450 on approximately February 8, 2019 and again certified that the statements made therein were "true, complete and correct to the best of my knowledge." In addition to not disclosing his affiliation with Liaocheng University in the second OGE Form 450, Li did not disclose the outside position with SPNM or the editorial positions or compensation he had obtained previously with *Begell House Publishers* and *Elsevier Publications*. As of the date of his termination, Li did not amend or correct his second OGE Form 450 or disclose to appropriate NSF Ethics Officials any of these outside editorial positions and income he received from *Elsevier* Publications in February 2019.

During a voluntary interview with Li on December 10, 2019, he stated that he applied to be a Taishan Scholar through Liaocheng University in China and had signed a contract in 2014 or 2015.[17] He was invited to do so by the President of Liaocheng University.[18] Although Li believed the contract had been "discontinued," neither party to the contract put that in writing.[19] When discussing the Form 450s and SF-85Ps, Li confirmed that he had not "given anyone else permission to sign forms on his [behalf]".[20] While Li continuously denied that he had received any research funding he did not disclose, when asked why he had not disclosed research projects funded by China on his applications for funding to NSF, Li replied "I don't think I disclose all the collaborations because I have so many collaborations… I don't think I disclose all of them."[21]

Li did admit that he should have disclosed to NSF his application for a Hong Kong Macao Scholars Research Fund award, which was subsequently awarded.[22] He also acknowledged that

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[15] TAB 3 – October 31, 2017 email
[16] https://www.journals.elsevier.com/biosensors-and-bioelectronics/editorial-board/professor-chenzhong-li
[17] TAB 4 - Li Interview transcript, pp. 43-44
[18] *Id.* p. 126
[19] *Id.* pp. 48-49
[20] *Id.* p. 98
[21] *Id.* p. 106
[22] *Id.* p. 175

his listed coauthors did not follow Li's stated practice of listing collaborators as affiliations in publications.[23]

Li refused to answer questions related to the representations made in his application for citizenship[24] and also declined to explain the origin of the funds used to buy Li's three rental properties.[25]

Our investigation uncovered evidence that Li held outside positions prior to and concurrent with his NSF employment, that he has affiliations with foreign entities related to those outside positions which were announced publicly in scientific publications, that he received funding from foreign entities, and he knowingly and intentionally did not disclose, and actively concealed such material information from NSF.

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

Based upon information uncovered during our multiagency investigation, the participating agencies referred the case to the U.S. Attorney's Office for the Eastern District of Virginia, which accepted the matter for further criminal investigation.

OIG Assessment

Grounds for Governmentwide Suspension

Pursuant to 2 C.F.R. § 180.605, suspension is the "temporary status of ineligibility for procurement and non-procurement transactions, pending completion of an investigation or legal proceedings." The procedures for suspension action are set forth in 2 C.F.R. § 180.700, which recognizes the serious nature of suspension actions, and sets for the procedures under which suspension may be effectuated. Pursuant to this section, the suspending official may issue a suspension if it determines that:

(1) "[t]here exists an indictment for, or other adequate evidence to suspect an offense listed under§ 180.800(a)," *or*
(2) "[t]here exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d)"; *and*
(3) "[i]mmediate action is necessary to protect the public interest."

Unlike debarment actions, suspensions are effective upon signature of the suspending official, and are generally imposed prior to notification to the suspended party.[26]

The analysis in suspension actions is similar to that undertaken in debarment actions, except that suspensions have a lower burden of proof of "adequate evidence," and an added requirement that

[23] Id. pp. 182-183
[24] *Id.* p. 109
[25] *Id.* p. 248
[26] 2 C.F.R. § 180.710

there be a showing of "immediate need."[27] Specifically, NSF may suspend a person or entity for the same reasons listed in 2 C.F.R. §180.800(a), -(b), -(c), or -(d), if there is adequate evidence to suspect that the individual or entity being considered for suspension is engaged in:

- "[c]ommission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public or private agreement or transaction";[28]
- "[c]ommission of ... theft, ... making false statements, ... [or] making false claims";[29]
- "[c]ommission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects ... present responsibility";[30] or
- "violation of the terms of a public agreement or transaction so serious as to affect the integrity of an agency program ... such as ... a willful violation of a statutory or regulatory provision or requirement applicable to a public agreement or transaction ... "[31]

NSF may also suspend such person or entity if NSF determines there is "[a]ny other cause of so serious or compelling a nature that it affects ... present responsibility."[32]

Adequate Evidence that Cause for Suspension Exists

In suspension actions, the burden of proof lies with the Federal agency to demonstrate that adequate evidence exists to support a debarment action. The debarment regulation lists 19 factors that the debarring official may consider, if applicable,[33] when determining whether there is adequate evidence that a cause for debarment exists. The following factors are pertinent to this case:

1. Actual or Potential Harm or Impact[34]

Li's actions have caused significant actual harm to NSF. Contrary to existing conflict of interest and ethical rules, Li repeatedly failed to disclose material information regarding his foreign affiliations, outside positions, and sources of compensation. Because NSF relies upon the integrity of its employees in the self-reporting financial disclosure process, Li's actions were difficult to detect. By abusing his high-level position of trust within NSF, he has compromised the foundation of a system that relies upon honesty to function properly.

2. Frequency of Incidents and/or Duration of the Wrongdoing[35]

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[27] 2 C.F.R. § 180.605
[28] 2 C.F.R. § 180.800(a)(1)
[29] 2 C.F.R. § 180.800(a)(3)
[30] 2 C.F.R. § 180.800(a)(4)
[31] 2 C.F.R. § 180.800(b)(3)
[32] 2 C.F.R. § 180.800(d)
[33] 2 C.F.R. § 180.860
[34] 2 C.F.R. § 180.860(a)
[35] 2 C.F.R. § 180.860(b)

Li has demonstrated a pattern of deception, beginning before he was given a position of public trust at NSF and continuing while he held that role. From at least 2014 on, Li made multiple false statements and omissions to NSF including submitting multiple grant proposals in which he failed to disclose his foreign affiliations and funding, providing false and misleading OGE Form 450s, and falsely certifying to the truthfulness and accuracy of his Questionnaire for a Public Trust Position.

3. Pattern of Wrongdoing[36]

Li's actions demonstrate a pattern of disregard for NSF standards for ethical conduct. From at least 2014, none of Li's proposal biosketches or current and pending support sections list his affiliations with Chinese institutions. Li's OGE Form 450s and Questionnaire for a Public Trust similarly omits this information, and information regarding compensation from outside sources.

4. Role in Wrongdoing[37]

Li is solely responsible for not disclosing his outside positions prior to and during his NSF employment.

5. Acceptance of Responsibility[38]

Although, Li agreed to be interviewed as part of this investigation, he did not fully accept responsibility for his actions during that meeting.

6. Repayment[39]

No funds have yet been returned to NSF. In response to a recommendation from NSF OIG, NSF terminated Li's IPA award CBET-19413391 to FIU.

7. Cooperation of the Subject[40]

Li agreed to be interviewed as part of this investigation and willfully provided passcodes to his electronic devices.

8. Position Held by Subject[41]

Li held a high-level position of trust as a Program Director at NSF and had primary oversight responsibility for the integrity of the program. As noted in NSF Bulletin 12-046,[42] Program

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[36] 2 C.F.R. § 180.860(c)
[37] 2 C.F.R. § 180.860(f)
[38] 2 C.F.R. § 180.860(g)
[39] 2 C.F.R. § 180.860(h)
[40] 2 C.F.R. § 180.860(i)
[41] 2 C.F.R. § 180.860(k)
[42] "Roles and Responsibilities of NSF Staff Involved in the Management and Oversight of Large Facilities" (February 10, 2012)

Officers are "the research community's interface to the NSF. The PO's responsibilities are substantial, and crucial to NSF's success." As part of his duties, Li oversaw approximately $12 million in awards. Li failed to adhere to the high standards that accompany such a role of responsibility.

9. Organizational Action[43]

In response to a recommendation from NSF OIG, NSF terminated Li's IPA award CBET-19413391 to FIU.

Immediate Need

"In deciding whether immediate action is needed to protect the public interest, the suspending official has wide discretion."[44] As an example, the suspending official "may infer the necessity for immediate action to protect the public interest ... from potential business relationships or involvement with a program of the Federal Government."[45]

OIG Recommendation

It is imperative that the ability of Li to obtain and spend Federal funds be suspended for the duration of this active investigation being conducted in conjunction and coordination with the U.S. Attorney's Office for the Eastern District of Virginia. Therefore, we recommend that NSF suspend Li governmentwide pending conclusion of this ongoing criminal investigation.

[43] 2 C.F.R. § 180.860(l)
[44] 2 C.F.R. § 180.705(c)
[45] 2 C.F.R. § 180.705(c)

Attachments

TAB 1 – Taishan Scholars website (translated)
TAB 2 – Liaocheng University website and translation
TAB 3 – October 31, 2017 email
TAB 4 – Li Interview Transcript

学校概况 组织机构 师资队伍 教学科研 招生就业 合作交流 学子家园 校园服务

师资队伍

两院院士
聊大名师
人才招聘

两院院士

左铁镛	魏江春	汪尔康
石钟慈	张新时	薛群基
吴培亨	黄伯云	

聊大名师

全国优秀教师	享受国务院政府特殊津贴专家	泰山学者
李晨钟	韩军	范尚立
山东省有突出贡献的中青年专家	山东省优秀教师	省级教学名师
校级教学名师		

人才招聘

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Taishan Scholar Overseas Experts List (Innovative Talents)

December 2014

Serial number	Reporting unit	Name	Country of Citizenship	Work unit before returning home	Proposed (current) position	Selection method
1		Dani Riccis (Daniel Lischinski)	Israel	Hebrew University of Jerusalem, Israel	professor	part time
2		Jiang Wenxin	United States	Northwestern University	professor	part time
3		Jiong Guo	Germany	Salzburg University	professor	full time
4	Shan Dong University	Chen Yu	Canada	Queens College, City University of New York, USA	Special expert	full time
5		Lou Jun	China	Rice University	Special expert	part time
6		Tan Baocai	United States	Chinese University of Hong Kong	Dean	full time
7	Ocean University of China	Dong Bo	China	Kobe Developmental Biology Center, Institute of Physical Chemistry, Japan	professor	full time
8		Xu Jingping	United States	US Geological Survey	professor	full time
9	Shandong Agricultural University	Xiao Yanmei	China	University of California, Davis	Distinguished Professor	full time
10	Shandong Normal University	Zheng Yuanjie	China	University of Pennsylvania	professor	full time
11		Tang Jie	Japan	National Institute of Materials Science, Japan	professor	full time
12	Qingdao University	Li Lei	China	University of Western Ontario	professor	full time
13		Li Qing Party	China	Kassel AuE, Germany	professor	full time
14	Qingdao University of Science and Technology	Sun Jing	China	Lawrence Berkeley National Laboratory	professor	full time
15	Qufu Normal University	Liu Zhe	China	University of Basel, Switzerland	professor	full time
16	Qingdao Technological University	Forest natural	Australia	Queensland University of Technology	Distinguished Professor	full time
17		Cistanche	United States	University of Miami School of Medicine	Overseas special experts	full time
18	Yantai University	Li Ji	United States	State University of New York at Buffalo School of Medicine	professor	full time
19	Linyi University	Wei Di	United Kingdom	Cambridge University	professor	full time
20	Liaocheng University	Chen Zhong Li	Canada	Florida International University	Overseas special experts	part time

twenty one	Shandong Jianzhu University	Farouk Tahamahaba (Taha Farouk Marhaba)	United States	New Jersey Institute of Technology	Distinguished Professor	part time
twenty two	Ludong University	You re-enter	Australia	Australian Department of the Environment, New South Wales	Overseas special experts	full time
twenty three	Jining Medical College	Xiong Huabao	United States	Institute of Immunology, Mount Sinai School of Medicine, USA	professor	part time
twenty four	Taishan Medical College	Zhang Hanjun	China	West Virginia University Health Sciences Center	professor	full time
25	Binzhou Medical College	Zhang Chunxiang	China	Rush University	Distinguished Professor, Dean of the China-US Institute of Translational Medicine	full time
26	Texas College	Zhou Yaoqi	United States	Griffith University	Distinguished Professor	part time
27	Qilu Hospital of Shandong University	Cao Yihai	Sweden	Karolinska Institute, Sweden	professor	part time
28		Wang Jian	China	University of Bergen, Norway	researcher	full time
29	Shandong Academy of Sciences	Chu Xinyu	China	University of Colorado	Chief Expert of the Lidar Detection Technology R&D Team	full time
30		Shifeng	China	Nagoya University	Research Director	full time
31	Shandong Academy of Agricultural Sciences	Rogafa	new Zealand	Royal New Zealand Academy of Agricultural Sciences	Environmental protection new fertilizer research and development job specialist	full time
32	Qingdao University Affiliated Hospital	Xing Mingzhao	United States	Hopkins University School of Medicine	Attending physician	part time
33	Qingdao Municipal Hospital	Zhang Xiaochun	China	University of Texas MD Anderson Cancer Center	Director of Qingdao Cancer Individualized Diagnosis and Treatment Research Center	full time
34	Yantai Branch of the 5th Research Institute of China Ordnance Industry	Cao Jianwu	China	Hitachi Chemical Co., Ltd.	Director of Special Ceramics Research Office	full time
35	Affiliated Hospital of Jining Medical College, Zhangzhou District	Yan Bo	United States	George Washington University	Director of the Center for Molecular Medicine	full time
36	Liaocheng People's Hospital	Liu Yusen	United States	Ohio State University School of Medicine	Director of pathophysiology laboratory	part time
37	Shandong Heavy Industry Group	Hu Haoran	United States	Eaton Corporation	chief scientist	full time
38	Haier Group Technology R&D Center	Du Yonggang	Germany	Bosch - Siemens Electric Co., Ltd.	Senior Technical Director	full time
39	Haier Group Technology R&D Center	Tao Xie	China	American EC Energy Power Systems (EchoGen Power Systems)	R & D Director	full time
40	Weihai Yulin Electronics Co., Ltd.	Qiu Zongwen	China Taiwan	Zheng Xiu University of Science and Technology	Deputy general manager	full time
41	Weihai New Standard Marine Breeding Technology Co., Ltd.	Bai Wei (BAIWHITE)	new Zealand	New Zealand NZCHNG Technology Research Institute	General Manager and Technical Director	full time
42	Weigao Group Co., Ltd.	Yu Huazhen	Austria	Austria Unicom GmbH	Chief Engineer, Weigao Group Technology Center	full time

43	Shandong Tiandingfeng Nonwovens Co., Ltd.	Liu Weili	United States	Dow Chemical Company	chief scientist	full time
44	Shandong Green Leaf Pharmaceutical Co., Ltd	Lu Jun	United States	Simulation Pharmaceuticals (Momenta)	Director of Antibody Pilot Research	full time
45	Shandong Kaisen Pharmaceutical Co., Ltd.	Wu Junjun	United States	American Edelmer	Deputy General Manager and President of Research and Development	full time
46	Shandong Nuomabo Biomedical Technology Co., Ltd.	Liang Shaoqin	United States	GlaxoSmithKline Research and Development Center (China)	Project Director	part time
47	Shandong Yamei Technology Co., Ltd.	Lai Xinge (Reisinger Christian)	Austria	Lanjing Holding Group	Independent Director of Bohai Industry, CEO of Yamei Technology	full time
48	Inspur Group Co., Ltd.	Zou Dingguo	United States	American Super Micro Company	Product design director	full time
49	Shandong Aneng Conveyor Belt Rubber Co., Ltd.	Sima Yu	China	United States	Chief formulator	part time
50	Shandong Weigao Orthopedic Materials Co., Ltd.	Lu Weijia	China Hong Kong	Hong Kong university	Special expert	part time
51	Linyi Kangfa Food & Beverage Co., Ltd.	Li Heng	China	American Yikang Group	Chief engineer, deputy general manager	full time
52	Shandong Haizhibao Ocean Technology Co., Ltd.	Laurentz Thomson (Laurenz thomsen)	Germany	Jacobs University, Bremen, Germany	professor	full time
53	Shandong Baolai Lilai Biological Engineering Co., Ltd.	York Jack (Joerg Josef JACOBY)	United States	MD MD Anderson Cancer Research Center, Houston, USA	Director of Human Functional Microecology Research Institute	full time
54	Yantai Dongcheng Pharmaceutical Group Co., Ltd.	Sha Bingdong	United States	University of Alabama at Birmingham	chief the scientist	full time
55	Shandong Qilu Stem Cell Engineering Co., Ltd.	Qu Tingyu	China	University of Illinois School of Medicine (Chicago)	Director of Shandong Cell Tissue Library and Deputy Director of Shandong Cord Blood Bank	part time
56	Shandong Changlin Machinery Group Co., Ltd.	Albertini (Marcello Albertini)	Italy	Italian Fiat Group	technical director	full time
57	Xinfa Pharmaceutical Co., Ltd.	Yang Jinghua	United States	Bouton University VA Medical Center	Research Director	full time
58	Shandong Ocean Engineering Equipment Co., Ltd.	Sun Yuanhui	United States	TSC Marine Group	CEO, Chief Technology Officer	full time
59	Shandong Chenglin Optoelectronic Technology Co., Ltd.	Wu Weidong	Canada	University of Toronto	technical director	part time
60	Shandong Baolai Lilai Biological Engineering Co., Ltd.	Shi Haining	United States	Harvard University	Technical experts	full time
61	Shandong Yinuoji Pharmaceutical Co., Ltd.	Wang Zhaoyi	United States	Creighton University School of Medicine	vice president	full time
62	Shouguang Lushou Seed Industry Co., Ltd.	Huff (RALF SCHMIDT)	Germany	German NLC Seed Group	senior consultant	full time
63	Shandong Liancheng Auto Hybrid Technology Co., Ltd.	Ai Xiaotong	United States	American Timken Company	chief scientist	part time
64		Wu Hao	China		Chairman and chief scientist	full time

	Dezhou Yuding Optoelectronics Technology Co., Ltd.			American CBC Consulting (CBC Consulting)		
65	Zaozhuang Jienu Biological Enzyme Co., Ltd.	He Zengguo	United States	Novozymes North America Group	technical director	part time
66	Qingdao Teruide Electric Co., Ltd.	Sigfried Roland (Siegfried Ruhland)	Germany	Siemens AG	President	full time
67	Jinan Shengquan Group Co., Ltd.	Youhuo River Pering (Juho Hermanni Jumppanen)	Finland	Adila Technology Co., Ltd.	Technology and marketing manager	full time
68	Qingdao Xumeng Biological Engineering Co., Ltd.	Chen Wei	China	Arizona State University	General manager	full time

Attachment 1b (Highlighted Sections)

LiaoChang University – Notable/ Famous Teachers/Scholars

Taishan Scholars

Li Chen Zhong

Shaorong Liu
University of Oklahoma

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

July 24, 2020

To: Teresa Grancorvitz
Head, BFA and Chief Financial Officer

From: [redacted]

Subject: Recommendation to Suspend NSF Award CHE-1904645 to University of Oklahoma, Norman Campus (OIG Case No. I-18-0110-O)

Attached is our recommendation to suspend NSF award CHE-1904645 to the University of Oklahoma, Norman Campus. The PI responsible for this award admitted to misusing previous NSF funds and we have uncovered evidence of misrepresentations which could lead to the misuse of CHE-1904645 award funds. Based on our investigation to date, we recommend this action to protect NSF funds.

[redacted]

Recommendation to Suspend Award

OIG Case Number I-18-0110-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

July 1, 2020

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Introduction

We recommend that NSF suspend award CHE-1904645 (the Award), entitled "Enabling Open Tubular Liquid Chromatography for Single Mammalian Cell Analysis," made to University of Oklahoma Norman Campus (OU), under the direction of Principal Investigator Shaorong Liu (Liu). The Award began August 1, 2019 and expires July 31, 2022. The Award was funded for $455,000, none of which has been drawn down. As set forth below, we have obtained evidence that Liu misused funds in two prior NSF awards and provided false statements to NSF when applying for the Award and in the Award's recent project report.

OIG Investigation

Liu is a faculty member at OU and owns a company which received a Small Business Technology Transfer (STTR) award from another federal agency. During an audit by that agency into the STTR expenditures, Liu submitted a document in which he admitted to using his NSF funds to OU to pay for work on the STTR award.[1] Liu provided an explanation in writing for what he described as "fund swaps" to the other agency, and the other agency's OIG provided the document to us. Based on our review of his statements, we concluded that Liu misused $145,827, plus associated indirect costs, of NSF funds on awards CHE-0822539 and CHE-1011957.

Subsequently, we became part of an ongoing multiagency investigation into Liu's misuse of federal funds and undisclosed affiliations with China. We reviewed the Award proposal, subsequent communications with the NSF Program Officer (PO), and recent publications.

When Liu submitted proposal CHE-1904645 on October 31, 2018, he listed the pending Award and an Oklahoma Center for the Advancement of Science & Technology (OCAST) award under "Current and Pending Support."[2] Through examination of Liu's email, obtained via search warrant, we discovered that Liu appears to have worked on, completed, and signed an application to a talent program at Chongquin Medical University in China prior to submission of the NSF proposal.[3] The affiliation is not mentioned in Liu's biosketch or anywhere else in the proposal. Subsequently, on December 2, 2018, Liu emailed himself an 87-page pdf file, which appeared to be a revised version of a Chongqing Medical University research laboratory proposal. Most of the proposal was written in Chinese with some English text and documents. The proposal was to establish a research laboratory called "Developing Enabling Technologies for Biomedical Research," with Liu as the Director. The Chongqing Medical University proposal included an English version of Liu's curriculum vitae (CV), which listed guest professor positions at Zhejiang University from 2002 to the present and at Wuhan University from 2008 to the present,[4] neither of which were listed in the biographical sketch included with the proposal for the Award.[5]

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[1] TAB 1, p. 2
[2] TAB 2, p. 38
[3] TAB 3
[4] TAB 4, p. 35-36. Partially written in Chinese and translated by a Program Analyst in our office. Please contact our office should you wish to view the memorandum on the translation.
[5] TAB 2, p. 30

On May 23, 2019, before making the Award recommendation, the PO emailed Liu and requested "an updated statement of Current and Pending Support. This must include a clear indication of the relationship between this work and any other funding. The statement must be relatively detailed if there is any possibility of overlap, which is closely monitored by Federal auditors." Liu responded, "I do not have any federal support at the moment. I have only a small grant from Oklahoma State (the Oklahoma Center for Advancement of Science and Technology) to keep me moving forward."[6] Liu did not disclose the pending applications to Chongqing Medical University in either the initial proposal or in the update he provided to NSF.

We have also identified inconsistencies with publications listed in the Award's first project report, submitted May 5, 2020,[7] which suggest that the Award proposal sought funds for research that Liu had already partially completed.[8] The first article (Article 1), entitled "Experimentally Validating Open Tubular Liquid Chromatography for a Peak Capacity of 2000 in 3 h" was submitted to Analytical Chemistry and acknowledged partial support by the Award.[9] The title of the article and research described overlap with the first objective in the Award proposal.[10] The article was first provided to the journal on March 22, 2019.[11] However, the Award start date was August 1, 2019. Thus, even if work began 90 days before the start date as NSF permits, that would only cover expenses and work dating back to May 1, 2019. Of additional concern, we note that in the article Liu is listed as being affiliated both with OU and the Department of Chemistry, the College of Sciences, Northeastern University, Shenyang, 110819, P.R. China,[12] which is not included in his biosketch in the Award's proposal.

Liu included three other articles with the first project report. One of the other articles (Article 2), entitled "Ultrafast Gradient Separation with Narrow Open Tubular Liquid Chromatography," also lists Liu's affiliation as both OU and Northeastern University.[13] Article 2 was submitted on May 9, 2019 to Analytical Chemistry and also purports to be supported in part by the Award.[14] Work on the Award was allowed to begin on May 1, 2019. Even if work on the project began that early, it is not feasible that the award substantially contributed to an article submitted on May 9, 2019, as claimed in the annual project report.

We are working with the appropriate United States Attorney's Office as we investigate the various allegations associated with Liu. As part of the larger investigation, on May 29, 2020, Liu and his wife were arrested and charged with conspiracy to commit wire fraud involving the STTR award described above.[15]

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[6] TAB 5
[7] The NSF PO rejected and returned the project report on May 26, 2020.
[8] TAB 6,
[9] TAB 6, p. 44, and acknowledgments, p. 48
[10] TAB 2, p. 8-9
[11] TAB 7
[12] TAB 6, p. 44
[13] TAB 6, p. 37
[14] TAB 8
[15] TAB 9

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend the Award pending the outcome of our investigation. It would be helpful to be cc'd on any actions taken in response to this recommendation.

[redacted]

Attachments

TAB 1 – Trial Balance Statement
TAB 2 – Award Proposal
TAB 3 – 10/5/2018 -Email to/from Liu
TAB 4 – 12/2/2018 Email to/from Liu
TAB 5 – Email PO to/from Liu
TAB 6 – Publications Included in First Annual Report
TAB 7 – Article 1 Dates
TAB 8 – Article 2 Dates
TAB 9 – Press Release

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Dr. Hu Bin
University of Tennessee Knoxville

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

August 25, 2020

To: [redacted]

From: [redacted]

Subject: Recommendation to Suspend NSF Award ECCS-1911659 to the University of Tennessee Knoxville (OIG Case I-18-0062-O)

Attached is our recommendation to suspend NSF award ECCS-1911659 to the University of Tennessee Knoxville. The award PI, Dr. Bin Hu, failed to disclose significant overseas affiliations, time commitments, and research funding in this and other NSF proposals submitted through the University of Tennessee Knoxville. Based on our investigation to date, we recommend taking this action to protect NSF funds.

[redacted]

Recommendation to Suspend Award

OIG Case Number I-18-0062-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

August 25, 2020

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Introduction

We recommend that NSF suspend NSF award ECCS-1911659 entitled "Exploring Spin-Orbital Coupling Effects: 3D to 2D Perovskite Solar Cells" (Award), made to the University of Tennessee Knoxville (UTK) and PI Dr. Bin Hu. NSF awarded $390,086 on the original proposal and $8,000 on an REU supplement proposal (ECCS-2028126) for a total award of $398,086, no part of which has been expended as of August 12, 2020. The Award period began July 15, 2019 and ends June 30, 2022.

As set forth below, we learned in 2018 that Dr. Hu had been identified in open source materials as a selectee to the Chinese Thousand Talents Program (TTP). Although Dr. Hu denied during a 2018 interview that he accepted the selection and acknowledged only limited consulting relationships with Chinese universities, subsequent investigation revealed that he had been a TTP professor at one Chinese university from 2009 to 2014, and at another Chinese university from 2014 to present date, with participation to continue through 2027. Dr. Hu did not disclose these positions, and the research and Chinese award activities related to them, to either UTK in outside-interest disclosures or to NSF in grant proposals.

OIG Investigation

We opened an investigation into Dr. Hu in 2018 when open-source research revealed his selection for a Chinese Thousand Talents Program and a review of his NSF proposals indicated that this affiliation had not been disclosed in either the current and pending support sections or the biographical sketches. During an interview of Dr. Hu in April 2018, he acknowledged the selection but denied entering into a contractual arrangement pursuant to the program. He reiterated this in his response to an IG subpoena issued concurrently with his interview. Dr. Hu did acknowledge consulting arrangements with Northeast Normal University (NNU), Beijing Jiaotong University (BJTU), and Huazhong University of Science and Technology (HUST), but claims he did not disclose them to NSF because he did not consider them "real appointments." He acknowledged receiving reimbursement of travel expenses. Dr. Hu disclosed the arrangements in general terms as summer consulting in outside-interest disclosures to UTK.

Subsequent investigation into the e-mails in Dr. Hu's UTK e-mail account contradicted his statements and indicated that he had entered into contractual arrangements with HUST for work at its Wuhan National Laboratory of Optoelectronics (WNLO) from 2009 to 2014, and at BJTU from 2014 to 2027. The arrangements at BJTU included laboratory space, students, research funding of about $700,000, compensation of about $55,000 per year, and various one-time housing and incentive allowances. In exchange, Dr. Hu committed to working on Chinese projects for 6 months each year, which was documented in various Chinese award documents in the e-mails. Over time Dr. Hu participated in at least seven Chinese awards in various capacities, including project lead.

Dr. Hu did not disclose any of these affiliations, time commitments, or monetary resources in over 30 NSF proposals since FY 2009, including the proposal for ECCS-1911659. We have also established that, as recently as 7 months ago, Dr. Hu concealed his TTP affiliation in a Department of Energy disclosure form specifically addressing foreign government talent recruitment program participation.

OIG Recommendation

Based on the information set forth above, which reflects Dr. Hu's repeated failure to disclose his foreign affiliations and funding to NSF and other government agencies as required, we recommend that NSF suspend the Award pending completion of our investigation. It would be helpful to be copied on any actions taken in response to this memorandum.

[redacted]

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Wed 9/10/2014 3:56 AM
From: [redacted]
Subject: Thousand Talents Plan Employment Contract – Hu Bin – 20140910
To: Hu, Bin; [redacted]u
You replied to this message on 12/8/2014 11:25 PM.

[Attachments:]
Thousand Talents Plan Employment Contract--Hu Bin-20140910.doc (98 KB)

[redacted]

[redacted]
Beijing Jiaotong University, Office of Human Resources

Employment Contract between Beijing Jiaotong University and Professor Hu Bin

Party A: Beijing Jiaotong University
Party B: Professor Hu Bin
Party C: School of Science, Beijing Jiaotong University

To protect the lawful rights and interests of Parties A, B and C, the three parties hereby enter this contract after consultation on an equal basis.

Article One: Term of Employment and Work Time

The term of employment is from 1 September 2014 to 31 August 2027. The first evaluation period will be four years (from 1 September 2014 to 31 August 2018), and thereafter each evaluation period will be three years. After each evaluation period, based on the evaluation of the contract tasks, the three parties will discuss and determine the job tasks, work objectives and compensation and benefits for the next evaluation period.

Work time: Party B shall work at Party A at least six months each year.

Article Two: Party B's Job Tasks and Requirements in the First Evaluation Period

I. General Requirements

1. Be patriotic and law-abiding; be dedicated to the work and love students; impart knowledge and educate people; hold a high educational standard; serve the society; be an example to students.

2. Observe all the management systems and measures of Parties A and C pertaining to faculty work.

3. Bring into play Party B's academic influence, rely on the existing platforms of the university and the School of Science, focus on the work in aspects such as discipline building, scientific research, teaching, cooperation and exchange with an international perspective.

II. Basic Tasks of the Position

Party B shall accomplish the following basic tasks of the position in the first evaluation period:

1. Meet the basic job requirements for the position of second-grade professor stipulated in the documents issued by Party C.

2. As an academic leader, Party B shall take the initiative to undertake the building of the optical engineering discipline and participate in related work such as evaluation of the discipline and applications for key programs related to the discipline.

3. Party B shall utilize his international influence to actively contact and recommend one to two team members to renowned domestic and foreign universities and scientific research organizations for long-term or short-term visits and exchanges; Party B shall organize and host important international conferences and special symposiums in the field.

4. Party B shall lead the team members to add and lead five national projects with Beijing Jiaotong University as the primary undertaking unit.

III. High-Level Tasks of the Position

Party B, in addition to accomplishing the basic tasks of the position, shall actively undertake the following high-level building tasks in the first evaluation period:

1. Take the lead in successfully applying for one "973" Program project or National Natural Science Foundation of China "key" project (or instrument project, or key international joint project).

2. Lead the team to strengthen the building of the Key Laboratory of Luminescence and Optical Information Technology under the Ministry of Education, improve the scientific environment and sophistication of the laboratory, and successfully apply for the designation of Innovation Team from the Ministry of Education.

3. Based on the university's talent introduction conditions, recommend and successfully bring in one high-level talent (academician, Long-Term Thousand-Talent Plan expert, Overseas Thousand-Talent expert, Changjiang Scholars Program professor, winner of National Science Fund for Outstanding Youths, or National High-Level Talent Special Support Program leader).

4. Take the lead in winning one second place or higher national scientific and technological award or one first place or higher provincial or ministerial scientific and technological award.

5. Based on the university's talent introduction conditions, successfully bring in two individuals selected for the "Thousand Youth Talents Plan" or as "National High-Level Talent Special Support Program Outstanding Youth Talents."

6. Help one team member successfully apply for Changjiang Scholars Program Distinguished Professor or become a winner of National Science Fund for Distinguished Young Scholar.

7. Party B and team members shall publish five papers with an impact factor higher than 10.

Article Three: Rights and Obligations

I. Rights of Party A and Party C

1. Manage Party B according to the objectives and tasks of the position.

2. Evaluate Party B according to the laws and regulations of the state and the applicable stipulations of Party A and Party C.

II. Obligations of Party A and Party C

1. Protect all the rights to which Party B is entitled according to law.

(1) Provide the university policies necessary for Party B to accomplish the job objectives and tasks stipulated in this Contract.

(2) Party A and Party C shall recommend and apply for rewards for any important achievements by Party B within the term of employment.

(3) Give Party B appropriate policy bias and actively help him resolve the difficulties and problems encountered during the building process.

2. Provide good working conditions for Party B.

(1) Party A shall provide Party B with approximately 340 square meters of office and laboratory space, which shall be configured and in place within one year of signing of the Contract.

(2) Party A shall invest approximately 4.7 million yuan as scientific research funding (including funding for starting scientific research and funding to support the discipline) for Party B to start his scientific research work, create the conditions for scientific research, and procure scientific research equipment. Party B will propose a funding use plan, and based on the sources of funds and on management requirements, Party A shall appropriate the funds in one payment as far as possible based on the situation, in accordance with procedures, after demonstration. In

addition, Party C shall invest 500,000 yuan as scientific research operating cost to be used as funding for starting scientific research and for international travel expenses.

(3) Party C shall provide Party B with two doctoral candidate enrollment quotas each year.

III. Rights and Compensation and Benefits of Party B

(I) Rights of Party B

1. Party B is entitled to all the rights of Party A's full-time faculty.

2. Party B will form a team and hire team members based on the requirements of his work. Based on his requirements, Party B may bring in three Distinguished Young Scholars who meet the conditions stipulated by the school. Party B should bring Distinguished Young Professors into the team on the basis of voluntary discussion. Party B may hire one assistant based on work requirements.

(II) Compensation and Benefits of Party B

1. During each evaluation period, an agreed-upon pay system will be implemented for Party B, consisting of two parts, the base annual salary and incentive compensation for the term.

2. If Party B fully completes the basic duties of the position in the first evaluation period (Article Two, paragraph 2 of this Contract), and there is substantive progress in the high-level responsibilities undertaken by Party B and Party B's annual evaluation is satisfactory, Party A will pay Party B a base annual salary at the rate of 400,000 yuan/ year (before taxes), paid monthly.

3. If Party B completes two to three of the seven tasks listed under the high-level responsibilities for the first evaluation period (Article Two, paragraph 3 of this Contract), Party A will pay Party B a one-time incentive compensation payment of 300,000 yuan (before taxes).

4. Party A will be responsible for implementing the "Thousand Talents Plan" professional healthcare benefit stipulated by the state which Party B will receive during the employment term. Party A will be responsible for payment of work-related injury insurance and unemployment insurance for Party B during the employment term in accordance with the provisions of state policy.

5. After the construction of new on-campus housing is completed, Party A will provide Party B with a relatively stable leased residence of approximately 120 square meters while Party B is working for Party A. The lease and management policies for the residence will be carried out in accordance with the relevant stipulations of the school. Party A will grant Party B a one-time settling-in allowance of 150,000 yuan (before taxes). Starting from the beginning of Party B's second evaluation period, Party A may grant Party B a certain appropriate housing allowance based on Party B's work performance and fulfillment of rent payment criteria.

6. For the period before new on-campus housing is completed and brought into use, Party A will pay Party B a rent allowance of 100,000 yuan/ year (before taxes, paid monthly).

IV. Obligations of Party B

1. Fully carry out the duties of the position and complete the objectives and tasks of the position's work; be subject to the management, supervision, and evaluation of Party A and Party C; and work for Party A for the period of time stipulated in Article One of this Contract. If Party B cannot honor the terms of the Contract, Party A is entitled to terminate the contract at any time.

2. All pedagogical or scientific research results achieved by Party B during the employment term are considered employee research results. Any papers or books published about them or awards, patents, or scientific research programs or funding applied for related to

these research results are attributable to Party A and Party B simultaneously (i.e. they must be attributed to both the author and the author's unit simultaneously, with the author's unit attributed as the name of Party A).

3. Party B may not perform substantial part-time work at another domestic institution during the employment term.

Article Four: Evaluation

1. Party A and Party C will examine and evaluate Party B's work hours on the position and the progress of Party B's work annually. If Party B's annual work hours on the position is insufficient or his performance of the basic responsibilities of the position (Article Two, paragraph 2 of this Contract) is poor, Party A may reduce Party B's compensation based on the evaluation results.

2. After the completion of each evaluation period, Party A will organize experts to evaluate Party B. The evaluation results will form an important basis for payment of incentive compensation and determination of the next evaluation period's compensation and benefits.

3. If Party B's evaluation results are unsatisfactory for two evaluation periods, Party A is entitled to terminate the employment contract with Party B.

Article Five: Modification and Termination of the Contract

1. Termination or modification of the contract shall be discussed and decided upon between the two parties.

2. If Party B wishes to terminate the contract for a special reason, Party B must send written notice to Party A three months in advance, and the contract will be terminated after discussion and agreement of the two parties.

Article Six: Supplementary Provisions

1. This Contract is made in three identical copies, with Party A, Party B, and Party C each having a copy. This Contract enters into force on date that it is signed and stamped by the parties.

2. Except in the case that the contract cannot be carried out due to force majeure, the three parties should strictly carry out each provision of the contract. If a dispute occurs, it should be handled through negotiation among the three parties, and the agreement of all three parties should be obtained for modification of the provisions of the contract.

3. For matters not covered by this Contract, the three parties should discuss and formulate supplementary provisions. The supplementary provisions have equal effectiveness as this Contract.

Signature of legal representative of Party A:	Signature of Party B:	Signature of person in charge of Party C:
Seal:		Seal:
Year Month Day	Year Month Day	Year Month Day

From: [redacted]
To: Hu, Bin; [redacted]
Subject: 千人计划工作合同--胡斌-20140910
Date: Wednesday, September 10, 2014 3:56:55 AM
Attachments: 千人计划工作合同--胡斌-20140910.doc

请胡教授、[redacted]、滕教授查收最新合同文本，有问题请告知。

[redacted]

北京交通大学 人事处

Dr. James Ricles
Lehigh University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

January 5, 2021

[redacted]

Subject: Recommendation to Suspend NSF Awards CMMI-1635227, CMMI-1662816, and CMMI - 1926326 to Lehigh University (OIG Case I-19-0040-O)

Attached is our recommendation to suspend NSF awards CMMI-1635227, CMMI-1662816, and CMMI – 1926326 to Lehigh University, on which Dr. James Ricles is listed as PI or Co-PI. Dr. Ricles was associated with undisclosed funded projects from Tongji University, People's Republic of China, and was a co-PI/International Collaborator on a Chinese National Science Foundation award. Based on our investigation to date, we feel this action is appropriate to protect NSF funds.

[redacted]

Attachment

[redacted]

Recommendation to Suspend Awards

OIG Case Number I-19-0040-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

January 5, 2021

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Introduction

We recommend that NSF suspend awards CMMI – 1635227, entitled "Collaborative Research: Development and Validation of a Resilience-based Seismic Design Methodology for Tall Wood Buildings," with an award period of September 1, 2017 through August 31, 2020 and $20.34 of unspent funds remaining; CMMI - 1662816, entitled "Advancing Knowledge on the Performance of Seismic Collectors in Steel Building Structures," with an award period of August 1, 2017 through July 31, 2021 and $700,902.32 of unspent funds remaining; and CMMI – 1928906, entitled "Collaborative Research: Frame-Spine System with Force-Limiting Connections for Low-Damage Seismic-Resilient Building," with an award period of August 1, 2019 through July 31, 2022 and $220,808.70 of unspent funds remaining.

Awards CMMI – 1635227, CMMI – 1662816, and CMMI – 1928906 (the Awards) were made to Lehigh University and listed Dr. James Ricles as Principal Investigator (PI) or Co-Principal Investigator (Co-PI). At present, nearly $921,731.36 remains unspent on the Awards. As set forth below, we obtained evidence that Dr. Ricles' foreign affiliations and funding were disclosed to Lehigh University, but were not reported in his NSF proposals.

OIG Investigation

We opened our investigation in March 2019 after open-source research found evidence that Lehigh University Professor Dr. James Ricles had received funding that was not disclosed in his NSF proposals. Specifically, we identified an application for a "Collaborative Research Project under International Joint Research Laboratory of Earthquake Engineering (ILEE)." (Attachment 1) This ILEE application was signed by "Party A," Tongji University, Shanghai, China, and "Party B," James Ricles, Lehigh University. On the application, Dr. Ricles was referred to as the Principal Investigator and Yiyi Chen, of Tongji University, was referred to as the Co-Principal Investigator.

Our investigation has determined that the ILEE application, dated and signed on December 30, 2015, provided funding of 600,000RMB (approximately $91,875 USD), of which 150,000RMB (approximately $22,968) was designated for International cooperation and exchange. In an interview with our office, Ricles confirmed he worked and traveled internationally on behalf of the collaboration with Tongji University. Dr. Ricles' proposals to NSF[1] did not disclose any current or pending support from Tongji University, as required by the Proposal & Award Policies and Procedures Guide (PAPPG).

Dr. Ricles informed us that Lehigh University was a party to the collaboration with Tongji University. (Attachment 2)[2] Furthermore, Dr. Ricles listed the collaboration with Tongji University on his annual "faculty activity report," which was required by Lehigh University. (Attachment 2)[3] According to Dr.

[1] Dr. Ricles is the recipient of 23 NSF awards throughout his career, totaling approximately $5.2 million dollars. The awards referenced in this Memo were awarded between July 2016 and August 2019 and totaled $1,618,694.

[2] Ricles' Transcript at p.18, lines16-20

[3] *Id.* at p.18, lines 19-20; p. 19, lines 1-12.

Ricles these reports, officially called "Professional Activity Report (PAR)," were reviewed by Dr. [redacted], who was the Chair of the Department of Civil and Environmental Engineering at the time Dr. Ricles was collaborating with Tongji University. Dr. Diplas was aware of the information discussed in Dr. Ricles' PAR, and Dr. [redacted] used the PAR for discussions with the Dean. (Attachment 2).[4] Also identified in Ricles' Professional Activity Reports was his role as a Co-PI on a separate Chinese National Science Foundation award funded for $528,467 in 2018, which was likewise not disclosed to NSF. According to Lehigh's Associate Director in the Office of Research and Sponsored Programs (ORSP) and the former Chair of the Department of Civil and Environmental Engineering, Lehigh uses different systems for reporting purposes, with some being more up to date than others, and some to which ORSP does not have access. The ORSP only pulls information on awards and proposals processed through its office. The Professional Activity Reports are not processed through the ORSP. Therefore, the ORSP is unable to ascertain information provided to other parts of the university regarding the outside activities and funding of researchers.

We continue our investigation into potential wrongdoing. We are working with a U.S. Attorney's Office on this matter.

OIG Recommendation

Based on the information as above set forth, we recommend that NSF suspend the Awards pending the outcome of our investigation. It would be helpful to the copied on any actions taken in response to this memorandum.

[redacted]

[4] [redacted] Transcript at p.2, lines 12-16; p.15, lines 15-20; p.19, lines 3-7; p.20, lines 15-17.

Attachments

1 - Application for a "Collaborative Research Project under International Joint Research Laboratory of Earthquake Engineering (ILEE)"

2 - Interview Transcript of Dr. James Ricles

3 - Interview Transcript of Dr. [redacted]

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Interview of Dr. James Ricles

May 7, 2020 (11:02 a.m.)

1

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MR. [redacted] Does everyone see that on their screen?

MS. [redacted] Uh, give me one second.

DR. RICLES: Yes.

MR. [redacted] Yes.

MS. [redacted] Continue. Okay.

MR. [redacted] Okay.

DR. RICLES: Do I need to hit the word continue there, I think, uh --

MR. [redacted] Yes.

DR. RICLES: -- [redacted]

MR. [redacted] Yes.

DR. RICLES: Okay.

MR. [redacted] All right. So the time is 11:02 a.m. on May 7th, 2020. This is [redacted] [redacted] I'm a Special Agent with the National Science Foundation Office of Inspector General. Um, I am here today with my colleague…

MS. [redacted] Office of Inspector General. Um, I'm the Director of the Investigative Attorneys.

MR. [redacted] Okay. And if I could just go around the Zoom to get everyone to introduce themselves. [redacted] if I can start with you.

MS. [redacted] from Ballard Spahr, and I represent Lehigh University.

MR. [redacted] I guess I'm next. This is Oldrich [redacted] I'm with, uh, [redacted] and I represent, uh, Dr. Ricles.

MR. [redacted] Okay.

DR. RICLES: Yes. And I'm, uh, Jim Ricles from Lehigh University -- or James Ricles.

MR. [redacted] Okay, Dr. Ricles. And again, um, [redacted] And just, you know, I know this is a little awkward over video, but here are my credentials which identify that I'm a Special Agent with the National Science Foundation. Please disregard the awkward picture that they took.

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Um, sir, just a few things. I wanted to get my screen back to where it was. Um, you know, I -- I -- we discussed this before I started hitting record. But I just want to confirm on the record that you provide us, um, authorization to record this interview today, sir?

DR. RICLES: Yes. That's correct.

MR. [redacted] Okay. Perfect. Also, this is a voluntary interview. Again, we appreciate you meeting with us today. Um, again, we don't plan on taking too much time, but we do wanna let you know that at any point during the course of this interview today, if you, uh, don't wanna answer questions, you're under no obligation to do so. And if you wanna stop the interview, uh, you're more than welcome to, uh -- to do that as well. We just wanna make that clear -- wanna make sure that you understand that.

DR. RICLES: Yes, I understand.

MR. [redacted] Okay. Perfect. Um, so, we are with NSF OIG. Uh, it's part of the federal

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government. With that said, uh, we are conducting, uh, an investigation, and we're asking that your answers be honest, uh, and truthful. Uh -- uh, material false statements can be a violation of U.S. law, and I just wanna put that on the record and make sure that you understand that sir.

DR. RICLES: Yes. Thank you.

MR. [redacted] Perfect. Um, I guess, sir, if I could just first start -- if I could just get your background. Uh, understanding that [redacted] and I have no scientific background, just what you do at Lehigh and -- and your work there, uh, over the course of your career.

DR. RICLES: Sure. I actually, uh, prepared a little blog here. So I'm currently -- well, my name is James Michael Ricles. I'm the, uh, Bruce G. Johnston Professor of Structural Engineering at Lehigh University. In terms of my, uh, I -- I -- I'll go a little bit into my background. My professional preparation, I earned a bachelor's degree from the

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University of Texas at Austin in architectural engineering and immediately followed that up with a, uh, master's degree in civil engineering. I, uh, then worked for Exxon Offshore, uh, Structures division in Houston for two years, followed by then pursuing a Ph.D. at University of California at Berkeley. Upon, uh, graduating from, uh, University of California, I then assumed my academic, uh, career beginning with, uh, the University of California at San Diego.

And then I had the opportunity to come to Lehigh University. And I came to Lehigh in 1992. And upon arriving at Lehigh University, that was, uh, 28 years ago. I -- great place to work. I advanced through the ranks to where I'm now a, uh, professor, in fact, now that -- an endowed professor of structural engineering, Bruce Johnston since, uh, 2003. That, um, position was, uh, granted -- the -- the Chairship.

In 2004, I was very fortunate to be in the position to, uh, become the PI and write a proposal to NSF for the, uh, NEES equipment site, who -- which I

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directed for 10 years. And then following that, we had the opportunity to compete and, uh, were successful in competing for the NHERI. That's -- and, uh, Natural Hazards Engineering Research In- -- Infrastructure. That's NHERI -- the, uh, Lehigh Experimental Facility which I've directed since 2016. That's sponsored by the National Science Foundation.

In terms of mentoring, I take great pride in, uh, the students that I've mentored. I've had 15 post-docs, uh, 33 Ph.D. students, and, uh, 34 master students. Very fortunate to work with all these great students. Uh, scholarship, published over 520, uh, papers and, uh, reports with my students and my colleagues. And, uh, I've had 23 NSF awards. The first one was in 1989 when I was at UC San Diego.

In terms of my, uh, area of expertise, um, basically, it's structural engineering, uh, with -- with, say, an emphasis of earthquake engineering. What I'm particularly interested in and have a compassion for is -- is -- is improving the performance of the

civil infrastructure, uh, during extreme natural hazards, um, and furthermore the development and promotion of concepts to improve commu- -- community resiliency. Very important topics now in today's society. Sorry, [redacted] I -- I -- I apologize that I -- I'm working from -- my dog is literally scratching the door. Do you -- do mind if I just --

MR. [redacted] No. No. Not a problem.

DR. RICLES: I -- I apologize. I'm sorry. This is --

MR. [redacted] No. Please, don't --

DR. RICLES: This is inappropriate but --

MR. [redacted] I have two --

DR. RICLES: Could be a whole --

MR. [redacted] -- I've two that I've locked upstairs in -- in our bedroom and two kids who are doing --

DR. RICLES: Yeah.

MR. [redacted] -- homework at the island, so we understand it's -- it's not a problem, sir.

DR. RICLES: I -- I -- I apologize.

MR. [redacted] No. No. Please don't.

DR. RICLES: He won't -- he won't answer any questions. I'm sorry. This'll only take two seconds.

MR. [redacted] No. No problem.

MS. [redacted] I was just thinking my dog is right next to me, and he is (inaudible).

DR. RICLES: Do you want to come in?

MS. [redacted] My dog might wanna - -

MS. [redacted] I think, [redacted] one of the calls my dog started barking which upset your dog.

DR. RICLES: Sorry. My -- my wife took care of that, I guess. Sorry.

MR. [redacted] You do not have to apologize. This is, uh --

DR. RICLES: I -- I'm sorry.

MR. [redacted] This is the state of the state right now with, uh -- with COVID so, please, no apologies needed. And I -- I'd like to thank you. That's, uh, you've answered a lot of your questions already with that -- with the, uh, your introduction. And I think part of what we wanted to get to, uh, next, Dr. Ricles, was your involvement with NSF. And I think you'd mentioned you started working your first proposal, was it in 2004? Is that correct?

DR. RICLES: At Lehigh University, my -- my first proposal at Lehigh University?

MR. [redacted] With, uh, with NSF.

DR. RICLES: With NSF. Um, well, I came here in 1992, and, uh, I think my first funded proposal was clo- -- shortly thereafter. Probably --

MR. [redacted] Okay.

DR. RICLES: -- 1993.

MR. [redacted] [redacted] I think I heard the professor suggest that he may have had some

involvement, uh, with NSF, uh, when he was in his position, I guess that was at, uh -- was it UC San Diego?

MR. [redacted] Okay. Understood. Understood. You said I think in -- in -- in all, sir was, like, 23 NSF awards that you've -- you've -- you've had funded over the course of your career. Is that correct?

DR. RICLES: Yes. Over the course of, what, 28 years I've had --

MR. [redacted] Okay.

DR. RICLES: -- uh, 23 NSF awards. Not -- not always the principal investigator, but involved --

MR. [redacted] No -- yeah.

DR. RICLES: -- with those awards. Mm-hmm.

MR. [redacted] Understood. Understood. And, sir, just from the perspective of Lehigh, can you kind of give [redacted] and I an understanding of, um -- and I know that, you know, funded research is a significant

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portion of -- of, uh, you know, work within academia. What kind of training does Lehigh provide in terms of, you know, grant requirements, proposals? Is there annual training that they provide their PIs and co-PIs on how to put proposals into the system with NSF and other agencies?

DR. RICLES: Yes. We have an Office of Research and Sponsored, uh, Programs that, uh, does a lot of the logistical information. They also guide you in terms of, uh, the requirements, say, in the RFPs or in the, pr- -- in the, uh, proposal grant preparation guide that NSF publishes each year. So they're quite familiar with all the, uh, aspects of that. Typically, they -- they don't want a proposal to be disqualified if it, uh, doesn't meet all the criteria. You know, there's a very strict criteria even coming down to font size.

MR. [redacted] Yeah --

DR. RICLES: We -- we also have, um, I guess it's a Provost or Vice Provo- -- Provost of

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Research that, uh, gives some guidance. And, um, furthermore, for the younger professors, there's, uh, meetings and mentorship by some of the older faculty and also by the, uh, appropriate office that mentors them in developing proposals, ideas, and, um, you know, doing the right thing. So I -- I think Lehigh is quite -- quite good at this.

MR. [redacted] Okay. Very good. Um, I -- I -- I'll be honest with you, Dr. Ricles, we- -- I'm gonna kind of cut to the chase in terms of why we wanted to speak to you, uh, today. Um, I know that we've set this up for a while, and you're probably thinking, you know, what is it that -- that the OIG is interested in. Um, we were provided -- and I can't get into the specifics -- specifics of how or where we were provided -- but very vague information, um, in reference to potential foreign affiliations.

And I guess the question that we have now, we understand at NSF that international collaboration is a humongous part of academia. But in

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reference to, you know, the formal talent recruitment programs, we wanted to see if -- if you would be able to provide us any insight on your involvement or lack of involvement with any foreign talent recruit- -- uh, recruitment programs that would have been initiated out of China.

DR. RICLES: Oh, okay. Um, the -- let me try to think about this a little bit. I -- I have some, uh -- I have some collaborators in China.

MR. [redacted] Sure.

DR. RICLES: Um, there was two -- two grants, um -- I don't have the specific names in front of me or the specific, uh, source of funding. I -- I've, um -- collaborate with a -- they -- they essentially borrowed our name. You know, they -- they were in the position -- the reason the Chinese wanna collaborate -- it -- they -- professors act in good faith, but it's really to put themselves in the forefront and compete with all the other competitors in China. And the -- the way they -- they do this is to

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try to, uh, publish in the United States and, you know, publish in the best journals. And the United States tends to have those, as well as in Europe.

MR. [redacted] Okay.

DR. RICLES: So they -- they realize collaborating with U.S., uh, researchers that they are able to sort of get an edge. So, um, I -- I've, uh, been approached by some, uh, Chinese collaborators. I -- I guess you could say where this started -- this is Tongji University --

MR. [redacted] Okay.

DR. RICLES: -- in Shanghai -- is that, um, I've always had, uh, Chinese students, uh, as Ph.D. students. They're -- they're -- they're very good, very hard working. I think, um, particularly have had some from, uh, China. The first one -- let's see, [redacted] [redacted] (phonetic 00:11:41) graduated about 10 years ago, uh, so maybe about 15 years ago. He's from Tongji University.

And, you know, as it turns out, if you have a student from Tongji University, you know, a -- a lot of the students from China like to come to the U.S. and get the best -- best education. And so, um, you know, I've had other Chinese students come and study underneath me. And they've all worked hard. And then, uh, I went to the World Conference in China in -- I forget the year. It's -- it's -- it's been a while.

But it may be 2008, and I met the, uh, professor of, uh, Dr. [redacted] who -- who, as I said, was my former student. [redacted] in fact is, uh, the -- the man. And, um, you know, he had some other students that were interested in coming. And, um, a few years ago, they had this opportunity -- I think it's the International Laboratory -- I -- I forget the exact name. But they had an opportunity to do international collaboration, and, um, they needed some U.S., um, colleagues.

So it was -- the -- the interesting and common topic was -- I do a lot of research in

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earthquake engineering and resiliency. And these topics are of keen interest in China, and they wanted to go ahead and pursue some of these things under this grant opportunity. So I agreed to, uh, you know, collaborate. And, um, you know, they had a budget and other aspects.

We -- we never received any money. Uh, we -- were a little bit frustrated, not necessarily receiving the money but maybe at least their students could come over to work with us. Um, that's not really happened, but we -- we would go over there and visit maybe once a year or when we had the opportunity, like when we were at a conference, we'd interact with them. So I -- I don't know that you could say that's really, uh, recruitment. It was opportunity.

MR. [redacted] Sure. Understood. And, yeah, I -- I think, you know, maybe there's a distinction between the -- the talent recruitment programs if you're familiar. And I know there's been a lot of -- in the media with like the Thousand Talents

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Program or Chanjiang Scholars. Um, and this sounds like it's more of just a funding -- collaborative funding. But you had mentioned, we, um -- that "we" didn't get funding from it. Was "we" you or was "we" Lehigh University?

DR. RICLES: I -- I'm sorry, [redacted] I didn't -- I didn't quite catch --

MR. [redacted] Sorry, sir. You'd -- you just mentioned that you -- we didn't receive anything from this collaborative funding. I think it was with Tongji with [redacted] [redacted] Was -- was this a collaboration between you and Tongji, or was Lehigh -- was Lehigh a party to this collaboration?

DR. RICLES: No. It was really Lehigh -- Lehigh University.

MR. [redacted] Okay. So Lehigh's aware of -- of, you know, this collaboration that was ongoing?

DR. RICLES: Yes. In fact, I, you know - we have to submit a, uh, fact -- let's call it faculty

activity report each year to -- to the dean so that they can assess your performance. And it's for, uh, performance evaluation and -- and possibly a promotion. And in that -- in that each year, I do put in this scholarship. You know, it's -- it's not funded through the Office of Research. There was no formal grant going through that, but we did, uh, have paperwork. And they're aware of that, and I put that in my, uh, activity report --

MR. [redacted] Okay.

DR. RICLES: -- each year. So they're -- they're well informed of -- about that.

MR. [redacted] Okay. Perfect. Um, so -- so scientific, you know -- from a -- obviously I know you'd mentioned that Tongji -- especially with your background from what it sounds -- to -- to have someone on an award like that it ob- -- it obviously helps Tongji University with being the forefront in publications. From the Lehigh side, did they -- did Lehigh receive any funding, personnel, equipment,

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anything from -- from this collaboration or was it more of like a, uh, tri- -- trying to, uh, understand, you know, Lehigh's role and -- and what they may have gained from -- from this collaboration?

DR. RICLES: Yeah. In -- in terms of that, we -- we received no funding, uh, no support. It's really -- again, they -- they have the money that they support their students, themselves. I guess they do all the experiments over there. Uh, we really were kind of, uh, sort of like advisors, if you wish, un -- unpaid consultants.

MR. [redacted] Okay.

DR. RICLES: And, um, so -- so the thing that we would get from this, and -- and I enjoyed working with them -- is, uh, you know, we would -- they would lead the papers, you know, published papers on, you know, put our names on it, and we would review it. And of course, it was some of our original ideas, which they extended, and so that's, you know -- the Lehigh name was -- was established there --

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MR. [redacted] Understood.

DR. RICLES: -- um, from being on the papers -- journal papers -- their free journal papers.

MR. [redacted] Okay. And -- and Dr. Ricles, with this agr- -- I mean, was there a formal agreement that was drafted up for this collaboration similar to what we would see with the NIH or NSF?

DR. RICLES: Yes. There was -- there was some, uh, paperwork. I recall that there was a s- -- statement there, and, uh, I -- I placed my signature -- I actually collaborate with Richard Sause. He's a -- he's a co-collaborator --

MR. [redacted] Okay.

DR. RICLES: -- on that. And, um, and then the counterparts had signed it as well. It was more or less, uh -- what do they call it -- memo of understanding in terms of, um, willing to collaborate and, uh, participate in this -- this manner, uh, which was identified we would act as, uh, consultants and, uh, we would meet with them every so often. And -- and

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it -- the only time we received any -- and we didn't receive direct money -- is that we were over there they would, uh 00 we would meet with them, and sometimes they would pay for our flight and our hotel, which was through their sourcing. We never received any money.

MR. [redacted] Understood. So there was no salary, no honoraria from -- from this?

DR. RICLES: No. No.

MR. [redacted] Okay. Perfect. Uh, how often do you -- I think you'd mentioned it was annually, ju- -- but just to confirm, you said, was it once a year you would travel over on behalf of this collaboration?

DR. RICLES: Ty- -- typically about once a year. They wanted to meet about once a year. And, um, sometimes, they -- they tried to coordinate that with maybe a, uh -- a workshop or a, uh, event that they would have. Um, so it's about once a year. The - - the last time we were supposed to have met they wanted us to come either in, uh -- it was past December

or this next June and -- and things got real quiet because of the CORVID.

MR. [redacted] Yeah.

DR. RICLES: So we -- we haven't been over there in, I think for over a year, year and a half. I forget the exact date.

MR. [redacted] Understood. Understood. Um, so the travel, that was paid through the funds of this -- this Chinese award? They would pay for your travel and I guess colleagues to head over. Is that correct?

DR. RICLES: I -- I'm sorry, [redacted] I -- I -- I didn't quite hear. Sorry.

MR. [redacted] Oh, no problem. Um, in terms of, uh, travel -- I guess reimbursement, would Tongji pay for your travel?

DR. RICLES: Tong -- Tongji literally would pay for everything directly.

MR. [redacted] I'm sorry, sir.

DR. RICLES: Tongji would basically purchase everything. There was --

MR. [redacted] Okay.

DR. RICLES: -- there was no exchange of money at all.

MR. [redacted] Okay. Perfect. And I -- I guess, you know, um -- and this makes perfect sense. Um, so we went through and -- and what is customary for an IG review is we'll look through awards that PIs -- co-PIs have, but we'll look at funding. We identified -- and I don't have the documents here because we didn't get the specifics from Lehigh. And we thought it would probably be relevant -- pertinent to talk to you first.

We noticed that there was foreign travel that was budgeted to some of your NSF awards. Um, do you recall which countries that you had traveled -- or it was coded as foreign travel on the, uh, on the general ledger that came back from -- from Lehigh? Do

you recall what foreign travel you may have traveled on in the last five years for your NSF --

DR. RICLES: The last five years. A- -- actually, I -- I have a list, um, so I can try to be a little bit more precise here. Um, going back, um, foreign travel, there was, uh, China.

MR. [redacted] Okay.

DR. RICLES: Um, Europe, Italy, uh, Chile.

MR. [redacted] Okay.

DR. RICLES: Uh, China again, uh, Japan, uh, New Zealand. Coming into 2019, it was, uh, Japan, uh, Italy, uh, Switzerland, and Japan.

MR. [redacted] Okay. A- -- and, sir, for the, um -- for the trips to China, I -- I mean, I just have to ask the question. Did NSF fund any of the travel for you to go over to work on this while you were over there working on this, uh, collaboration with Tongji University?

DR. RICLES: The airplane ticket, uh, was purchased by the Chinese. The hotel was paid by them, I think most of the food. If -- if -- if anything, and I don't think there was -- there should not be -- I may have had to, uh, pay for my, uh, mileage and my parking at the Newark airport.

MR. [redacted] Okay.

DR. RICLES: I usually would -- I would fly directly out of Newark to, um -- to Beijing. It was a direct flight.

MR. [redacted] Understood. That -- was that, to your recollection, uh -- do you recall any of that being charged directly to, you know -- any of your NSF awards?

DR. RICLES: I don't recall. Um, I have an expense account which I would charge to. These are discretionary funds, and it either was charged to that or -- I'm not saying it was not charged to NSF, but if it was, it was probably a very small amount. But I -- I don't recall, [redacted]

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MR. [redacted] Okay. No, I -- completely understood. And, sir, those trips to -- to China, the ones, uh, that you'd mentioned for -- for NSF, do you have the dates of -- of, uh, those trips available? I know you said you had made a list.

DR. RICLES: Sorry. The dog is kicking again. I can --

MR. [redacted] Let the dog in. Honestly, this is --

DR. RICLES: Sorry.

MR. [redacted] -- not an issue.

DR. RICLES: I -- I apologize. He -- he -- he won't be of any help. But -- sorry.

MR. [redacted] If you feel better, I can bring one of my two toy poodles in.

DR. RICLES: Come on in. You're the center of attention now, Zoey. Just sit there and be nice. Good, boy. Sorry. Sorry. I apologize.

MR. [redacted] No problem.

DR. RICLES: He's --

MR. [redacted] No problem.

DR. RICLES: He's pretty frisky. Little guy, but he's a big chore here. So [redacted] I'm sorry. The question was, uh, the dates of the trips to China?

MR. [redacted] Yes, sir. For your, uh -- your NSF travel.

DR. RICLES: Well, I have one here in December of 2018. Uh, I think it was December 7th through December 16th, 2018. That was certainly a collaboration meeting. Um, there was also a time I went there -- it wasn't for a, uh, meeting with these particular people. It was, um, in October 3rd through October 15th, 2017. Uh, there I actually was asked to be a keynote speaker at a, uh, conference in Nanjing. This -- this came through my former student, uh, still has a lot of colleagues in China. And then after that, I attended a, uh, workshop at Tongji University.

Um, I don't recall if I was over there actually in 2019. I -- I hope I'm not missing anything, but, uh, I don't have anything written down

here. And I lit- -- literally reviewed my itinerary and my appointment books, and I didn't see anything in 2019 that -- that -- that popped up, in terms of going to China. And I haven't been over there this calendar year in 2020.

MR. [redacted] Understood. And, uh, you'd mentioned a December 18 trip. Um, where -- which universities was that that you traveled to for NSF? Do you recall?

DR. RICLES: The -- Tong- -- Tongji University is --

MR. [redacted] Okay.

DR. RICLES: -- is the, uh -- is the main university there.

MR. [redacted] All right. Um, and these trips, the -- the December of 2018 and the October 2017, this -- these trips were separate from the work that you were doing under this collaborative exchange?

DR. RICLES: The one in 2017, uh, was separate. That actually was a, uh, a -- again, that

was a conference I attended in to- -- Nanjing Univ- -- in Nanjing, which is not at Tongji University. Nanjing is southeast China, I believe, and Tongji University's in Shanghai. So it was two different places. And so that was separated from the 20, uh, 18 -- unrelated, uh, meeting. The one in 2018, I -- I have written -- written down here collaboration meeting, also a symposium that I attended.

MR. [redacted] Yeah. And -- and that's my question, sir. For either of 20- -- 2017 and 2018 trips, was the -- the travel solely for your NSF related work, or was it a, um -- was it both your NSF and the collaborative project that you had between Lehigh and Tongji University?

DR. RICLES: The -- in the 2017 -- sorry, and the 2018 or the 2018?

MR. [redacted] For eith- -- for either of the trips for China. We're trying to determine whether or not there was, you know -- if it was, you're over there for one sole purpose, NSF --

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DR. RICLES: Oh, okay. I understand.

MR. [redacted] -- or was it NSF and this collaborative research, uh, that you were doing with [redacted] with Tongji University that you'd --

DR. RICLES: Mm-hmm.

MR. [redacted] -- previously discussed.

DR. RICLES: Well, the 2017 one, um, was one in which I, uh, was representing also the NHERI facility. Um, and so --

MR. [redacted] I'm sorry, sir. Which facility was that?

DR. RICLES: S- -- sorry. NHERI is N-H-E-R-I. That's our current NSF, uh, experimental facility.

MR. [redacted] Okay.

DR. RICLES: Which -- which I direct so I -- I know that I was, uh, there at that workshop, um, representing -- that I wore two hats. One of the reasons being is because there were other U.S. researchers there. There's sort of well-established

people, and part of my mission, uh, the program director always reminds us is, we need to broaden the user base to be open access. So that was one of the things I -- I did. And -- and I think that was probably most of what I was committed towards. I did make a presentation about our facility and all the things that we've been able to do, um, in both the conference and the workshop.

The, um, second meeting, which was 2018 -- it was first a, uh -- I think it's every two years there's a famous Chinese earthquake professor, I think is [redacted] (phonetic 00:27:05). Uh, there's a symposium in which I was invited to, and I made a presentation on our, uh, facility -- state of the art, uh, research. And so I was probably at -- you say -- if you want -- if you wish, I was wearing the hat of representing our facility, trying to, um, market the facility, appeal to, uh, researchers, primarily American researchers who were attending. And then following that, there is a, uh -- uh -- uh, meeting with our, uh, colleagues, if

you wish, with the Chinese I think the last day or two. And so that hat I would have worn there would have been in terms of col- -- collaborators.

MR. [redacted] Okay. So for any of those -- the -- the funded travel in 2017 and 2018, the NSF -- now, did NSF pay -- and again, I -- I apologize, I don't have the breakdown. We didn't request it from Lehigh -- on specific charges. But did NSF pay for airfare, uh, to -- to China in those instances, to the best of your recollection?

DR. RICLES: The -- the one in 2018, it should not have. Um, typically, if it's -- sorry. If it's a meeting with the -- with the collaborators, they actually would purchase the air -- air -- air tickets.

MR. [redacted] Okay.

DR. RICLES: And, um, I'm trying to recall, in 2017 where I was at a workshop which was non-related and this conference that I think there I -- I, uh, may have actually charged it to my, uh, research grant.

MR. [redacted] Okay. In 20- --

DR. RICLES: In 2017.

MR. [redacted] Okay.

DR. RICLES: I don't have the numbers in front of me. I apologize.

MR. [redacted] Okay. No. Not a -- not a problem, sir. Um, [redacted] do you have any questions? I -- I know we've gone through this, and I think, you know, what we'll probably do is, you know, we can go through our records and -- and see what was, uh, provided by -- by Lehigh. [redacted] do you have any questions about the -- the travel overseas?

MS. [redacted] Uh, I have --

DR. RICLES: I'm sorry about --

MS. [redacted] -- um, a couple follow up questions. So going back to -- Dr. Ricles, you said, um, for the collaboration purposes you would go to China about once a year -- one -- once a year. Is that correct?

DR. RICLES: On average, about once a year. Yes.

MS. [redacted] Okay. And what was the duration? You said year, year and a half. What was the duration, um, of those visits? How long were you there?

DR. RICLES: Uh, actually being physically there? Usually --

MS. [redacted] Yes.

DR. RICLES: -- maybe two or three days. The whole trip would take perhaps about a week with the, uh -- the -- the travel -- the travel time. So I -- I think about average three days physically being present there.

MS. [redacted] And in those three days, could you just give us generally what would happen -- what you would do with the collaborators?

DR. RICLES: Well, for instance, um, sh- -- sh- -- should I go back to where I attended the --

the workshop and the conference, or you wanna hear specifically about when I met with our collaborators?

MS. [redacted] Uh, specifically about when you met with the collaborators outside of the --

DR. RICLES: Oh, okay.

MS. [redacted] -- symposiums.

DR. RICLES: Well, this one particular time there was this long symposium that lasted, um, I think it was two days. There's invited people from the U.S. that they're invited to present. And, uh, so for the first two days it was like a typical conference, uh, workshop in which, you know, we met other colleagues. We attended lectures. I, uh, made a presentation myself, and it was really no interaction with any of the colleagues, uh, at all.

And then, um, the last day, I believe, that I was there -- this would have been, what, I think the third day -- I -- we -- we had some -- a meeting with our collaborators. They just wanted to discuss, uh, the progress and moving forward, what things to

look at. They had some questions about some of the work and asked, uh, Richard Sause and I about some suggestions of, uh, what to pursue.

Their -- their students presented, uh, their work, and, you know, we made some comments. And I recall I made a -- a -- a presentation, again, about our NHERI facility -- about then some of the things that, uh, we would like to do. And that was basically -- basically it. I think there was -- there's always a dinner, you know, an informal -- well, somewhat semi-formal dinner which, you know, we would meet but that was primarily it.

MS. [redacted] Okay. And that's -- is that what you meant by, like, consulting?

DR. RICLES: I'm sorry. Pardon?

MS. [redacted] Is that what you meant when you said you were like a consultant -- you were consulting with the collaborators -- that they --

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DR. RICLES: I -- I don't know if the word consultant is appropriate. It's more an advisor. I -- I --

MS. [redacted] Advisor.

DR. RICLES: -- in terms --

MS. [redacted] Okay.

DR. RICLES: Yes. For -- for instance, the, um, students would be -- be pursuing a concept with -- with their, uh -- with their faculty. And there were, like, three -- three of the faculty and I think about six students. We were in the room together. And, um, they had a particular concept they were -- were wondering if this would work well. Because they knew I'd had a lot of experience in these things and could very much appreciate what they were working on.

They, literally, had the opportunity to take things further than we -- we managed to do. And, um, they wanted to know specifically if this device they put underneath the beam -- could it develop enough

energy dissipation to be effective. And so, from our experience, we would say, "Well, that may not be the best thing to do. Maybe from a construction perspective, you should put it someplace else." It was that type of interaction.

MS. [redacted] Okay. My last follow up question is you had mentioned that they would pay for everything. Um, and I just wasn't sure what "everything" meant.

DR. RICLES: I -- I -- I guess on the Chinese side it would be the -- the -- the air travel. I think most of the air travel if not all of it was typically covered. Um, now this is the second meeting. I think the first one I believe I went in 2017 -- I would -- I have to recall. I need to go back probably and look, but I -- I think that one, because it was -- you're invited to come and present, um, I had to pay for my own airfare, I -- I believe. I'm pretty sure.

But the second meeting, uh, you know, they -- they arranged for the hotel. It was, uh,

actually on the campus. I think the university owns a hotel. And, um, of course when we had meals with them, they would, uh, you know, pay for -- for the meals. Their students actually drove us back and forth from the airport.

Um, once we were at a site, so to speak, or before we actually saw them, we would have to pay for our own things such as parking at the Newark airport, uh, mileage back and forth, uh, meals, um, both in the U.S. at the airport and maybe at the Chinese airport, uh, probably other incidentals.

MS. [redacted] Okay. And so -- so far as the air ticket that they paid for, you said no money exchanged hands. So how would you get the ticket? How did that work? They would -- they would purchase it and then send you the, like, e-ticket or confirmation?

DR. RICLES: Yes. I -- I -- United Airlines -- they would ask for the airline that you, um, wanted to fly on, and, uh, they -- they would purchase a ticket. And then, uh, I -- I told them

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"Make sure you have my frequent flyer number," and I would receive a confirmation that -- that, you know, that ticket's been purchased. And I guess you could say it was an e-ticket.

MS. [redacted] Okay. And I keep saying that last question but really my last question this time. Um, so you said you flew out of Newark. How -- what's the mileage between, uh, where you are -- and I'm assuming somewhere near Lehigh University to Newark?

DR. RICLES: Newark to, uh, my house, I think it's close to 85 miles one way, so it would be 150 round trip.

MS. [redacted] And just so you know, I went to Rutgers University in Newark, New Jersey, for my graduate studies, so I'm quite familiar with that airport.

DR. RICLES: Very confusing with the parking.

MS. [redacted] I would just take a shuttle or a bus from -- I didn't have a car there, so I -- I

didn't have to deal with that. All right. Thank you. Tho- -- those are my follow up questions.

DR. RICLES: All right.

MR. [redacted] Dr. Ricles, just a, I think, one or two more questions about the form of travel, and then we're -- a few more things and then we'll be done. Um, when you travel for the collaborative work with Tongji, did you travel by yourself, or did you travel with any colleagues? I know you'd mentioned, I think, Richard -- was it Sause -- Sauce --

DR. RICLES: Rich -- Rich -- Richard Sause and I. We -- we were both, uh, collaborators. We -- I -- I don't know if the word collaborators appropriate but advisors with the, uh -- with the Chinese colleagues.

MR. [redacted] Okay. And then for any of the travel that NSF funded, if indeed NSF bought tickets, would you travel by yourself or would you travel with a colleague as well under the NSF funding?

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DR. RICLES: In terms of going to China?

MR. [redacted] Yes, sir.

DR. RICLES: Well, when I went to China I, uh, was always there with Richard Sause, so, um, I know he also was at the symposium and conference in 2017.

MR. [redacted] Okay. Understood. All right. Um, so going back, and I -- I think, you know, again, commend you -- thank you for putting the time and effort into the, you know, your -- the beginning with your background. Uh, I know you'd mentioned you'd had a lot of, uh, experience with NSF, and I would imagine probably other awards that you've received from the federal government and other entities. Uh, what is your understanding, from your professional background, about what needs to be listed on, you know -- on the current and pending section of the proposal to NSF?

Um, because at least from what you've told me now that -- you had a -- you were, I guess a PI or a collaborator on this Chinese award. Um, what's

your understanding of what actually has to be listed on the NSF proposal in regard to that?

DR. RICLES: When you -- when you submit it -- when you prepare an NSF proposal, the budget and budget justification?

MR. [redacted] Uh, yeah. Absolutely. And then there's a section that says "current and pending support" for any current support or support in the future. What -- I mean, what's your understanding of what needs to be listed in that section of the proposal?

DR. RICLES: Okay. So -- so on the budget, you know, there's a -- a breakdown of, uh, senior personnel, other personnel, um, domestic travel, foreign travel, materials and supplies, consultants, uh, graduate students, um, direct and then indirect costs. Uh, and then associated with that is the budget justification notes which describes in enough detail that the person reviewing that could understand what

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all the numbers mean. Um, and so that's -- that's listed.

And I -- I know lately on the -- on the travel, you have to, uh, list what you anticipate where you'll go. This was something that I think in the last one or two years I know that that now is a requirement. There is also, um, current and pending support, one of the required documents for NSF which lists, uh, current support.

And so there I guess you'd have the -- I think it's, uh -- there's a grant number I believe. There's some internal accounting numbers, but then there's the amount, the year, and the, uh, I think the amount of support. I think it's usually like summer -- or effort. I think they call it effort. That would be on the -- on the current. So that's the current grants and th- -- then any pending grants --

MR. [redacted] Right.

DR. RICLES: -- that were still pending and hadn't been decided upon.

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MR. [redacted] So I -- I guess my question to reference to that aspect of the proposal is we had looked through the, you know -- with the very little information that -- that we -- we had, um, we looked through your proposals to NSF. And it didn't appear to us that, uh, this collaboration, uh, between Tongji and Lehigh was articulated in the current and pending support section. Would you be able to explain why that wasn't listed, uh, in the proposal?

DR. RICLES: Probably because the fact that through the Off- -- that -- that -- that current and pending comes from the Office of Research and Sponsored Programs. And so --

MR. [redacted] Mm-hmm.

DR. RICLES: -- when that document is being prepared, uh, they would go to the database and -- and seek the current projects you have that are listed, you know, going through officially Office of Research. And I guess, uh, there's a formal -- or approval or signature process that has to go through.

So then it's entered into the -- into the system. And so with the Chinese one, this was one that was really established through China where there's a memo of understanding and no formal, uh, I'd say grant number that's through the Office of Research.

MR. [redacted] So --

DR. RICLES: It appears. So I -- I think that's the reason it's not in their -- in their, um, in that -- that particular database.

MR. [redacted] Okay. So you had mentioned, um -- you'd mentioned earlier that, I guess, the Office of Sponsored Research -- they're the ones who actually populate the current and pending support section of the --

DR. RICLES: Yes.

MR. [redacted] -- proposal?

DR. RICLES: Correct.

MR. [redacted] So you had -- do you have -- at any point in the proposal process, do you have visibility on what's being put into that document?

DR. RICLES: Yes. In fact, I always check, um, because sometimes things get, uh -- that shouldn't be there that are -- the grant was either not awarded or it's expired, um, and so I always -- I always check that very carefully. And so we're provided a -- I usually get an email, and it says check -- check this over and make sure this is the current, uh, support and the grant and the -- I check that and send it back to the, uh, Office of Research, who -- who then uploads it to the website.

MR. [redacted] And you had mentioned -- so the -- the Chinese, uh, award was not listed on there. And I'm sorry, the rationale for that again was -- was what?

DR. RICLES: Well, it -- it -- it's not really an award to Lehigh University, and there's no formal, you know, official agreement with Lehigh. It really was a memo of understanding, which, uh, you know, I had signed, Richard had signed. And it was really just to provide advice to the Chinse, and so,

uh, it wasn't entered into their database. But they're -- the Dean and everyone's infor- -- informed about it. As I said, I -- listed that in my faculty activity report --

MR. [redacted] Understood.

DR. RICLES: -- um, each year.

MR. [redacted] Okay. Understood. Um, all right. So, I mean, have you ever in your -- your career, have you ever worked -- I'm just trying to, you know, understand your perspective or Lehigh's perspective. Have you ever received funding from a foreign entity and listed that in your current and pending support?

DR. RICLES: No.

MR. [redacted] Okay. All right. Um, re- -- uh, bear with me. The reason being -- this is -- and yet again, maybe this is, uh -- no, that's your -- uh, so this is our -- our guideline, and I just have a section I'm gonna pull up, uh, for purposes of the

interview today. I have this as, uh, Tab A. So this is current and pending support.

This comes out of the PAPPG. I think you actually had referenced that earlier where it asks for any project including, you know, funding, um, from whatever source: federal, state, local, foreign government. Um, so it -- you know, this -- this is what the actual -- what's articulated in the -- the PAPPG, uh, guidance. And it's for any ongoing, uh, projects or proposals. So at least from our interpretation from NSF -- and I would say for the future I -- I think maybe be a little bit more liberal in -- in putting that down. Because our program officers, what they do want to know is the totality of -- of your involvement as a PI, um, because that's one of the factors that's used when they're assessing whether or not you have enough time to commit to -- to awards.

So, um, I would direct you to the PAPPG in the future because that is the -- the guidelines

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that NSF puts out for, um, what they're asking for -- for in these proposals. Um, when you had -- does Sponsored Research ever provide any guidance on what has to be submitted and what -- what doesn't need to be submitted in the, uh, current and pending support to the NSF proposals.

DR. RICLES: Our Office of Research, you know, they -- they -- uh, we have a, um, person that's usually your -- like, for instance in our case, assigned to the department or our, uh, research center. So there's always typically the same person you interact with, and they're -- they're always knowledgeable. And they remind us of, uh, things you need to be very careful about. And -- and, um, and the current and pending, you know, they're -- they're prep- -- they will prepare as well, so I think the process is -- is quite good. And, you know, they -- they do the best they can. If there's any ever questions on their side, they -- they will consult the university, or they'll contact directly NSF --

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MR. [redacted] Sure.

DR. RICLES: -- because the last thing they would want to have done is to have a principal investigator put in a lot of work and then the proposal becomes disqualified because it didn't meet all the requirements for submission.

MR. [redacted] Understood. And, um, the MOU that you had mentioned that you had signed, I guess in addition to, uh, I guess the co-PI or your colleague from Lehigh, does, uh -- does Lehigh have a copy of that -- the MOU?

DR. RICLES: I'm not sure they do. Um, they -- they -- they may not, [redacted] I --

MR. [redacted] Okay.

DR. RICLES: -- they may not have that.

MR. [redacted] What is the extent to which Lehigh is aware of the collaboration? I know that you had mentioned that you had provided the, um -- I know that you had mentioned that you had provided reports on, I guess, the status of this collaboration.

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Can you gi- -- kind of go into detail what that -- what that consisted of, those reports that you'd provided?

DR. RICLES: Yes. We -- we are, uh, asked each year by our dean to prepare what's called our faculty activity report. And the faculty activity report, uh, is to evaluate our performance for not only that year, but they compare back to the two prior years. And it consists of three components.

There's, um, teaching, so you -- they have the courses that you taught and, um, your course evaluations. And what you're asked to do there is to go ahead and -- and write out in -- in an essay form what your plans are for teaching in the next -- next following year. So the dean will use that information on your performance in the -- in the classroom and then your plans moving forward or any other discussion that you happen to have of -- as part of the equ- -- equation for evaluation.

Uh, the -- the other component is, um, uh, scholarship. And scholarship includes research,

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uh, student mentoring, you know, uh, the number of Ph.D. students and number of papers you've published, and -- and also the, uh, research projects you have. So in that part of the, um, report, the -- some of the information is provided from the university such as the number of research projects that you have, uh, the dollar amounts that were spent, say, on certain categories, particularly student support and -- and expenditures. Uh, what was not there was this, um, collaboration with China so I would add it.

And I would send in a note and add it to make sure it was listed there. And then the, uh, and -- and so what I list there is the, uh, the -- the title of that. There's -- there's no dollar amount, so I didn't list any dollar amount and just indicated, you know, the purpose of that was really this collaboration -- interaction with the Chinese colleagues in terms of trying to advance the earthquake engineering.

MR. [redacted] Understood.

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DR. RICLES: And then, um -- and then the final component was -- was basically service.

MR. [redacted] Now, to the best of your recollection, sir, di- -- did Lehigh understand that there was a formal MOU that was agreed upon? Had -- you'd articulated the collaboration, but does Lehigh know, you know, the formality that there was actually documents singed? We were able to -- there was a number of things that we were able to find online that this was, um -- I guess I might as well just do this now. Bear with me, uh.

So this is tab number three. Uh, this was a document -- and I believe this was originally in -- let me see if I can make it bigger. I think this was originally in Chinese. We found this online indicating that, uh, announcement of cooperation of first batch of earthquake engineering, uh -- international cooperation Joint Laboratory Cooperation fund. And what it discusses here is the innovate- -- innovative self-centering structural systems and hybrid

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simulation. Um, it identifies you as the applicant and I think [redacted] as the on-campus coordinator and that this was a funded project.

So I guess while Lehigh might not have received any funding, they paid for your travel over. I guess my question is does Lehigh understand that this was a -- a -- a formal project that was applied on that there was an MOU in place between you, Lehigh, and Tongji University?

DR. RICLES: That's kind of a confusing question. I -- I guess I should back up in terms of, um, the formality was the -- the agreement we had signed, and there was no intent of us actually providing any -- getting any funding. Um, the way that it was reported was through the activity report. I -- I believe they didn't receive -- it was a piece of paper in which we had singed and agreed to collaborate and participate.

I -- I wanna add, [redacted] here that -- and this was a very frustrating process. This

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particular meeting here -- actually, there was several -- actually, the international cooperation joint laboratory cooperation is -- is something they've established to try to collaborate with, uh, U.S. professors. And you can see here, there's several professors. [redacted] is actually from, uh, Canada --

MR. [redacted] Sure.

DR. RICLES: -- [redacted] is, uh, UC Davis -- or -- uh, [redacted] And, um, the frustrating thing I found is, we -- we were literally held in a dark. I -- I -- I asked them when I noticed that we were invited to present -- or should I prepare something because I don't know what to present. What have you guys been working on? We're -- there's no communication. They literally are using our name to put on the papers. And their response was "No, we'll take care of it. We'll present."

MR. [redacted] Okay.

DR. RICLES: You know. So ve- -- very strange from that perspective and so frustrating. You

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know, we -- we wanted to participate more, but we were just there because it was really they're required. You had to have a U.S. collaborator -- international collaborator to -- to get -- I guess for the Chinese to get their funding. All the funding was basically spent in -- in China there.

MR. [redacted] Understood. No, understood. I guess my question is I -- I'm trying to get an understanding because this may go back to the current and pending support. If there was no formal MOU in place, it would be my interpretation that Lehigh University would have nothing to draw from. Um, if they didn't know that this was a formal project with a signed MOU, it would be difficult for them to populate this as a potential activity on the current and pending support section of the proposal.

DR. RICLES: Yes. Yes. And -- and I guess the word "support" -- we were never intended, I guess -- and their intent was to receive support.

MR. [redacted] Understood.

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DR. RICLES: We -- I -- I -- in -- and in -- and in fact, I think it was noted there that, uh, the collaboration would be where they would ask us to come over and meet and interact with them for advice. So it was -- I -- I didn't really view it as really being support. It's really more of kind of a collaboration.

MR. [redacted] Understood. Understood.

DR. RICLES: And -- and -- and in fact, that's why I never thought of putting in the -- what we call the C and P. Maybe an oversight on my part. I can understand, maybe, you have to be more formal here, but --

MR. [redacted] Understood. Now, was this something that typically an MOU like this would have to be routed through General Counsel before it's -- before it's signed, in your experience in the past with Lehigh?

DR. RICLES: If -- if it required commitment at Lehigh for resources, uh, if there was

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funding, an actual proposal with a budget and other things, the university would have to approve it. The Office of Research would -- would ask for the university, uh, appropriate people -- usually I think it's the Provost or Vice-Provost of Research to review it and approve or disapprove.

MR. [redacted] Okay.

DR. RICLES: In this case, we had no budget. You know, we weren't expecting any money. We were just, uh, acting as, you know, good faith U.S. advisors. So that -- that process never took place in terms of that formality.

MR. [redacted] Okay. Understood. Um, okay. And you'd mentioned before that there -- outside of reimbursing your incidentals, hotel, and airfare, um, there was no honoraria, no salary, no, um, bonuses paid through this --

DR. RICLES: No.

MR. [redacted] -- collaboration.

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DR. RICLES: No. I -- I don't -- no. There was none.

MR. [redacted] Okay. Okay. Um, did the work that happened with Tongji under this collaboration, uh -- did that -- how similar was that or how different was it from the research that you were conducting from NSF on the funded awards?

DR. RICLES: Well, you -- I -- I should move -- you have to go a little bit back in history. The, um, particular topic they were looking at, [redacted] was one that's called self-centering compliant systems. And it's a concept that I developed and -- and worked on with [redacted] back in, um, maybe 2004. We worked on this sop- -- topic where we were able to get structures to perform in a very resilient manner under very extreme earthquake conditions.

And this became widely published. You know, it's got a lot of citations, became internationally known, which, you know, we're very proud of that work and the students that we've done.

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And -- and they, um, the other thing that I'd also worked on was something called, um, the experimental technique that enables you to get the -- a whole system into the laboratory. Some are based -- actually say virtual, but it's linked to what's physically in the lab.

So concerning both of those aspects, you literally could take this method called hybrid simulation and investigate this concept even further, take it to the next step. Uh, and so they -- they were looking for ideas and topics, and it had become very popular in China. And that's what they wanted to pursue. And so since we had worked on that -- we were sort of the original developers of this -- uh, they thought the best people to talk to, uh, was myself and -- and -- and [redacted].

MR. [redacted] Okay. And --

DR. RICLES: And so that they took the topic to the, you know, to the -- they developed the topic further.

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MR. [redacted] Okay. So the -- the work that was done under the collaboration with Tongji was completely different than the funded work that was --

DR. RICLES: Completely different. Completely different.

MR. [redacted] All right. Completely understood. Um, just going back, you know, based on this MOU -- and this really was the nexus -- to -- to why we wanted to speak to you based off the information that we received. Um, given, you know, like, kind of what you know now or just in hindsight, do you believe that that MOU, you know -- that you should have provided that to the university?

Um, the reason wh- -- I mean, you're -- you're talking about the process with the proposals, and you mentioned that it's up the Office of Science to populate the current and pending support, which is our understanding that you were listed as a PI. Regardless of funding, you were listed as a PI on an award. Um, is that something that should have been provided to the

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university? I would imagine if they had that, you know, potentially the Office of Science would have li-- would have added that to your current and pending support. Is that a correct assertion, or do you think I'm off?

DR. RICLES: I'm not so sure they would have added it, [redacted] to the current and pending. Um, granted, sometimes we have research projects, say, funded by NSF which we put all the funds into supporting the staff or the students, and we would follow with any support. But -- but we have a vested interest in things are being committed at the university, and we're doing research at the university.

Um, in this particular case, it was, um -- we weren't receiving support. There was no exchange of money. Um, the only time we really heard from them was, um, when they wanted some advice or when they had a paper that was being written they wanted us to give their comments. In fact, sometimes it got to the point

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they wanted me to review other papers unrelated to this, and I said no.

Um, perhaps, we may not be in the situation today if -- if in fact I was a little bit more thoughtful in that regards and -- and gave it to, uh, Lehigh. But I -- I don't know if they would have put it in the current and pending, um, because it wasn't any really formal, you know, agreement where Lehigh had to commit something. It was really, if anything, voluntary on my part. I -- I was very interested because I developed this topic and wanted to see, you know, how far it could go. The -- and no disrespect to any of the U.S. funding agencies. We do fundamental research -- the Natural Science Foundation funds fundamental research --

MR. [redacted] Absolutely.

DR. RICLES: Once -- once something evolves and it's matured and it's become transformative, there -- the opportunities are ones in which you have to seek other topics. And the Chinese

had the opportunity to really continue the work we had, which was not so transformative -- that I was very interested to see where they would go with this. And so that was -- that was my interest, basically.

MR. [redacted] Understood. Understood. Um, [redacted] do you have any, uh, follow up questions?

MS. [redacted] I just wanna go back to that question, Dr. Ricles. You said you don't believe, even if Lehigh had, um, this MOU that you had entered into, they would have listed it because -- and -- and I just wanna be sure I'm clear about the because -- because there was no money exchanged? I'm sorry. Can you repeat that?

DR. RICLES: I -- I -- I don't -- sorry -- sorry, [redacted] I didn't wanna say something wrong and -- and say it out of context. I -- I think it would have probably been at the discretion of Lehigh. They certainly, probably would've wanted to make a note of it because they're -- they're really good at record

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keeping, and I don't wanna get anyone in trouble with saying the wrong thing.

Whether they would have done or not I -- I was gonna mention, you don't necessarily have to have support to be listed as current and pending or, um, on a project. But if there's actually a budget, I certainly -- it'd be current and pending. Um, and so with no budget, no money, I don't know that that would have been put in the current and pending or if that would have been put in another category. I -- I -- I think that's a logistical thing that I'm not that informed about.

MR. [redacted] Okay.

DR. RICLES: But certainly --

MS. [redacted] Okay. And I guess --

DR. RICLES: -- it would have been inspected.

MS. [redacted] No. I -- thank you for that. And I guess, would they have any reason to wanna know about the time that you're collaborating? You said

it's only about a week a year that you would go, um, to the Chinese university. But would that be something that the Office of Sponsored Research would have been interested in knowing and would not have known because they didn't have the MOU?

DR. RICLES: I -- I think, um, you know, the university's always interested in how you spend your time. That's part of the purpose of the faculty activity report. You know, we -- we don't wanna be overcommitted, but yet you, you know, you have a lot of liberty in what you can pursue, you know, your passion. There's, um, um -- get -- you know, it's your -- it's discretionary.

So the dean and everyone else wants -- you have to have accountability. I -- I think whether the Office of Research would have been interested if I was spending time over there, um, if it wasn't a financial or contractual thing -- I don't wanna say -- I'm hopefully not saying anything wrong -- I don't know if they would have or not. I think it would have been

more on the scholarly activity and how you're being productive, uh, aspect, which would maybe for more -- fall more on the academic aspect.

MS. [redacted] And that's when you turned in the reports to the dean. Is that correct?

DR. RICLES: Yes. Yes.

MS. [redacted] Okay.

MR. [redacted] And Dr. Ricles, just one -- one follow up. The reports to the dean, did they mention this collaboration as just a collaboration, or did they just -- did they mention it and discuss it as an MOU between you, Lehigh, and Tongji University?

DR. RICLES: In terms of my report to the dean, it was more of a collaboration. And I -- I would list the, uh, the Chinese side, you know, the, uh, I believe it had the professor's name and the institute that they were assoc- -- affiliated with and the subject.

MR. [redacted] Okay. Um, sir, that's -- that's all the questions that I have uh, right now.

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[redacted] are there any other follow ups that you have at this point?

MS. [redacted] No, no. Thank you. You've been very clear in answering our questions. I appreciate that.

MR. [redacted] Uh, Dr. Ricles, um, you know, I love taking the opportunity to -- to talk to you for an hour and ask you questions. I'll ask you if you have any questions for us right now. If we can answer them, we'll do our darndest to do that, um, knowing that sometimes it's difficult for us to answer while it's an ongoing investigation. But do you have anything for either [redacted] or myself?

DR. RICLES: No. I don't have any other questions. If anything comes to mind, uh, perhaps we can -- we can contact you. I think everything I've stated is to my best knowledge and -- and truthful and honest. And hopefully, we've been of -- of help to you and, you know --

MR. [redacted] You've been --

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DR. RICLES: -- appreciate your sincerity in these difficult times here.

MR. [redacted] Oh, it's, uh -- it's -- it's, you know, again, uh -- I appreciate your -- your assistance. Uh, we've, you know, helped clear up, uh, you know, a -- a large portion of this. Uh, yeah. We may have some additional questions, and if so, we'll, uh, just contact you thr- -- you through your counsel. And if we have any questions for the university, we'll go through [redacted]

Um, if you have anything for us, obviously we'd be more than happy to -- to speak. We would ask again that you go through your counsel if you have -- have any questions. But otherwise, uh, if you don't have anything else, is there anything, uh, from anyone else? Any other questions at this point?

MR. [redacted] No. I just, uh, you know, again, uh, wanna thank my client for his forthrightness and, uh, you know, I guess, uh, sort of respond to your suggestion that you may have other questions or

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requests for documents. You know, whatever we have in our possession or control, you know, we certainly would cooperate. You know, so- -- some may simply be in Lehigh's possession and don't wanna speak for them. Um, but, uh, you know, we'll continue to cooperate.

MR. [redacted] Absolutely. We, uh, really appreciate it. [redacted] anything from your end?

MS. [redacted] You had asked a question, and -- and -- and I just wanted to break it down. The question you asked, [redacted] was -- uh, Professor Ricles was have you ever received funding from a foreign entity and listed it in your proposal? And the answer was no, but I wanted to break it down. Is -- have you ever received funding from a foreign entity, period?

DR. RICLES: For -- for research or…

MS. [redacted] Research.

DR. RICLES: No. I don't recall ever having funding from any foreign entity in research. No.

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MS. [redacted] Right. I mean, that's -- that's why I wanted to break it down. I didn't want it to be that he had received foreign funding and just not listed it. It was that he's never received foreign funding. So that was -- I just wanted to break that down.

DR. RICLES: Mm-hmm.

MR. [redacted] Okay.

MS. [redacted] Okay. That's it.

MR. [redacted] Anything else? All right. Uh, well, if there's no other questions, uh, it's 12:05 p.m. on May 7th. I'm gonna stop the recording at this time. Let's see, uh, stop.

END OF RECORDING

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CERTIFICATE OF CERTIFICATION

IN THE MATTER OF JAMES RICLES'S INTERVIEW

I, [redacted], the officer before whom the foregoing audio file was delivered, do hereby certify that the transcript that appears in the foregoing pages was reduced to typewriting under my direction; that said transcript is a true and accurate record of the proceedings; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this proceeding was administered; and further, that I am not a relative or employee of any counsel or attorney employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

[redacted]
Notary Public in and for the
District of Columbia

My Commission expires: March 31, 2021

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Dr. Sebastian Bednarek
University of Wisconsin-Madison

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

June 28, 2021

[redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-19-0029-O)

Attached is our investigative report concerning allegations that Dr. Sebastian Bednarek failed to disclose to NSF a dual employment with Zhejiang Normal University and positions as a High-End Foreign Expert and member of China's Thousand Talents Program.

In order to protect the Government, we recommend that NSF debar Dr. Bednarek for one (1) year. The basis for our recommendation is described in detail in the report.

We have the following contact information on file:

[redacted]

[redacted]

Attachment

[redacted]

Recommendation for Governmentwide Debarment

OIG Case Number I-19-0029-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

June 25, 2021

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AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case Number I-19-0029-O
June 25, 2021

WHAT WE FOUND

We received information alleging Dr. Sebastian Bednarek was affiliated with China's Thousand Talents Program. Our investigation confirmed that Dr. Bednarek was a member of the Thousand Talents Program and a High-End Foreign Expert with Zhejiang Normal University (ZNU) since at least 2013, and that Dr. Bednarek failed to disclose that information to the University of Wisconsin-Madison (UWM) and NSF, as required.

WHAT WE RECOMMEND

Based on Dr. Bednarek's conduct, pursuant to 2 C.F.R. § 180 *et. seq.* and based on upon the facts described herein, we recommend that NSF debar Dr. Bednarek for one (1) year.

[redacted]

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Factual Background

Dr. Sebastian Bednarek is a Professor in the Biochemistry Department at the University of Wisconsin-Madison (UWM). He was PI or Co-PI on eight[1] NSF awards since September 2012; three of these awards were issued between September 2012 and December 2016, and totaled over $817,000.

As set forth below, we have obtained evidence that Dr. Bednarek did not disclose foreign affiliations, as required, in his NSF proposals.

OIG Investigation

We investigated allegations concerning Dr. Bednarek's undisclosed foreign affiliations with China's Thousand Talents Program and his position as a High-End Foreign Expert with Zhejiang Normal University (ZNU). A review of online information confirmed his relationship with ZNU since at least 2012. A September 21, 2012 ZNU website article discussed a "Visiting Professor Appointment Ceremony" for Dr. Bednarek.[2] Additionally, Dr. Bednarek's CV, posted to the Nanjing Agricultural University State Key Laboratory of Crop Genetics & Germplasm Enhancement website, listed his High-End Foreign Expert award from the China Central Government from 2013 – 2016; Thousand Talents Plan award from the Zhejiang Province Government from 2013 – 2016; and position as a Guest Professor at ZNU from 2012 – 2014.[3]

We issued an IG subpoena to UWM requesting information about Dr. Bednarek's NSF awards, as well as documents related to annual disclosures and conflict of interest forms he filed with the university. On September 13, 2019, we received an email from UWM's Office of Legal Affairs which stated, "In the course of assisting with the collection of the responsive materials, Professor Bednarek explained that he had received two awards from Chinese government programs for the period of 2013-16: a National 'High End Foreign Expert Award' and a 'Thousand Talents Program Award.' These awards are referenced in his CV provided to his department as part of his 2015 post-tenure review process."[4]

A review of documents produced pursuant to our subpoena identified Outside Activity Reports (OARs) completed by Dr. Bednarek from 2012 – 2016.[5] For each of these reports, Dr. Bednarek selected "No" to whether "you, your spouse, or your dependent children have any reportable outside activities related to your institutional responsibilities?" However, per UWM policy, Dr. Bednarek was responsible for reporting, "any compensation given directly to you, your spouse, or your dependent children (not through the University) …[g]ifts or other rewards…[t]eaching services to another entity…[i]ncome from such activities sponsored by a foreign institution of higher education or foreign governmental body is reportable compensation."[6] Additionally, Dr. Bednarek completed mandatory Conflict of Interest trainings through

[1] This figure does not include any award supplements with different NSF proposal numbers. Additionally, any preliminary proposals were not counted.
[2] Tab 01, ZNU website
[3] Tab 02, Bednarek CV on NAU website
[4] Tab 03, September 13, 2019 email from [redacted]
[5] Tab 04, Bednarek OARs for 2012 - 2016
[6] Tab 05, Reportable outside financial activities 2012 – 2016

UWM on December 17, 2013 and November 14, 2016, the latter of which specifically included disclosure requirements for annual OARs.[7]

On November 7, 2019, Dr. [redacted] Chair of the Department of Biochemistry at UWM, memorialized in writing a meeting that he had with Dr. Bednarek, "covering your relationship with two foreign talent programs from 2013-16, the appropriate ways to report financial compensation and travel on your OAR, and your ongoing obligations for reporting on your Biosketch and the Other Support section in grant applications to the NSF and other federal agencies."[8] In the letter, Dr. [redacted] said the Department was informed of this matter after receiving an OIG subpoena, and while Dr. Bednarek had listed the positions on his CV, the "awards" were not disclosed in Dr. Bednarek's OARs or grant proposals.

Dr. [redacted] accepted Dr. Bednarek's explanation that he did not know awards/honoraria from foreign universities were reportable. As Dr. [redacted] wrote in his letter, "there was no clear guidance from the NSF about listing outside activities, or income received from activities outside of your university duties in grant applications" in 2013 – 2016.[9] However, he noted "UW's guidance on outside activity reporting was sufficiently clear in the time period of 2013-16."[10] According to Dr. [redacted]:

> it is my view that you should have recognized that your professional expertise as a UW Madison faculty is the primary basis for your NSF-funded research, and invitations to participate in foreign talent programs … or engage in other compensated outside professional activities have high probability for overlap with your professional expertise and NSF funding. Consequently, these activities should have been reported in your grant application biosketches as an additional professional appointment or perhaps as a synergistic activity.[11]

While holding positions with ZNU (September 21, 2012 – December 31, 2016), Dr. Bednarek submitted eight proposals to NSF and was awarded three grants totaling over $817,000. In all eight of these NSF proposals, Dr. Bednarek did not disclose his ZNU employment positions and research activities conducted with ZNU based on his contractual requirements.

Based on these facts, we referred this investigation to the Criminal Division of the U.S. Attorney's Office, Western District of Wisconsin, and executed a search warrant for Dr. Bednarek's UWM email account. We obtained the following information during our review of Dr. Bednarek's emails:

- A November 2012 email exchange with [redacted] of ZNU requesting documents for Dr. Bednarek's application to the High-End Foreign Experts Recruitment Program, including an employment certificate from UWM, documentation of Dr. Bednarek's research grants, and a

[7] Tab 06, Bednarek COI training. The UWM Office of Legal Affairs did not specifically state whether the 2013 training directly discussed OAR disclosure requirements.
[8] Tab 07, November 7, 2019 letter to S. Bednarek
[9] Id.
[10] Id.
[11] Id.

request to complete the English portions of the enclosed "Contract of Employment/Letter of Intent."[12]

- A December 30, 2012 email from [redacted] confirming Dr. Bednarek's "monthly salary is 60,000 Yuan" for the High-End Foreign Experts program.[13] As of that date, 60,000 Yuan equaled approximately $9,625.
- A March 5, 2014 email exchange with [redacted] where Dr. Bednarek said, "[m]y thought would be to visit twice (for a total of 2 months stay) this year," in reference to his High-End Foreign Expert position.[14]
- An October 11, 2014 email from Jianwei Pan with Dr. Bednarek's Thousand Talents Program "Employment Contract" attached.[15] In relevant part, the contract detailed:
  - Employment dates of January 1, 2014 – December 31, 2016;
  - A requirement to establish cooperative relationships with universities in China and abroad;
  - A requirement to "obtain one project of National Science Foundation of China";
  - Requirements to publish papers and give lectures;
  - A requirement to recruit overseas high-level talents;
  - A requirement to work at ZNU "for at least two month [sic] every year during the contract period"; and
  - "Month Salary" of RMB 60,000, and RMB 600,000 in construction funds of which RMB 200,000 "shall be used as scientific research funds."

Although Dr. Bednarek's contracts with ZNU expired in 2016, he had discussions with [redacted] as recent as October 2019 where it was proposed that Dr. Bednarek would receive $5,000 for a visit in which he would give a talk at a symposium.[16]

On November 16, 2020, we interviewed Dr. Bednarek who confirmed his participation in the High-End Foreign Experts Program and Thousand Talents Program.[17] In total, Dr. Bednarek claimed to recall being paid only approximately $80,000 for his work with the programs. Although emails reviewed pursuant to our search warrant referenced Dr. Bednarek's positions with ZNU as employment positions and his payments as salary, Dr. Bednarek continued to characterize his positions as "awards." When shown a copy of his Thousand Talents contract during our interview, Dr. Bednarek said he didn't recall his contract stating it was for employment. Because he didn't consider the position an "appointment," he didn't list it on his NSF biosketch. He also described his actions as "completely above board"[18] with UWM.

On November 19, 2020, we interviewed Dr. [redacted] as he and his predecessor had previously signed letters requesting visas for Dr. Bednarek's authorized travel to ZNU in 2012 – 2016.[19] For each trip, the letters described collaborative efforts between Dr. Bednarek, ZNU, and Dr. [redacted], but neglected to discuss

[12] Tab 08, November 2012 email exchanges with [redacted]
[13] Tab 09, December 30, 2012 email from [redacted]
[14] Tab 10, March 5, 2014 email from [redacted]
[15] Tab 11, October 11, 2014 email with contract
[16] Tab 12, October 2, 2019 email from [redacted]
[17] Tab 13, Transcript of S. Bednarek interview
[18] Id.
[19] Tab 14, Transcript of [redacted] interview

Dr. Bednarek's employment/financial relationship with ZNU. When asked if Dr. Bednarek's disclosures regarding his Thousand Talents Program and the High-End Foreign Experts Program positions were "above board" as Dr. Bednarek described in our interview, Dr. [redacted] responded, "[w]ell, transparent to the university would have been reporting the financial compensation in his outside activities report … He admitted yesterday that he didn't do that until we instructed him to go back and refresh his reports."[20]

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

We referred this matter to the United States Attorney's Office for the Western District of Wisconsin. It was initially accepted for further investigation, but the matter was ultimately declined for criminal prosecution.

OIG Assessment

Grounds for Debarment

NSF has authority to debar an individual for "[c]onviction of or civil judgment for … [c]omission of … making false statements … [or] making false claims,"[21] or "[a]ny other cause of so serious or compelling a nature that it affects (the Subject's) present responsibility."[22]

In this case, Dr. Bednarek's conduct falls within the above-referenced section of 2 C.F.R. § 180.800(d).

Burden of Proof

In debarment actions, the burden of proof rests with NSF to demonstrate by a preponderance of the evidence that a cause for debarment exists.[23] We believe that, as evidenced by the facts of this case, this burden has been met.

Relevant Factors

The debarment regulation lists 19 mitigating and aggravating factors that the debarring official may consider when determining whether to impose debarment and the length of the debarment period.[24] The following factors are pertinent to this case.

1. Actual or Potential Harm or Impact[25]

[20] Id.
[21] 2 C.F.R. § 180.800(a)(3)
[22] 2 C.F.R. § 180.800(d)
[23] 2 C.F.R. § 180.850(a)
[24] 2 C.F.R. § 180.860
[25] 2 C.F.R. § 180.860(a)

By concealing his appointment(s) at ZNU, Dr. Bednarek caused actual financial harm to NSF. Specifically, these omissions caused NSF to make awards for over $817,000 to UWM. Also, although they were ultimately not funded, Dr. Bednarek sought additional research funds from NSF, which potentially would have been impacted by his dishonest behavior had any of those proposals been funded by NSF.

2. Frequency of Incidents and/or Duration of the Wrongdoing[26]

From approximately September 2012 through December 2016, Dr. Bednarek held foreign appointments but did not make full disclosures to either NSF or UWM. As earlier stated, Dr. Bednarek submitted eight NSF proposals from September 2012 through December 2016, but failed to disclose his ZNU appointment or Thousand Talents Program affiliation to NSF.

Dr. Bednarek also filed annual OARs with UWM during that same time frame and, again, did not disclose his foreign appointment or affiliation. Any mention of his positions to UWM were in his CV under "awards" and provided to Dr. Bednarek's department as part of his 2015 post-tenure review. According to the chair of Dr. Bednarek's department, however, "[UWM]'s guidance on outside activity reporting was sufficiently clear in the time period of 2013-16 that your participation in foreign talent programs at foreign universities should have been reported and that the final compensation received, whether characterized as honoraria or gifts or other awards, was also reportable."[27]

3. Pattern of Wrongdoing[28]

Dr. Bednarek's actions constitute a pattern of wrongdoing. As noted, this is not a single omission, which could be attributed to carelessness or a misunderstanding. Rather, Dr. Bednarek neither disclosed his appointment with ZNU, his membership with the Thousand Talents Program, nor the High-End Foreign Experts program for approximately 3 or more years and across various documents submitted to both NSF and UWM. When he did reference his positions, he characterized them as "awards" and told OIG he did not recall his contract being an "employment contract." This behavior demonstrates a purposeful and deliberate pattern of dishonesty wherein Dr. Bednarek attempted to conceal his appointment and affiliations with ZNU.

4. Role in Wrongdoing[29]

Dr. Bednarek is solely responsible for his actions. His conduct cannot be attributed to UWM or another individual.

5. Acceptance of Responsibility[30]

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[26] 2 C.F.R. § 180.860(b)
[27] Tab 07
[28] 2 C.F.R. § 180.860(c)
[29] 2 C.F.R. § 180.860(f)
[30] 2 C.F.R. § 180.860(g)

While Dr. Bednarek stated he now understands that he should have disclosed his foreign positions to UWM in his OARs, he told OIG, "I was completely above board with [disclosing his relationship with ZNU to his employer] … it was listed on my CVs … there was no attempt to hide it."[31] However, Dr. Bednarek's CV, as provided to UWM, listed his positions as "awards" and minimized the employer-employee relationship associated with his foreign positions. The chair of Dr. Bednarek's department said, "transparent to the university would have been reporting the financial compensation in his outside activities report."[32]

6. Repayment[33]

To our knowledge, Dr. Bednarek has not made any repayments to NSF or UWM. However, neither NSF nor any other federal agency has contacted Dr. Bednarek seeking any repayments.

7. Cooperation of the Subject[34]

Dr. Bednarek agreed to a voluntary interview with OIG.

8. Other Factors[35]

Dr. Bednarek told OIG that his frequent foreign collaborator, Dr. Jianwei Pan, passed during Summer 2020., Dr. Bednarek stated, however, that he "continue[s] to work with several of [Dr. Pan's] students, you know, because we have a joint paper that we've been working on for now a couple years, um, even after, uh, Professor Pan's death to – to complete that."[36]

OIG Recommendation

To protect the interests of the public and NSF, OIG recommends that NSF debar Dr. Bednarek for one (1) year. Such a period of time is necessary to ensure federal funds are safeguarded.

[31] Tab 13
[32] Tab 14
[33] 2 C.F.R. § 180.860(h)
[34] 2 C.F.R. § 180.860(i)
[35] 2 C.F.R. § 180.860(I)
[36] Tab 14

Attachments

TAB 01 – ZNU website
TAB 02 – Bednarek CV on NAU website
TAB 03 – September 13, 2019 email from [redacted]
TAB 04 – Bednarek OARs for 2012 - 2016
TAB 05 – Reportable outside financial activities for 2012 - 2016
TAB 06 – Bednarek COI training
TAB 07 – November 7, 2019 letter to S. Bednarek
TAB 08 – November 2012 email exchanges with [redacted]
TAB 09 – December 30, 2012 email from [redacted]
TAB 10 – March 5, 2014 email from [redacted]
TAB 11 – October 11, 2014 email with contract
TAB 12 – October 2, 2019 email from [redacted]
TAB 13 – Transcript of S. Bednarek interview
TAB 14 – Transcript of [redacted] interview

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Dr. Mingqing Xiao
Southern Illinois University-Carbondale

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

November 1, 2022

To: [redacted]

From: [redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-21-0043-O)

Attached is our investigation report concerning Southern Illinois University – Carbondale's Assistant Professor, Dr. Mingqing Xiao. He was the Principal Investigator (PI) on NSF award DMS-1854638 but also received at least one foreign award that was not disclosed to NSF. He was convicted in the Federal Southern District of Illinois on three counts of False Statements on Tax Returns and one count of Failure to File Report of Foreign Bank Account.

In order to protect the federal government, we recommend that NSF debar Dr. Xiao for three years. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for the subject and/or the subject's counsel:

Dr. Mingqing Xiao
[redacted]

[redacted]

[redacted]

Attachment

[redacted]

[redacted]

CUI//PRVCY/PRIVILEGE

Recommendation for Governmentwide Debarment

OIG Case Number I-21-0043-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

[redacted]

October 19, 2022

REPORT RELEASE RESTRICTION

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[redacted]

AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case Number I-21-0043-O
October 19, 2022

WHAT WE FOUND

In September 2018, Southern Illinois University – Carbondale submitted a proposal for an NSF grant in which Dr. Xiao was the Principal Investigator. In the proposal, Dr. Xiao was required to disclose all sources of "Current and Pending Support." He omitted a 2017 award from a foreign institution that had a period of performance spanning 2018-2022. Dr. Xiao also failed to disclose his employment with a foreign institution which obligated him to fulfill certain teaching and research duties through 2023. Before making the NSF award, the agency asked whether Dr. Xiao had any support he would like to update, to include any "world-wide sources." Dr. Xiao indicated he had none despite submitting a proposal to a foreign funding agency in March 2019.

To effectuate his foreign activities, Dr. Xiao maintained at least one foreign bank account with a value of more than $10,000 during calendar year 2019. He did not file a Report of Foreign Bank and Financial Accounts with the US Treasury's Financial Crimes Enforcement Network. Additionally, on at least three tax returns, Dr. Xiao stated he had no financial interests or signature authority over a financial account located in a foreign country – statements that were false.

A criminal indictment was filed against Dr. Xiao on or about April 21, 2021, in the Southern District of Illinois. A superseding indictment was filed on or about October 5, 2021. The Government alleged Dr. Xiao committed: two counts Wire Fraud (18 USC § 1343), one count False Statement (18 USC § 1001(a)(1)), three counts False Statement on Tax Return (26 USC § 7206(1)), and one count Failure to File Foreign Bank Account (31 USC § 5513, 5322).

On or about May 5, 2022, a jury found Dr. Xiao guilty of the three counts of False Statement on Tax Return and one count Failure to File Foreign Bank Account. He was sentenced to one year of probation and approximately $1,000 in repayments.

WHAT WE RECOMMEND

Based on Dr. Xiao's history of behavior and criminal conviction, we recommend NSF issue a three-year debarment.

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Factual Background

Dr. Xiao was the Principal Investigator ("PI") on NSF award DMS-1854638 ("Award"), which was suspended as part of this investigation.[1] In April 2021, OIG received allegations that Dr. Xiao provided false statements to NSF by intentionally omitting information from the Award's Current and Pending Support document. The purpose of Dr. Xiao's false statements, submitted through Southern Illinois University at Carbondale ("SIUC"), was to have his proposal selected for award.

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

On November 15, 2021, associated with a separate OIG investigation, NSF made a finding of research misconduct regarding plagiarism against Dr. Xiao.[2] In that investigation, Dr. Xiao took responsibility for copying text he placed in two declined NSF proposals, but stated the information was either common knowledge or from online sources. NSF concluded his actions met the applicable definition of plagiarism as set forth in NSF regulations.

Related to Dr. Xiao's conduct on the Award, he was indicted on seven counts of criminal activity, including: Wire Fraud,[3] False Statements,[4,5] False Statements on Tax Returns,[6] and Failure to File Report of Foreign Bank Account.[7,8]

The case went to trial and Dr. Xiao was found guilty on three counts of False Statements on Tax Returns and one count of Failure to File Report of Foreign Bank Account.[9] On September 20, 2022, he was sentenced to one year of probation and payment of a $400 assessment and $600 fine.[10]

OIG Assessment

Grounds for Debarment

NSF has the authority to debar an individual whose lack of present responsibility is evidenced by one of the causes listed in 2 CFR 180.800. Two bases for this recommended debarment action exist - a "Conviction…for making false statements, tax evasion, [or] making false claims"[11] and "Any other cause of so serious or compelling a nature that it affects your present responsibility."[12]

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[1] Attachment 1 - Notice of Suspension of Award_SIUC
[2] Attachment 2 – Notice of Research Misconduct
[3] 18 USC § 1343
[4] 18 USC § 1001(a)(1)
[5] Attachment 3 – Indictment
[6] 26 USC § 7206(1)
[7] 31 USC § 5513, 5322
[8] Attachment 4 – Superseding Indictment
[9] Attachment 5 – Jury Verdict_Xiao
[10] Attachment 6 – Sentencing JE_Xiao
[11] 2 CFR 180.800(a)(3)
[12] 2 CFR 180.800(d)

Burden of Proof

"In any debarment action, the Federal agency must establish that there is cause for debarment by a preponderance of the evidence."[13] However, "if the proposed debarment is based upon a conviction or civil judgment, the standard of proof is met."[14]

Dr. Xiao has been convicted of tax offenses, including making false statements on his tax returns. These actions are those contemplated by the debarment regulations in 2 CFR 180.800(a)(3). The burden of proof has been met because the court, an independent trier of fact, has found Dr. Xiao guilty.

The second cause of action requires showing "Any other cause of so serious or compelling a nature that it affects your present responsibility."[15] The predicate facts of the conviction constitute a cause so serious or compelling a nature that it affects Dr. Xiao's present responsibility. Specifically, the facts of lying whether he had a financial interest or authority in a foreign bank account as well as failure to file his foreign bank account with Financial Crimes Enforcement Network is egregious behavior that is established by a preponderance of the evidence and is a sufficient cause for debarment.

Relevant Factors

The debarment regulation lists 19 factors for the debarring official to consider.[16] No factors that would mitigate Dr. Xiao's lack of present responsibility under these regulations are known to OIG; however, two aggravating factors exist.

1. Acceptance of Responsibility[17]

   Dr. Xiao has not accepted responsibility for his wrongdoing nor recognized the seriousness of the misconduct that led to the cause for debarment.

2. Repayment[18]

   Dr. Xiao was ordered to pay a special assessment and fine to the Government, but this amount does not go to or make the agency whole.

OIG Recommendation

We recommend Dr. Xiao be debarred for a period of three years, pursuant to 2 CFR 180.800(a)(3) and 2 CFR 180.800(d). The debarment recommendation under 2 CFR 180.800(a)(3) is based upon Dr. Xiao's

[13] 2 CFR 180.850; 2 CFR 180.855
[14] 2 CFR 180.850(b)
[15] 2 CFR 180.800(d)
[16] 2 CFR 180.860
[17] 2 CFR 180.860(g)
[18] 2 CFR 180.860(h)

conviction in the Southern District of Illinois for of False Statements on Tax Returns and Failure to File Report of Foreign Bank Account, while the recommendation under 2 CFR 180.800(d) is based on the underlying facts. Such a period of time is necessary to ensure federal funds are safeguarded.

Attachments

Attachment 1 – Notice of Suspension of Award_SIUC
Attachment 2 – Notice of Research Misconduct
Attachment 3 – Indictment
Attachment 4 – Superseding Indictment
Attachment 5 – Jury Verdict_Xiao
Attachment 6 – Sentencing JE_Xiao

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

May 4, 2021

[redacted]

Subject: Recommendation to Suspend NSF Award DMS-1854638 to Southern Illinois University at Carbondale (OIG Case I-21-0043-O)

Attached is our recommendation to suspend NSF award DMS-1854638 to Southern Illinois University at Carbondale. The award, *Study of Low Rank Approximation of Tensorial Data Set via Non-convex Regularization,* lists Dr. MingQing Xiao as the sole PI. $145,784 of the $151,099 award remains unexpended.

As set forth below, Dr. Xiao was indicted on April 21, 2021, on two counts of wire fraud and one count of making a false statement. It is alleged that Dr. Xiao fraudulently obtained grant funds from NSF by concealing support he was receiving from the Chinese government and from a Chinese university. Additionally, Dr. Xiao was placed on administrative leave following the indictment and the university has not notified NSF. To date, the university has not nominated an appropriate substitute PI. Based on our investigation to date, we recommend taking this action to protect NSF funds.

[redacted]

Recommendation to Suspend Award

OIG Case Number I-21-0043-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

May 4, 2021

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REPORT RELEASE RESTRICTION

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Introduction

We recommend that NSF suspend award DMS-1854638, entitled *Study of Low Rank Approximation of Tensorial Data Set via Non-convex Regularization,* made to Southern Illinois University at Carbondale. DMS-1854638 started on August 1, 2019 and expires on July 31, 2022. It was funded for $151,099 and, at present, approximately $145,000 remains unspent.

OIG Investigation

We learned that Dr. Xiao was indicted on April 21, 2021, on two counts of wire fraud and one count of making a false statement. It is alleged that Dr. Xiao fraudulently obtained grant funds from NSF by concealing support he was receiving from the Chinese government and from a Chinese university. The investigation that led to the indictment of Dr. Xiao was conducted by the FBI, the IRS, and the Department of Homeland Security. We have opened an investigation to further examine the conduct of Dr. Xiao and to address NSF equities in this matter.

To date, the university has not offered a substitute PI in DMS-1854638. In fact, we note that Dr. Xiao was placed on administrative leave following the indictment and the university has not notified NSF. To date, the university has not nominated an appropriate substitute PI.

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend award DMS-1854638 to protect NSF funds pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

Attachments

TAB 1 – Department of Justice, Office of Public Affairs Press Release [linked here]

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

National Science Foundation
Office of the Director

November 15, 2021

BY ELECTRONIC MAIL

MingQing Xiao, Ph.D.
[redacted]
Makanda, IL 62958
mxiao@siu.edu

Re: Notice of Research Misconduct and Letter of Reprimand

Dear Dr. Xiao:

This letter serves as formal notice that the National Science Foundation ("NSF") has made a finding of research misconduct pursuant to 45 C.F.R. Part 689. The basis for this finding is set forth in the attached Report of Investigation ("Report") of the NSF Office of the Inspector General ("OIG").

As a result of this finding, NSF is taking or imposing the following actions:

1. Issuance of a letter of reprimand. This letter documenting NSF's finding of research misconduct also serves as your letter of reprimand.

2. You must complete a comprehensive responsible conduct of research training course within one year from the date of this letter and provide documentation of the program's content. The instruction should be in an interactive format, such as a live (virtual) instructor-led course or workshop, and should include a discussion of plagiarism. All certifications and assurances should be submitted in writing to the following e-mail address: [redacted]

3. For a period of one year from the date of this letter, you are required to submit contemporaneous certifications that any proposals or reports you submit to NSF do not contain plagiarized, falsified, or fabricated material. All certifications and assurances should be submitted in writing to the following e-mail address: [redacted]

4. For a period of one year from the date of this letter, you are required to submit contemporaneous assurances by a responsible official of your employer that any proposals or reports you submit to NSF do not contain plagiarized, falsified, or fabricated material. All certifications and assurances should be submitted in writing to the following e-mail address: [redacted]

5. You are prohibited from serving as an NSF reviewer, advisor, or consultant for a period of one year from the date of this letter.

Research Misconduct

Under NSF's regulations, "research misconduct" is defined as "fabrication, falsification, or plagiarism in proposing or performing research funded by NSF …". 45 C.F.R. § 689.1(a). Plagiarism is defined as "the appropriation of another person's ideas, processes, results or words without giving appropriate credit." 45 C.F.R. § 689.1(a)(3). A finding of research misconduct further requires that:

> (1) There be a significant departure from accepted practices of the relevant research community; and
> (2) The research misconduct be committed intentionally, or knowingly, or recklessly; and
> (3) The allegation be proven by a preponderance of evidence.

45 C.F.R. § 689.2(c).

According to the OIG Report, as a faculty member at Southern Illinois University at Carbondale ("University"), you plagiarized approximately 99 lines of copied text and 1 embedded reference from 10 sources in two declined NSF proposals. You took full responsibility for the copying but stated that the text was either common knowledge or from online sources. You acknowledge that the text was not appropriately cited. Lastly, you attempted to argue that copying text was not as important as being accurate. Your admissions and the other information in the OIG Report permit me to conclude that your actions meet the applicable definition of plagiarism as set forth in NSF's regulations.

Pursuant to NSF's regulations, the Foundation must also determine whether to make a finding of misconduct based on a preponderance of the evidence. 45 C.F.R. § 689.2(c). Your use of materials without proper citation does not comport with accepted practices in your research community. The attempt to explain away the plagiarism by referring to a statement by a professional society is not persuasive. Even under the Mathematical Association of America's statement, quoting online sources would still require citations. Moreover, the University investigation showed proper citations in your published works but not in the proposals. We also note that the NSF Proposal and Award Policies and Procedures Guide ("PAPPG") is unambiguous about copying from other materials in proposals, stating:

> NSF expects strict adherence to the rules of proper scholarship and attribution. The responsibility for proper scholarship and attribution rests with the authors of a proposal; all parts of the proposal should be prepared with equal care for this concern.

PAPPG (NSF 16-1, 17-1), Chapter I.D.3. Failure to comply with the PAPPG for any parts of your proposal, including common or supporting material, is a significant deviation from accepted practices in your research community.

Turning to the issue of intent, you were aware that the proposals in question contained plagiarism but were concerned that citations to online sources would take up valuable space. You also stated that the copied text was common knowledge. However almost all of the copied text could be found only in the original source material. Thus, I conclude that your actions were knowing.

In sum, this information, as well as the other information in the OIG Report, permits me to conclude that the preponderance of evidence demonstrates that your plagiarism was (a) a significant departure from accepted research practices of your research community; and (b) committed knowingly. Therefore, I am issuing a finding of research misconduct against you.

NSF's regulations establish three categories of actions (Group I, II, and III) that can be taken in response to a finding of research misconduct. 45 C.F.R. § 689.3(a). Group I actions include issuing a letter of reprimand; conditioning awards on prior approval of particular activities from NSF; requiring that an institution or individual obtain special prior approval of particular activities from NSF; and requiring that an institutional representative certify as to the accuracy of reports or certifications of compliance with particular requirements. 45 C.F.R. § 689.3(a)(1). Group II actions include award suspension or restrictions on designated activities or expenditures; requiring special reviews of requests for funding; and requiring correction to the research record. 45 C.F.R. § 689.3(a)(2). Group III actions include suspension or termination of awards; prohibitions on participation as NSF reviewers, advisors or consultants; and debarment or suspension from participation in NSF programs. 45 C.F.R. § 689.3(a)(3).

In determining the severity of the action to impose for research misconduct, I have considered the seriousness of your misconduct as well as other relevant circumstances. 45 C.F.R. § 689.3(b). Based on these criteria, I have proposed the actions enumerated in paragraphs 1-5, above.

Appeal Procedures for Finding of Research Misconduct

Under NSF's regulations, you have 30 days after receipt of this letter to submit an appeal of this finding, in writing, to the Director of the Foundation. Any appeal of this finding should be addressed to the Director at the National Science Foundation, Attention: [redacted] At the present time there is limited access to the NSF building. Therefore, we ask that any correspondence related to this be sent electronically to [redacted]. For your information, we are attaching a copy of the applicable regulations.

Sincerely,

[redacted]

Attachments: OIG Report of Investigation
45 C.F.R. Part 689

[1] Any appeal of the finding of research misconduct should include a discussion of the mitigating factors listed at 45 C.F.R. § 689.3(b)(1)-(5).

Dr. Weiwei Deng
University of Central Florida
Virginia Tech

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

JUL 02 2018

[redacted]

Subject: Addendum to Recommendation to Suspend NSF Award CMMI-1549917 to Virginia Polytechnic Institute and State University (OIG Case No. I-18-0050-O)

I. Introduction

OIG recommends that NSF suspend award CMMI-1549917, entitled "CAREER: Scalable Electrospray Processing of High-Efficiency Perovskite Solar Cells," (the Award) made to Virginia Polytechnic Institute and State University (Virginia Tech). The Principal Investigator (PI) is Dr. Weiwei Deng. The Award, totaling $500,000, began August 1, 2015 and is expected to end July 31, 2020. The award was originally made to the University of Central Florida, but was transferred to Virginia Tech effective August 10, 2015. As of June 5, 2018, $164,642.58 in award funds have not yet been distributed.

OIG previously provided NSF a recommendation to suspend the Award on May 25, 2018. Since that date, OIG has obtained additional information for NSF's consideration in this matter.

II. Background and Factual Summary

OIG is investigating allegations that Dr. Deng is no longer employed at Virginia Tech despite still being listed as the PI on the Award. The website for the Southern University of Science and Technology (SUST) in China lists Dr. Deng as currently working at SUST beginning May 2017 and previously working at Virginia Tech from August 2015-May 2017. Dr. Deng's bio on the SUST website also referenced an "American CAREER Award," and as of the date of this memorandum, Dr. Deng is still the listed PI on the Award.

On April 27, 2018, OIG sent a subpoena to Virginia Tech for documentation, including "Employment contracts, term sheets, appointment letters or other documentation reflecting the terms and conditions of employment such as duties, positions, dates, pay, and time commitment, including percentages of employment" for Dr. Deng. OIG received responsive documentation from Virginia Tech on or about May 9 and 16, 2018. Included in this documentation was a Separation Notice for Dr. Deng indicating he was hired effective August 10, 2015 and separated

effective August 9, 2017 (See Tab 1). Also included in the initial production was a letter on Virginia Tech letterhead reflecting the same employment dates for Dr. Deng (See Tab 2). The employment change was not referenced in eJacket in either the Communications section or a Change in PI Request. It was on this information that OIG initially based its recommendation to suspend the Award, and on May 23, 2018, OIG informed the cognizant Program Officer via a telephone call that the suspension recommendation was pending as Dr. Deng had left Virginia Tech and was likely no longer residing in the United States. At that time, the cognizant Program Officer expressed surprise over Dr. Deng's departure, but did not provide additional details concerning Dr. Deng's status at the time of the call or afterwards. The suspension recommendation was then sent to NSF on May 25, 2018.

On June 1, 2018, OIG telephonically interviewed Dr. Deng, who stated he now works full-time for SUST in China. Dr. Deng stated he also is an unpaid adjunct professor at Virginia Tech and was given permission from the cognizant Program Officer to remain PI on the Award. OIG requested any written correspondence related to this permission, and Dr. Deng provided this information immediately following the interview. This information included an August 30, 2017 email from Dr. Deng to the cognizant Program Officer asking if Dr. Deng could remain as PI after leaving for a position in China and retaining adjunct status at Virginia Tech and the cognizant Program Officer's permission for this arrangement on August 31, 2017 (See Tab 3). Dr. Deng also provided OIG a letter dated September 18, 2017 on Virginia Tech letterhead offering Dr. Deng an Adjunct Professor position through "the end of Summer II semester 2020" (See Tab 4); the letter provided by Dr. Deng was *not* provided to OIG in response to the subpoena to Virginia Tech.

On June 4, 2018, OIG contacted Virginia Tech and informed the university that OIG received a letter concerning Dr. Deng's adjunct status that was not produced in response to the subpoena and requested additional responsive documents that were not initially produced. That day, Virginia Tech provided the same adjunct status letter that was provided to OIG by Dr. Deng (See Tab 5). OIG also requested that Virginia Tech provide written explanation as to whether adjunct positions were considered tenured or tenure-track. Virginia Tech confirmed adjunct positions are *not* considered tenured or tenure-track and provided the following quote from its Faculty Handbook: "Appointment to the rank of adjunct assistant, associate, or full professor is reserved for persons whose primary employment is with another agency, organization, or educational institution, or with a non-instructional unit of the university."

Solicitation NSF 14-532, under which the Award was submitted, states the following under "Additional Eligibility Info" for proposers:[1]

> "By October 1st following the deadline for submission of CAREER proposals:
>
> - Be employed in a tenure-track (or tenure-track-equivalent) position as an assistant professor (or equivalent title) at an accredited institution located in the U.S., its territories, or possessions, or the Commonwealth of Puerto Rico, that awards degrees in a field supported by NSF;
> OR

[1] See NSF 14-532, IV.A.

- Be employed in a tenure-track position (or tenure-track-equivalent position) as an assistant professor (or equivalent title) at an organization located in the U.S., its territories or possessions, or the Commonwealth of Puerto Rico, that is a non-profit, non-degree-granting organization such as a museum, observatory, or research lab.

Tenure-Track Equivalency - For a position to be considered a tenure-track-equivalent position, it must meet all of the following requirements: (1) the employing department or organization does not offer tenure-track positions to any new hires; (2) the employee is engaged in research in an area of science or engineering supported by NSF; (3) the employee has a continuing appointment that is expected to last the five years of the grant; (4) the appointment has substantial educational responsibilities; and (5) the proposed project relates to the employee's career goals and job responsibilities as well as to the goals of the department or organization. Note that PIs that are Associate Professors or in equivalent appointments, with or without tenure, are not eligible for the CAREER program.

NO EXEMPTIONS FROM THESE ELIGIBILITY CRITERIA WILL BE GRANTED." [emphasis in original]

Thus, after August 9, 2017, Dr. Deng was no longer an eligible PI for the Award.

III. Recommendation

Based on the information set forth above, OIG recommends that NSF suspend the Award pending OIG's investigation. In order to effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by July 27, 2018.

[redacted]

Attachments

Tab 1: Separation Notice for Dr. Deng
Tab 2: Employment Dates Letter for Dr. Deng
Tab 3: Email Correspondence Between Dr. Deng and Cognizant Program Officer
Tab 4: Adjunct Status Letter (From Dr. Deng)
Tab 5: Adjunct Status Letter (From Virginia Tech)

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OCT 3 1 2018

[redacted]

Subject: Recommendation to Terminate NSF Award CMMI-1549917 to Virginia Polytechnic Institute and State University (OIG Case No. I-18-0050-O)

I. Introduction

OIG recommends that NSF terminate award CMMI-1549917, entitled "CAREER: Scalable Electrospray Processing of High-Efficiency Perovskite Solar Cells," (the Award) made to Virginia Polytechnic Institute and State University (Virginia Tech). The Principal Investigator (PI) is Dr. Weiwei Deng. The Award, totaling $500,000, was effective August 1, 2015 and is expected to end July 31, 2020. The award was originally made to the University of Central Florida but was transferred to Virginia Tech effective August 10, 2015. As of the date of this memorandum, $153,633.70 in award funds have not yet been distributed.

NSF suspended the Award effective July 16, 2018 in response to a previous recommendation.

II. Background and Factual Summary

OIG is investigating allegations that Dr. Deng is no longer employed at Virginia Tech despite still being listed as the PI on the Award. The website for the Southern University of Science and Technology (SUST) in China lists Dr. Deng as currently working at SUST beginning May 2017 and previously working at Virginia Tech from August 2015-May 2017. Dr. Deng's bio on the SUST website also referenced an "American CAREER Award," and as of the date of this memorandum, Dr. Deng is still the listed PI on the Award.

OIG determined from Virginia Tech that Dr. Deng was hired effective August 10, 2015 and separated effective August 9, 2017. OIG also learned from Dr. Deng that on August 30, 2017, Dr. Deng emailed the cognizant NSF Program Officer asking if Dr. Deng could remain as PI after leaving for a position in China and retaining adjunct status at Virginia Tech, and the cognizant Program Officer gave permission for this arrangement on August 31, 2017. Dr. Deng also provided OIG a letter dated September 18, 2017 on Virginia Tech letterhead offering Dr. Deng an Adjunct Professor position through "the end of Summer II semester 2020." OIG confirmed with Virginia Tech that adjunct positions are *not* considered tenured or tenure-track.

Solicitation NSF 14-532, under which the Award was submitted, states the following under "Additional Eligibility Info" for proposers:[1]

> "By October 1st following the deadline for submission of CAREER proposals:
>
> - Be employed in a tenure-track (or tenure-track-equivalent) position as an assistant professor (or equivalent title) at an accredited institution located in the U.S., its territories, or possessions, or the Commonwealth of Puerto Rico, that awards degrees in a field supported by NSF;
> OR
> - Be employed in a tenure-track position (or tenure-track-equivalent position) as an assistant professor (or equivalent title) at an organization located in the U.S., its territories or possessions, or the Commonwealth of Puerto Rico, that is a non-profit, non-degree-granting organization such as a museum, observatory, or research lab.
>
> ***Tenure-Track Equivalency*** - For a position to be considered a tenure-track-equivalent position, it must meet all of the following requirements: (1) the employing department or organization does not offer tenure-track positions to any new hires; (2) the employee is engaged in research in an area of science or engineering supported by NSF; (3) the employee has a continuing appointment that is expected to last the five years of the grant; (4) the appointment has substantial educational responsibilities; and (5) the proposed project relates to the employee's career goals and job responsibilities as well as to the goals of the department or organization. Note that PIs that are Associate Professors or in equivalent appointments, with or without tenure, are not eligible for the CAREER program.
>
> **NO EXEMPTIONS FROM THESE ELIGIBILITY CRITERIA WILL BE GRANTED."** [emphasis in original]

Solicitation NSF 14-532 also notes that a "CAREER award must be relinquished if the principal investigator transfers at any time prior to or during the award period to a position that is not either tenured, tenure-track, or tenure-track equivalent; and/or the new organization is not CAREER-eligible." In these circumstances, transfer of the CAREER award to a substitute PI is not permissible.

Furthermore, the document "Frequently Asked Questions for the Faculty Early Career Development (CAREER) Program for Submission in Years 2015 and 2016" states that a CAREER award "must be relinquished if the PI transfers at any time prior to or during the award period … to a university or college outside the U.S.… In these circumstances transfer of the CAREER award to a substitute PI is not permissible."

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[1] See NSF 14-532, IV.A.

Thus, after August 9, 2017, Dr. Deng was no longer an eligible PI for the Award. Additionally, because the purpose of the CAREER Award was to support Dr. Deng's professional development, and Dr. Deng is no longer in a tenure or tenure-track position at Virginia Tech, replacing the PI would not be consistent with the goals and policies underlying the CAREER award program.

III. Recommendation

Based on the information set forth above, OIG recommends that NSF terminate the Award. In order to effectively pursue this matter, it would be helpful to be cc'd on any actions taken in response to this memorandum by November 21, 2018.

[redacted]

[redacted]

VIRGINIA TECH

Weiwei Deng [redacted]

About Award ID 1549917

[redacted]

Thu, Aug 31, 2017 at 12:37 AM

[redacted]

Weiwei,

I have no objection to having the CAREER award continue at VT, while you take the new faculty position in China.

I am assuming your Adjunct Faculty position at VT will be official so you can remain the official NSF PI on the CAREER project. Make sure you will be able to do your CAREER research, research education integration and outreach without any problems.

It is important that your progress is smooth and that your students are tended to.

Regards.

[redacted]

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard, [redacted] Arlington, VA 22230, USA | www.nsf.gov

[redacted]

From: Weiwei Deng [redacted]
Sent: Wednesday, August 30, 2017 8:31 AM
To: [redacted]
Subject: About Award ID 1549917

Dear [redacted]

How are you? Recently I decided to take an academic job opportunity in China, but I will remain as Adjunct Faculty and can serve as a PI at Virginia Tech. Two Ph.D. students [redacted] were being supported by the CAREER award (1549917). They have made exciting progress toward electrospray printing of perovskite solar cells (see for example the report slides I sent to you and [redacted] previously). They are about only one to two years till their graduation, and they don't want to switch project or advisor. Is it possible I remain as the PI of the grant so the it can support the two students till they graduate? I personally will not draw any salary from the grant. I will travel to VT about once every two months and advise their project through video conference. Thank you very much for your consideration.

Best regards,

Weiwei

[redacted]

Dr. Alex Liu
Michigan State University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, VA 22314

JAN 06 2020

[redacted]

Subject: Recommendation to Suspend NSF Award CNS-1837146 to Michigan State University (OIG Case No. I-19-0076-O)

Introduction

We recommend that NSF suspend NSF award CNS-1837146 entitled "CPS: Small: Mechanical Vibration Based Prognostic Monitoring of Machinery Health with Sub-Millisecond Accuracy Using Backscatter Signals" (the Award), made to Michigan State University (MSU). The Award was funded for $499,998, and $418,906.93 remains unexpended. The Award period began January 1, 2019 and ends December 31, 2021.

As set forth below, we learned that Dr. Alex Liu, the Principal Investigator (PI) on the Award, is no longer employed at MSU. A review of eJacket to date, as of December 17, 2019, shows no record that MSU has notified NSF of Dr. Liu's departure. Furthermore, we obtained information that Dr. Liu submitted fraudulent travel and supply purchase reimbursements to MSU for expenses charged to several NSF awards.

OIG Investigation

We opened an investigation into allegations that Dr. Liu submitted fraudulent reimbursement requests to MSU for expenses incurred on multiple NSF awards spanning the past seven years. A preliminary investigation has identified potential misuse of NSF funds totaling more than $35,000. In some instances, Dr. Liu had submitted reimbursement for items that he claimed to have purchased for research purposes but had returned and received refunds prior to submitting the reimbursement requests to MSU. MSU then charged these expenses to NSF awards. NSF award CNS-1837146 is the only NSF award currently active in which Dr. Liu is the PI.

We also learned that when Dr. Liu was interviewed by Federal law enforcement officers in October 2019, he stated that he had resigned from MSU and was currently employed as a computer scientist in a foreign country. A review of eJacket shows no record that MSU notified NSF of Dr. Liu's departure, as required by the Proposal & Award Policies and Procedures Guide.

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend the Award pending completion of our investigation. It would be helpful to be copied on any actions taken in response to this memorandum by January 27, 2020.

[redacted]

[redacted]

Dr. Tao Li
University of Florida

U.S. NATIONAL SCIENCE FOUNDATION
Office of Inspector General

MEMORANDUM

DATE: March 13, 2025

TO: [redacted]

FROM:

SUBJECT: Recommendation for Governmentwide Debarment (OIG Case I-19-0023-O)

Attached is our Report of Investigation concerning Dr. Tao Li's duplicate proposal submitted to NSF, which was already funded by a Chinese funding agency in Hong Kong. It also addresses Li's false statements related to his positions as a Chinese Dragon Star Plan presenter and Changjiang Scholar while he was an NSF Intergovernmental Personnel Act (IPA) Program Officer (PO) assigned to the Computer and Information Science and Engineering directorate and a Principal Investigator on numerous NSF awards. Furthermore, it discusses research misconduct findings related to his submission of fabricated research results to a professional society, and how he leveraged his position as an NSF PO in a quid pro quo relationship.

To safeguard federal funds, we recommend NSF debar Li for three years. We also recommend that NSF ban Li from serving as an NSF reviewer, panelist, or IPA for three years. The report describes the basis for our recommendation in detail.

We have on file the following contact information for the subject:

Tao Li, Ph.D.
[redacted]

[redacted]

Recommendation for Governmentwide Debarment

OIG Case Number I-19-0023-O

U.S. NATIONAL SCIENCE FOUNDATION
Office of Inspector General

March 12, 2025

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This report contains protected personal information, the unauthorized disclosure of which may result in personal criminal liability under the Privacy Act, 5 U.S.C. § 552a. This report will only be disclosed outside NSF if such disclosure is required or consistent with standards allowing disclosure under the Freedom of Information and Privacy Acts, 5 U.S.C. §§ 552 & 552a. This report may be further disclosed within NSF only to individuals who must have knowledge of its contents to facilitate NSF's assessment and resolution of this matter. Please take appropriate precautions handling this report.

At a Glance

Recommendation for Governmentwide Debarment
OIG Case Number I-19-0023-O | March 12, 2025

WHAT WE FOUND

We initiated this investigation upon receipt of information alleging Dr. Tao Li was involved in the People's Republic of China Dragon Star Plan from 2012 to 2016. Li was an NSF Intergovernmental Personnel Act (IPA) Program Officer (PO) from 2015 to 2017, where he was on detail from the University of Florida (UF). Since 2010, Li has been a Principal Investigator (PI) or Co-PI on 15 NSF awards totaling approximately $4.9 million.[1]

Our investigation uncovered a duplicate proposal Li caused UF to submit to NSF, which the Research Grants Council - General Research Fund of Hong Kong already funded. Li also leveraged his position as an NSF PO in a quid pro quo relationship and fabricated research results. This fabrication played a role in the death of his mentee and graduate student. Li was banned for 15 years from participating and publishing with a professional organization. He also failed to cooperate with investigators and destroyed evidence. Amid UF's investigation, Li transferred nearly all his assets to his spouse, divorced, and departed to China. Our findings and the timeline of our investigation are detailed in this report.

UF placed Li on administrative leave on February 15, 2021. On April 23, 2021, NSF and UF mutually terminated three of Li's NSF awards. On April 24, 2021, Li departed the United States outbound to China. He resigned from his position at UF on May 15, 2021, while he was under investigation by UF.

WHAT WE RECOMMEND

We recommend that NSF debar Li for three years to ensure federal funds are safeguarded. We also recommend that NSF ban Li from serving as a peer reviewer, advisor, or consultant for NSF for three years.

CONTACT

[redacted]

[1] This amount does not include any award supplements with different NSF proposal numbers.

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Factual Background

Dr. Tao Li was an Intergovernmental Personnel Act (IPA)[2] Program Officer (PO) assigned to NSF Computer and Information Science and Engineering (CISE), Computing and Communication Foundations (CCF) from 2015 to 2017. As a PO, Li was responsible for the long-range planning and budget development for CISE; managing a timely merit review, award and declination process; advising the community of current and future funding opportunities; and assisting the CISE Director.[3]

During his time in the IPA program, Li was on detail from his position as a professor in the Department of Electrical and Computer Engineering at the University of Florida (UF) and had three active NSF awards: 1822459, 1822989 and 1900713. UF placed Li on administrative leave on February 15, 2021.[4] On April 24, 2021, Li departed the United States outbound to China and resigned from his position at UF on May 15, 2021, while he was under active investigation by UF.

OIG Investigation

This case was initiated when we received information from the Federal Bureau of Investigation (FBI) related to Li's involvement in the People's Republic of China (PRC) Dragon Star Plan (DSP)[5] as a course presenter from 2012 to 2016, which included a teaching role at Chongqing University.[6]

During the investigation, we issued subpoenas, executed search warrants, conducted open-source research, conducted database searches, reviewed Li's travel, and conducted interviews. This revealed the extent of Li's engagement with foreign entities and his failure to disclose them to NSF.

Our investigation found that UF submitted NSF proposal 1822459 for which Li was the PI. The proposal was materially identical to one already funded by the Research Grants Council (RGC) - General Research Fund (GRF) of Hong Kong. Li did not disclose his previously funded foreign grant as required by the Proposal and Award Policies and Procedures Guide (PAPPG). We also discovered evidence that Li maintained positions with the DSP from 2012 to 2016 and as a Changjiang Scholar in 2017, which he did not disclose on his NSF grant proposals, his OGE-450s, or his IPA activities plans and annual reports.

Li also leveraged his position as an NSF PO in a quid pro quo relationship. Evidence suggests he offered his influence to award NSF funds in exchange for reviewers to support the publication of papers he submitted to an international symposium in 2016-2017.

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[2] Attachment 1– Li - IPA Award Summary
[3] Attachment 2 – Li Tao Sabbatical Packet
[4] Attachment 3 – March 2, 2021, Email re Li on Administrative Leave
[5] https://www.uscc.gov/research/overseas-chinese-students-and-scholars-chinas-drive-innovation
[6] Attachment 4 – DSP - Li is sponsored by Chongqing University (English embedded in comments)

Additionally, UF investigated Li for his role in the suicide of his doctoral student with whom he worked on a paper submitted to a 2019 international symposium sponsored by the Association for Computing Machinery (ACM) that contained falsified data. The UF investigative committee found that Li knowingly and intentionally fabricated research results in the 2019 Paper. In another investigation, UF found that Li lied about a Dropbox account he used to share files with his students and deleted many documents in the months following the suicide, which he refused to restore.

In an investigation related to the 2019 Paper, ACM found that Li violated their code of ethics when he attempted to impede their investigation, breached ACM publication policies, displayed a significant lack of candor, and failed to take responsibility for these actions. Li was banned from ACM participation for 15 years and the paper was retracted, among other sanctions.

Duplicate Proposal

Li began as an NSF PO on August 24, 2015.[7] While in his position as a PO, on November 8, 2016, Li wrote a Letter of Support on UF letterhead for Dr [redacted] proposal to the RGC of Hong Kong, proposal number 15206617.[8] [redacted] was a researcher at the Hong Kong Polytechnic University. On June 30, 2017, [redacted] emailed Li stating, "Hi big brother, This year's GRF result has been formally announced." The email included award details for the project titled "Leveraging the Interplay of RAID and SSD for Lifetime and Reconstruction Optimization of Flash-based SSD RAID Array for Cloud and Big Data Workloads."[9] Li was identified as the Co-Investigator on the RGC-GRF proposal.[10] The approved project duration was 36 months.[11] On December 23, 2017, Li's NSF IPA ended, and he returned to UF as a professor.

Eleven days later, on January 3, 2018, Li submitted NSF proposal 1822459, "EAGER: Leveraging the Interplay of RAID and SSD for Lifetime and Reconstruction Optimization of Flash-based SSD RAID Array for Cloud and Big Data Workloads," which was awarded.[12] Portions of the NSF proposal, including much of the Project Summary and Project Description, were identical to the proposal funded by the RGC-GRF in June 2017, which Li did not disclose to NSF as required in the PAPPG.[13] We confirmed the proposal was a duplicate in an October 2022 interview with NSF CISE PO Dr. Erik Brunvand, who stated the proposals appeared to be "extremely similar to the point of being essentially identical," and while there were minor differences in the introduction section, Section 2 of the proposal was "100% the same" as the foreign award."[14]

[7] Attachment 1 – Li - IPA Award Summary
[8] Attachment 5 – Li Letter of Support (Excerpt from GRF info_pdf)
[9] Attachment 6 – Email from [redacted] - GRF info
[10] Attachment 7 – RGC GRF Proposal 15206617, p. 29
[11] Attachment 6 – Email from [redacted] - GRF info,p. 25-26; Attachment 8 – GRF-2017-18-ZIII.pdf, p. 2
[12] Attachment 9 – 1822459 Entire Proposal
[13] [https://www.nsf.gov/pubs/policydocs/pappg17_1/index.jsp], Chapter II.C.2.h, Current & Pending Support; Chapter II.C.2.f, Biographical Sketch; Chapter II.C.1.e, Collaborators and Other Affiliations
[14] The interview transcript is maintained by OIG and may be reviewed as necessary by NSF Management.

He also noted if NSF knew that the RGC-GRF previously funded the same proposal, NSF would "absolutely not" have awarded 1822459. Award 1822459 began on May 1, 2018, and was mutually terminated on April 30, 2021, after Li departed the United States. However, $299,584 of the awarded $300,000 was spent.[15]

Notably, Li's publications relevant to this NSF award failed to acknowledge NSF support as required by the PAPPG.[16] However, his publications did acknowledge funding from the nearly identical RGC-GRF award.[17] A review of the NSF Public Access Repository (PAR) failed to return any publications associated with NSF Award 1822459.[18]

In October 2023, we requested an NSF expert, Dr. Jason Hallstrom, review the two proposals, Li's relevant publications, and presentations Li listed in his annual project reports submitted to NSF, which Li reported were the resulting effort of his NSF award. Hallstrom opined:

> There is evidence that ***shows*** that some of the work documented in the annual report was completed prior to the submission of the proposal. There is evidence that ***suggests*** that the core work proposed was initiated prior to the submission of the proposal. There is evidence that ***shows*** that the publications listed in both reports are not directly connected to the work proposed, while the PI was engaged in the work proposed, as documented through publications that were not included in the reports. There is evidence that ***shows*** that the vast majority of publications failed to properly acknowledge NSF support, despite the careful documentation of foreign sources of support. It is my ***opinion*** that these publications were added as padding and that the two most important publications were intentionally omitted from the various documents submitted to the NSF.[19]

Conflicts of Interest

As a member of the IPA program, Li was required to submit an OGE Form 450 (OGE-450), Confidential Financial Disclosure Report, which he did on three occasions during his IPA assignment.[20] Parts I and III required him to disclose any paid outside programs or positions. If the position was voluntary (unpaid), Li was required to disclose it in Part III of the form. Li did not disclose his position with DSP (sponsored by Chongqing University) or as a Changjiang Scholar Chair Professor participant in his 2015, 2016, and 2017 OGE 450 submissions.[21]

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[15] Attachment 10 – Grant Letter_1822459 Amd 001 Termination

[16] [https://www.nsf.gov/pubs/policydocs/pappg17_1/index.jsp], Chapter XI.E.4. Grantee Obligations

[17] Attachment 11- Publications Acknowledging RGC-GRF Award, pp. 10, 12, 26

[18] [https://www.nsf.gov/pubs/policydocs/pappg17_1/index.jsp], Chapter XI.D.2.c, Public Access to Copyrighted Material; Chapter XI.E.4. Grantee Obligations; [https://par.nsf.gov/search/award_ids:1822459]

[19] Attachment 12 – Dr. Hallstrom's Analysis, p. 4. Bold and italics were included in the original document.

[20] Attachment 13 – Li - OGE 450_2015-2017

[21] Attachment 13 – Li - OGE 450_2015-2017; Attachment 14 – Li 2017 Changjiang Scholar announcement (English embedded in comments)

Additionally, he did not disclose these affiliations in his NSF proposals for 1822459, 1822989, or 1900713. Open-source research revealed that Changjiang Scholar Chair Professor recipients are awarded research funding of 30,000 Yuan per month for three years.[22]

As a benefit, NSF permits IPAs with approved Independent Research and Development (IRD) Activities plans to maintain their involvement with their professional research while assigned to NSF. Li took advantage of the IRD benefit and was required to submit an IRD Activities Plan describing his planned activity for the upcoming year. He was also required to submit an annual report of IRD accomplishments upon completion of each year. During our review of these documents, we found issues of concern.

On his IRD Activities Plans, Section 7, Li indicated "No" when asked if he would combine personal days with IRD days for each year.[23] However, an analysis of his international travel revealed that during Li's time as an IPA, (August 24, 2015 – December 23, 2017), Li was outside of the United States for 265 days. This included at least 18 trips to China, only two of which he reported to NSF in his IPA annual reports. During these trips, evidence indicates Li provided lectures at Chinese universities outside his approved IRD activity. For example:

- January 12, 2016 - Li presented at the National High Performance Computing Center, Shenzen, China.[24]
- May 4, 2016 - Li presented at Chongqing University, Chongqing, China.[25]
- August 8-12, 2016 - Li taught a course at Sichuan University, Sichuan, China.[26]
- December 5, 2016 - Li presented at the Chinese Computing Foundation, Chongqing, China.[27]
- April 10, 2017 – Li presented at the ISN Key Laboratory of Xidian University, Xi'an, China.[28]
    - Li claimed on his IRD annual report that he attended the ACM ASPLOS conference from April 8-12, 2017.[29]
- October 2017 - Li presented at the China National Computer Congress, China Computer Conference, Fujian, China.[30]

Li did not report these engagements in his IRD Activities Plans or annual reports.

Also, in Section 7, Li indicated "No" when asked if he held an office or position with a foreign government or an entity of a foreign government, including service on a committee or as an

[22] Attachment 15 – 2017 Changjiang Scholars Program – announcement
[23] Attachment 16 – IRD Activities Plan 2016-2017; Attachment 17 – IRD Annual Reports - Statements of Accomplishment 2015-2017
[24] Attachment 18 – 2016 Jan 12_National High Performance Computing Center Shenzhen Branch
[25] Attachment 19 – 2016 May 4_Li presents at Chongqing Univ, p. 2
[26] Attachment 20 – 2016 Aug 8-12 Course Schedule-DSP Course CCF Sichuan Univ, p. 1
[27] Attachment 21 – 2016 Dec 5_Li presents at CCF YOCSEF Chongqing, pp. 2, 4-5
[28] Attachment 22 - 2017 Apr 10_Li presents at Xidian Univ, pp. 12-15
[29] Attachment 17 – IRD Annual Reports - Statements of Accomplishment 2015-2017
[30] Attachment 23 – 2017 Oct_Li presents at CNCC2017 China Computer Conference, pp. 2, 4

advisor. Li did not disclose his involvement with the DSP as a course presenter in any IRD plan or annual report from 2015 to 2017.[31] Our investigation also revealed Li was a Changjiang Scholar in the Chair Professor category in 2017.[32]

Li also skipped 'Section 9' in his 2016 and 2017 IRD Activities Plans. Section 9 lists activities prohibited as part of the IRD plan, which may or may not be allowed outside the IRD Plan. It asked Li to confirm that he would not participate in these activities while on an IRD. For example, "No Teaching" and "No preparation of new proposals, including proposals to other Federal agencies." Our investigation revealed that Li and Dr. [redacted] submitted a proposal to the RGC-GRF of Hong Kong,[33] sometime between November 2016 and June 30, 2017, when it was awarded.[34] Also, Li reported on his IRD Annual Report for 2016-2017 that he attended the 22nd ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS-2017), April 8–12, 2017, Xi'an, China. However, evidence shows Li taught at Xidian University on April 10, 2017. He also taught at Sichuan University from August 8-12, 2016, although not in conjunction with an IRD trip.[35]

Moreover, Section 10 of the IRD Activities Plan, entitled "Organizational Involvement," is used to identify existing and new conflicts of interest that the IPA may have because of the IRD plan. It asked for organizational involvement, including collaborations with researchers and staff at other organizations and institutions. In both of Li's plans for 2016 and 2017, he indicated that his only organizational involvement was with his home institution, UF. As previously noted, Li had a position as a DSP presenter and was identified as a Changjiang Scholar at Central South University in China in 2017.[36]

Li's Mentee and Graduate Student Commits Suicide

In June 2019, Li's graduate student, [redacted] was found deceased in a UF laboratory in the Department of Electrical and Computer Engineering.[37] In [redacted]'s suicide note, he accused Li of forcing him to fabricate/falsify data in a conference paper submitted to the International Symposium on Computer Architecture (ISCA) in 2019 (2019 Paper), which acknowledged six NSF awards.[38] UF conducted an investigation[39] in which they reviewed documents and correspondence, including chat messages between [redacted] and [redacted]'s girlfriend [redacted] and Li,

[31] Attachments 16 – IRD Activities Plan 2016-2017; Attachment 17 – IRD Annual Reports - Statements of Accomplishment 2015-2017
[32] Attachment 14 – Li 2017 Changjiang Scholar announcement (English embedded in comments); Attachment 15 – 2017 Changjiang Scholars Program – announcement
[33] Attachment 6 – Email from [redacted] - GRF info, p. 25-26; Attachment 7; Attachment 8, p. 1
[34] Attachment 6 – Email from [redacted] - GRF info
[35] Attachment 20 – 2016 Aug 8-12 Course Schedule-DSP Course CCF Sichuan Univ
[36] Attachment 4 – DSP - Li is sponsored by Chongqing University (English embedded in comments); Attachment 7 – RGC GRF Proposal 15206617; Attachment 14 – Li 2017 Changjiang Scholar announcement (English embedded in comments)
[37] Attachment 24 - UF grad student family files claim against university after suicide
[38] Attachment 25 – UF Inquiry Report 12.19.2019, pp. 21-22, 45
[39] Attachment 26 – University Investigation Report

and between [redacted] and [redacted], a co-author of the 2019 Paper. The texts demonstrated that [redacted] wished to withdraw the paper, and [redacted] requested removal from the author list.[40] [redacted] texted, "It would damage my reputation" and "[i]f I can't fix it, I'll make a fool of myself."[41] In a text message to his girlfriend, [redacted] wrote, "[h]e forced me to make fakery if I failed to submit it before the deadline."[42] He also wrote, "[i]f I ruin his reputation, he will kill me."[43]

Based on a preponderance of the evidence, the investigation committee found that Li knowingly and intentionally fabricated research results by omitting data in the 2019 Paper and committed research misconduct.[44] Li lacked candor and was unwilling to participate in UF's investigative process.[45] Additionally, the committee believed that he colluded with reviewers to subvert the review process as part of a pattern of manipulation.[46] The 2019 Paper was available in the ACM Digital Library for over 1.5 years before it was retracted.[47]

A second UF investigation found that Li destroyed documents and used communication services that UF did not approve. Emails discovered during the investigation showed Li deleted 2,285 files from his personal Dropbox on June 27, 2019, eleven days after [redacted]'s death. Li deleted an additional 4,209 files on July 5, 2019, the same day he met with UF's Assistant Research Integrity Officer (ARIO) and was asked about his use of Dropbox.[48] UF asked Li to restore the files, including one titled, "NSF-CNS-Nov-5.doc and 4,031 files," but he did not.[49] UF found the timing of the deletions suspicious.[50]

Other Actions

The Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) together formed a Joint Investigative Committee (JIC) which investigated Li for violations of ACM's publication policies associated with the 2019 Paper.

When Li was "interviewed and presented with clear evidence of wrongdoing, [he] displayed a significant lack of candor and failed to take responsibility for [his] actions."[51] The JIC and ACM Publications Board viewed his behavior as an attempt to impede the investigation, violating

[40] Attachment 26 – University Investigation Report, pp. 13-14
[41] Attachment 26 – University Investigation Report, p. 10
[42] Attachment 26 – University Investigation Report, p. 16
[43] Attachment 25 – UF Inquiry Report 12.19.2019, p. 33
[44] Attachment 26 – University Investigation Report, p. 26
[45] Attachment 26 – University Investigation Report, p. 21
[46] Attachment 26 – University Investigation Report, pp. 26-27
[47] Attachment 26 – University Investigation Report, pp. 26-27
[48] Attachment 27 – Eml-005 Respondent email regarding Dropbox
[49] Attachment 28 – Eml-006 Respondent email regarding Dropbox; Attachment 29 – Eml-007 Respondent email regarding Dropbox
[50] Attachment 26 – University Investigation Report, p. 21
[51] Attachment 30 – 2020.11.19 Tao Li Decision Letter, p. 2

ACM's Code of Ethics.[52] The investigation determined that there was clear and convincing evidence that Li repeatedly breached ACM publication policies.[53] Specifically, the investigation determined that Li:[54]

- Repeatedly violated ACM publications policies requiring the anonymity and independence of reviews in connection with the submission of the paper entitled "3D-based video recognition acceleration by leveraging temporal locality" (the 2019 Paper) to ISCA in 2019;
- Submitted to the ISCA the 2019 Paper for publication while knowing it contained incorrect and/or falsified results;
- Violated ACM's publications policy on coercion in publications in connection with the 2019 Paper; and,
- Breached ACM's confidentiality policies in connection with the ASPLOS 2017 conference by sharing access to confidential materials with individuals who were not entitled to access these materials.

In November 2020, ACM imposed the following:[55]

- A 15-year ban from Li publishing in any ACM venue -- conference, journal, magazine, newsletter, or book;
- A 15-year ban from Li serving as a reviewer for any ACM publication or conference;
- A 15-year ban from Li serving as a program committee member, editor, or in any position where he may influence the selection or review of papers submitted to any ACM;
- Retraction of the 2019 Paper from the ACM Digital Library with an annotation that the Paper was knowingly submitted with incorrect results and a requirement that Li should not list the 2019 Paper as a published paper; and,
- Li was expected to write a letter of apology to the program committee chairs of ISCA 2019, SIGMETRICS 2018, and ASPLOS 2017, including an admission of wrong-doing, and provide copies of these letters to ACM's Director of Publications within six weeks of his penalty period beginning.

Further, there is evidence that Li leveraged his position as an NSF PO in a quid pro quo relationship. Evidence suggested he offered his influence to award an NSF grant in exchange for a program committee member to support his papers submitted to the International Symposium on High-Performance Computing Architecture (HPCA) in 2016-2017. Li contacted four program committee members and requested they support his papers, telling them which papers were his, subverting the blind review process.[56] One of those committee members was [redacted] a faculty member at the University of Texas, San Antonio. [redacted] submitted proposal 1652655 to NSF on July 20, 2016. On August 4, 2016, Li started an email

[52] Attachment 30 – 2020.11.19 Tao Li Decision Letter, p. 1
[53] Attachment 30 – 2020.11.19 Tao Li Decision Letter, p. 1
[54] Attachment 30 – 2020.11.19 Tao Li Decision Letter, p. 1
[55] Attachment 30 – 2020.11.19 Tao Li Decision Letter, p. 1
[56] Attachment 31- Li contacts program committee members HPCA 2017

exchange with [redacted] and asked [redacted] if he had his papers, "HPCA #38, #44, and #102".[57] On October 4, 2016, Li told [redacted] that his "CAREER proposal did well in the panel" and that he would "hear about the positive news within 1-2 months. Please keep this confidential until the official email comes from NSF."[58] Li continued, "BTW, HPCA #102 is mine," and asked for [redacted]s support during voting.[59] On October 4, 2016, [redacted] responded, "Thanks a lot. I will keep that in mind."[60] On October 10, 2016, Li asked [redacted] to recommend HPCA #44 for "the best paper award."[61] On January 24, 2017, Li told Muzahid, "After long holding and fighting for your CAREER proposal, I have good news for you. It looks like I can fund your proposal. Wait for the official email for the next step."[62] On April 16, 2017, NSF funded CAREER award 1652655, under the direction of [redacted], with Li as the cognizant program officer.[63] One of Li's HPCA papers, "Towards Pervasive and User Satisfactory CNN across GPU Microarchitectures," was nominated for best paper that year.[64]

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

The case was referred to the criminal division of the United States Attorney's Office and, on October 17, 2024, was ultimately declined for criminal prosecution. On January 15, 2025, we presented the case to the civil division of the United States Attorney's Office for the Southern District of Florida for consideration.

The investigation is ongoing.

OIG Assessment

Grounds for Debarment

NSF may debar a person[65] for the reasons listed in 2 C.F.R. §180.800(a), -(b), -(c), or -(d), such as:

- Commission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public or private agreement or transaction (2 C.F.R. § 180.800(a)(1));

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[57] Attachment 32 – Li email exchange with [redacted], p. 1
[58] Attachment 32 – Li email exchange with [redacted], p. 3
[59] Attachment 32 – Li email exchange with [redacted] p. 3
[60] Attachment 32 – Li email exchange with [redacted] p. 6
[61] Attachment 32 – Li email exchange with [redacted] p. 4
[62] Attachment 32 – Li email exchange with [redacted] p. 5
[63] Attachment 33 – Grant_Letter_1652655
[64] Attachment 34 – HPCA2017 Papers - Table_of_contents
[65] 2 C.F.R. § 180.985 defines "person" as any individual, corporation, partnership, association, unit of government, or legal entity, however organized.

- Commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, receiving stolen property, making false claims, or obstruction of justice (2 C.F.R. § 180.800(a)(3));
- Commission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects the subject's present responsibility (2 C.F.R. § 180.800(a)(4)); or
- Violation of the terms of a public agreement or transaction so serious as to affect the integrity of an agency program, such as a willful violation of a statutory or regulatory provision or requirement applicable to a public agreement or transaction (2 C.F.R. § 180.800(b)(3)).

NSF may also debar a person for any other cause so serious or compelling in nature that it affects the subject's present responsibility.[66]

Burden of Proof

In any debarment action, the federal agency must establish that there is cause for debarment by a preponderance of the evidence.[67] However, if the proposed debarment is based upon a conviction or civil judgment, the standard of proof is met.[68]

Relevant Factors

The debarment regulation lists 19 factors that the debarring official may consider when determining whether to impose debarment and the length of the debarment period. The following factors are pertinent to this case:

1. Actual or Potential Harm or Impact (2 C.F.R. § 180.860(a))

Li was well-versed in NSF's requirements for disclosing other funding sources and affiliations as a former NSF PO. However, he caused UF to submit a proposal to NSF that was previously funded by a foreign entity, which resulted in NSF awarding a grant that would otherwise not have been funded. Furthermore, Li's omissions deprived NSF of the opportunity to fully consider his potential conflicts of commitment and conflicts of interest. NSF was not fully informed in its decision to fund Li's awards, which led NSF to award $1.27 million to UF via NSF Awards 1822459, 1822989, 1900713.

Li did not acknowledge his duplicate NSF award in any publications, except for the 2019 Paper, which was ultimately retracted because of fabricated research results. The publication was publicly available for 1.5 years before it was retracted, potentially causing a ripple effect amongst other researchers who may have relied on its data. His actions also undermined NSF's mission to keep the United States at the leading edge of discovery in science and engineering

[66] 2 C.F.R. § 180.800(d)
[67] 2 C.F.R. § 180.850(a); 2 C.F.R. § 180.855
[68] 2 C.F.R. § 180.850(b)

by denying the United States of his research results. Instead, he provided his foreign institution with the results and acknowledgments. Further, an NSF expert concluded that none of the listed publications in his Annual Project Report were attributed to NSF award 1822459.[69]

2. Frequency of Incidents and/or Duration of the Wrongdoing (2 C.F.R. § 180.860(b))

Li's duration of wrongdoing extended for years, beginning with the start of his IPA position with NSF in 2015, when he failed to disclose conflicts with his ongoing DSP membership. As an IPA, he continued his wrongdoing by not reporting his outside activities on his OGE-450s as required. He also abused the IRD program by not reporting his outside engagements in his IRD plans and abused his authority by leveraging his position as an NSF PO in a quid pro quo relationship.

Furthermore, Li caused UF to submit a proposal to NSF that was previously funded by a foreign entity. He fabricated research findings, which his mentee and graduate student cited as reasons for his suicide. This resulted in Li being banned for 15 years from participating in and publishing with a professional organization, and his 2019 Paper was retracted. Additionally, Li failed to cooperate with UF investigators, and he destroyed evidence. Finally, on April 24, 2021, Li departed for China during UF's investigation.

3. Pattern of Wrongdoing (2 C.F.R. § 180.860(c))

Li engaged in a pattern of wrongdoing for years and avoided responsibility. Li did not disclose his continued affiliation as a DSP member and selection as a Changjiang Scholar in his application to become an IPA. He abused the NSF IRD program by participating in undisclosed outside activities during his NSF tenure, and he used his PO position for personal gain.

In 2018, Li caused UF to submit a proposal to NSF that was previously funded by the RGC-GRF of Hong Kong. In June 2019, Li's graduate student committed suicide in a laboratory at UF, blaming Li for making him fabricate and falsify data in the 2019 Paper. In October 2021, UF recommended a finding of research misconduct related to the 2019 Paper and found Li uncooperative with the investigation and that he attempted to subvert the review process as part of a pattern of manipulation.

4. Role in Wrongdoing (2 C.F.R. § 180.860(f))

From August 2015 to December 2017, Li served as an NSF PO and took an active role in several wrongful acts. From August 2016 to April 2017, Li abused the power and trust afforded to him by employing a quid pro quo tactic to gain favorable reviews of his HPCA 2017 paper submissions. Li was also aware that RGC-GRF previously funded a materially identical proposal he caused UF to submit to NSF. There is evidence to show that in November 2016, Li participated in crafting the proposal that was submitted to the RGC-GRF.[70] While still an IPA, he

[69] Attachment 12 – Dr. [redacted]'s Analysis
[70] Attachment 35 – Li's email to [redacted] with Li's edits of the RGC-GRF proposal

drafted a letter of support on UF letterhead for the foreign proposal. On January 3, 2018, eleven days after his IPA time ended, Li submitted a materially identical proposal to NSF with himself as the PI. Aside from the duplicative proposal, Li also failed to disclose his RGC-GRF award on two additional NSF proposals he submitted in 2018, which NSF awarded.[71] Lastly, while an NSF PO, Li failed to disclose his ongoing outside activities with the DSP and as a Changjiang Scholar, as was required on his OGE-450s, IRD Activities Plans, and annual reports.

As a professor, Li's graduate student, [redacted] took his own life amid accusations that Li forced him to publish false data in the 2019 Paper submitted to ACM. ACM conducted an investigation substantiating the data falsification allegations and retracted the paper in question. UF also investigated and found Li's actions consistent with research misconduct.

5. Acceptance of Responsibility (2 C.F.R. § 180.860(g))

Li has not accepted responsibility for his misconduct. UF placed Li on administrative leave on February 15, 2021, while UF conducted its investigation. Rather than face the outcome of the UF investigation, on March 15, 2021, Li transferred his assets to his wife's name including a Tesla vehicle and five properties. On March 19, 2021, the couple filed for divorce. Li departed for China on April 24, 2021. His divorce was finalized on May 12, 2021.

ACM and UF both noted in their investigation reports that Li did not accept responsibility for his actions and lacked candor. UF also found that Li destroyed documents and deleted files in the months after his graduate student's suicide. This demonstrates Li's avoidance of any responsibility.

6. Repayment (2 C.F.R. § 180.860(h))

Li's NSF awards, 1822459, 1822989, and 1900713, were suspended on March 17, 2021, and subsequently terminated on April 23, 2021, to protect the government's interests.[72] The total amount obligated at the time of termination was $663,651 for the three terminated awards. No attempt has been made to repay these awards.

7. Cooperation of the Subject (2 C.F.R. § 180.860(i))

UF's investigation committee (IC) found Li lacked candor in various ways.[73]

The first was regarding Li's use of messaging services and drafts of the 2019 retracted paper. Li told the IC he did not often use messaging services with his students, yet the message log from Li's graduate student [redacted] showed Li frequently communicated with him via WeChat. Further, when the IC requested access additional drafts of the 2019 Paper, Li told them he asked students to provide hard copies and gave feedback verbally or via handwritten notes. He said

[71] NSF Awards 1822989 and 1900713
[72] Attachment 36 – NSF Notice of Termination and Grant Termination Letters
[73] Attachment 26 – University Investigation Report, p. 21

he returned the hard copies and did not have any drafts. However, the IC found emails from Dropbox in Li's email indicating [redacted] edited files in a shared folder. Further, the chat messages showed that PDF versions of the 2019 Paper were exchanged electronically between the two. Additionally, Li claimed he did not look at the electronic copies that students provided, and he did not know if he still had them. When the IC asked about the drafts exchanged via chat messages, Li said he had a new phone and did not have messages before 2020. The IC concluded Li lacked candor and cooperation regarding obtaining drafts of the 2019 Paper to assist in the investigation.[74]

The second was regarding evidence that he manipulated the review process of the 2019 Paper. When asked by the IC, Li said he did not know the identity of the 2019 Paper's reviewers and did not interfere in the review process. When the IC presented him with chat messages that indicated he had interfered in the review process, Li declined to answer questions and implied the messages had been forged. However, the IC noted that Li had earlier confirmed that it was his WeChat ID in the messages and did not dispute the veracity of other messages. The IC did not find it credible that only part of the message record was forged.[75]

The third involved the deletion of files from a Dropbox account. The Assistant Research Integrity Officer (ARIO) asked Li if he had saved any files related to the case to Dropbox. Li stated that his students did not share files with him through Dropbox. However, UF's investigation found that [redacted] had shared files related to the 2019 Paper with Li through Dropbox, and Li deleted thousands of files from his personal Dropbox the day he met with the ARIO. UF investigators asked Li to restore the files, and Li's attorney responded on August 3, 2019, that the deleted files contained no information related to the investigation. The files were not restored.[76] The IC concluded that the refusal to restore the files indicated there was likely relevant information in them. The IC noted, "this refusal is not consistent with the expectations the university can rightfully have of its employee."[77]

In addition, when the JIC interviewed Li for violations of ACM's publication policies, they presented "clear evidence" of the wrongdoing to Li. They opined that he displayed a significant lack of candor and failed to take responsibility for his actions. The JIC and ACM Publications Board viewed his behavior as an attempt to impede the investigation, in violation of ACM's Code of Ethics.[78]

8. Position Held by Subject (2 C.F.R. § 180.860(k))

As a former NSF PO, Li was able to influence the funding of future research and development vital to advancing the United States as a technological leader. The position instilled a high level

[74] Attachment 26 - University Investigation Report, pp. 18-19
[75] Attachment 26 - University Investigation Report, pp. 19-20
[76] Attachment 27 - Eml-005 Respondent email regarding Dropbox; Attachment 28 - Eml-006 Respondent email regarding Dropbox; Attachment 29 - Eml-007 Respondent email regarding Dropbox
[77] Attachment 26 - University Investigation Report, p. 21
[78] Attachment 30 - 2020 11.19 Tao Li Decision Letter, p. 2

of trust in Li, which he undermined by using it as a tool for personal gain. Further, he was required to disclose his outside activities to NSF, but he failed to do so for years.

Li served as PI or Co-PI on many NSF proposals and awards. Li was responsible for disclosing all current and pending awards, and his affiliations and outside activities in each proposal submission. Li was a respected member and mentor of the computer architecture community and was able to influence students, professional societies, and promising foreign and domestic research.

OIG Recommendation

We recommend that NSF debar Li for three years to ensure federal funds are safeguarded. We also recommend that NSF ban Li from serving as a peer reviewer, advisor, or consultant for NSF for three years.

Please copy us on any actions taken in response to this recommendation.

List of Attachments

Attachment 1 – Li - IPA Award Summary
Attachment 2 – [redacted]abbatical Packet
Attachment 3 – March 2, 2021 Email re Li on Administrative Leave
Attachment 4 - DSP - Li is sponsored by Chongqing University (English embedded in comments)
Attachment 5 - Li Letter of Support (Excerpt from GRF info_pdf)
Attachment 6 - Email from [redacted] - GRF info
Attachment 7 - RGC GRF Proposal 15206617
Attachment 8 - GRF-2017-18-[redacted].pdf
Attachment 9 - 1822459 Entire Proposal
Attachment 10 - Grant_Letter_1822459 Amd 001 Termination
Attachment 11 - Publications Acknowledging RGC-GRF Award
Attachment 12 - Dr [redacted]'s Analysis
Attachment 13 - Li - OGE 450_2015-2017
Attachment 14 - Li 2017 Changjiang Scholar announcement (English embedded in comments)
Attachment 15 - 2017 Changjiang Scholars Program – announcement
Attachment 16 - IRD Activities Plan 2016-2017
Attachment 17 - IRD Annual Reports - Statements of Accomplishment 2015-2017
Attachment 18 - 2016 Jan 12_National High Performance Computing Center Shenzhen Branch
Attachment 19 - 2016 May 4_Li presents at Chongqing Univ
Attachment 20 - 2016 Aug 8-12 Course Schedule-DSP Course CCF Sichuan Univ
Attachment 21 - 2016 Dec 5_Li presents at CCF YOCSEF Chongqing
Attachment 22 - 2017 Apr 10_Li presents at Xidian Univ
Attachment 23 - 2017 Oct_Li presents at CNCC2017 China Computer Conference
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Attachment 33 - Grant_Letter_1652655
Attachment 34 - HPCA2017 Papers - Table_of_contents
Attachment 35 - Li's email to [redacted] with Li's edits of the RGC-GRF proposal
Attachment 36 - NSF Notice of Termination and Grant Termination Letters

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

March 16, 2021

To: [redacted]

From: [redacted]

Subject: Recommendation to Suspend NSF Awards CCF-1822459, CCF-1822989, CCF-1900713, CCF-1947425 and pending award CCF-2007401 to University of Florida (OIG Case I-19-0023-O)

Attached is our Recommendation to Suspend NSF Awards CCF-1822459, CCF-1822989, CCF-1900713, CCF-1947425 and pending award CCF-2007401 to University of Florida. The awards are under the direction of Principal Investigator Dr. Tao Li who we recently learned incurred severe penalties as a result of an investigation by the Association for Computing Machinery into his actions. Additionally, according to the University of Florida, Dr. Li was placed on administrative leave. Based on our investigation to date, we recommend taking this action to protect NSF funds.

[redacted]

Attachment

cc: [redacted]

Recommendation to Suspend Awards

OIG Case Number I-19-0023-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

March 15, 2021

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Introduction

We recommend that NSF suspend the following NSF awards: CCF-1822459 entitled "EAGER: Improving lifetime and data reconstruction time of Flash-based RAID by orchestrating control between RAID and SSD controllers," CCF-1822989 entitled "SPX: Collaborative Research: Enabling Efficient Computer Architectural and System Support for Next-Generation Network Function Virtualization," CCF-1900713 entitled "SHF: Medium: Collaborative Research: Enhancing Mobile VR/AR User Experience: An Integrated Architecture-System Approach," (the Awards), and continuing grant CCF-1947425 entitled "SHF: Medium: Collaborative Research: Enhancing Mobile VR/AR User Experience: An Integrated Architecture-System Approach" made to the University of Florida (UF). The cumulative award funding is $1.27 million and $613,762 remains unexpended. The award periods range from August 1, 2018 to September 30, 2023. Additionally, award CCF-2007401 entitled "Collaborative Research: SHF: Small: Enabling Light-Weight and Cost-Effective Training on Edge Heterogeneous AI Systems," with a requested funding amount of $250,000, is currently pending.

As set forth below, we learned that Dr. Tao Li (Dr. Li), the Principal Investigator (PI) on the Awards, was recently prohibited from publishing in any Association for Computing Machinery (ACM) venue for the next 15 years, and was banned from serving in any review, editorial, or program committee position for the same interval. The penalties assessed were a result of an investigation conducted by ACM. We also learned that Dr. Li was placed on administrative leave from the University of Florida, effective February 15, 2021.

OIG Investigation

We opened an investigation into allegations that Dr. Li had multiple undisclosed foreign affiliations, in violation of NSF policy. However, we recently received an article published on February 8, 2021 by ACM[1] which outlined the results of the Joint Investigative Committee's (JIC) investigation into significant allegations of professional and publication-related misconduct. Based on information obtained through the course our investigation, we know the individual referenced in the report to be Dr. Li.

Specifically, the report details "allegations of potential academic and publishing-related misconduct related to the ISCA'19 Conference" that were "widely rumored within the community and included accusations of academic bullying, violations of reviewer confidentiality, and inappropriate influence on the review process." According to the report, while the initial investigation did not uncover "tangible evidence of wrongdoing" or "substantiate the rumors shared by anonymous sources," in January 2020, additional information was uncovered as well as a witness not previously interviewed. As a result, ACM created the JIC to investigate the additional evidence put forward to "included confidential conference information, such as article submission details, reviewer comments, and author names, which provided

[1] https://www.sigarch.org/wp-content/uploads/2021/02/JIC-Public-Announcement-Feb-8-2021.pdf
[2] https://www.wcjb.com/2021/03/02/university-of-florida-professor-on-administrative-leave-following-investigation-into-student-death/

the first verifiable evidence that the confidential double blind peer review process for the Conference had been breached."

The JIC presented their findings and based on the evidence, "the ACM Publications Board concluded unanimously that:

1. There was clear and convincing evidence that several individuals …intentionally breached the peer review process for ISCA'19 by repeatedly sharing reviewers' names and reviewer scores connected with submissions…
2. There was clear and convincing evidence of breaches of reviewer confidentiality for HPCA'19 and ASPLOS'17 discovered incidentally to this investigation.
3. There was clear and convincing evidence that an ISCA'19 author had coerced a co-author to proceed with a submission despite that co-author's repeatedly expressed concerns about the correctness of the results reported in the work.
4. In several instances, there were signs of other wrongdoing exposed by the investigation…"

As a result, multiple penalties were assessed, however, we have information that confirms the most severe penalty of the 15-year prohibition was given to Dr. Li.

Additionally, we were made aware of an article published by WCJB 20 abc, Gainesville, FL,[2] reporting Dr. Li was placed on administrative leave pending an ongoing university investigation. Officials at the University of Florida confirmed to NSF OIG that Dr. Li was placed on administrative leave from the university, effective February 15, 2021.

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend the Award(s) pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

The Gainesville Sun | Ga[redacted]nesville.com

CAMPUS

Family of UF grad student who died by suicide files legal claim against university

Thomas J. Weber Fresh Take Florida

Published 10:25 a.m. ET Aug. 13, 2021 | **Updated 2:41 p.m. ET Aug. 13, 2021**

The family of a University of Florida graduate student who died by suicide has filed a legal complaint seeking unspecified financial damages against the school for neglecting to intervene in what it said was mistreatment by a former professor.

The statement of claim filed by the family of Huixiang Chen with the Florida Department of Financial Services is a legal maneuver that is a precursor to a civil lawsuit against a state government agency. Chen, 30, hanged himself in a university lab in June 2019 and left behind notes accusing his tenured professor in the Department of Electrical and Computer Engineering, Tao Li, 49, of abusive behavior and academic misconduct.

The claim said Li "engaged in a pattern of emotional abuse, harassment, intimidation, threats and deceit" involving Chen and his studies, and said without citing evidence that the university had "notice and knowledge" of Li's conduct and Chen's "imminent threat of suicide."

Earlier: UF professor retires amid investigation after grad student's suicide

From 2019: UF reviewing circumstances in Chinese student's death

It sought unspecified payment for damages and attorney's fees. It said the university and at least one other individual it did not identify — presumably Li — were liable in Chen's death, and described a troubled relationship between Chen and Li.

A university spokesperson, Steve Orlando, declined to comment on the pending litigation.

Former UF professor divorced his wife after 19 years of marriage

Meanwhile, Li divorced his wife, Lan Luo, in Gainesville after 19 years of marriage with two children. He agreed to give her nearly all the couple's assets, according to court records: She received about $3 million in property, a new Tesla and bank accounts – including five homes and $5,034 in monthly child support – and Li agreed to take $1,000 and a used Subaru.

Li, who said he earned $203,419 last year from the university, was not represented by a lawyer in his divorce, according to court records. Luo said in court records she was unemployed and had no income

last year.

Florida operates under the laws of "equitable distribution," meaning that during a divorce assets and debts between spouses are generally divided equitably and fairly. "I do raise an eyebrow at a spouse who says, 'take virtually 100% of a multi-million dollar estate,'" said Kira Willig, a civil and family law attorney and adjunct professor at the University of Miami's School of Law.

It's not clear where Li might be living now, or whether he has returned to China. A reporter visited all five of the former couple's properties looking for him, and Li did not respond to questions about his whereabouts. The divorce case alluded to a "long-distance parenting plan" for Li that was not included as part of the court records.

Li resigned under pressure in May amid university investigations in the case. Reached by email, Li would not answer specific questions but provided a 26-page statement about the case.

Li said that Chen had opportunities to complain about any alleged mistreatment, that Chen could have withdrawn his problematic scientific paper at any point without interference from Li, that Li wasn't responsible for Chen's suicide and that Chen's friends should have sought help for Chen's deteriorating emotional state.

Two of Chen's friends declined to speak on the record about Chen's depression, saying they already have faced legal threats from Li about speaking publicly about the case. One friend was also concerned that speaking publicly could harm future academic prospects.

Li has been the subject of at least three overlapping investigations by the university since Chen's death. Complicating any settlement by the school with Chen's family, one investigation concluded in February there was insufficient evidence to confirm that Li had mistreated Chen. It cited another doctoral student of Li's, for example, who said he was "just a normal professor and did not do bad things to us."

In notes to friends, Chen had complained about being expected to run personal errands for Li unrelated to his studies. He wrote that Li asked him for trips to airports and that he was responsible for driving Li's wife and father-in-law places. More seriously, Chen said, Li pressured him to submit false data in a research paper submitted under both their names and presented at a prestigious academic conference.

"If I ruin his reputation," Chen wrote in a translated text, "he will kill me."

Tension between Chen and Li had escalated days before Chen's suicide. Witnesses, including administrative assistant Dina Quinn, overheard screaming in Mandarin and items crashing to the floor inside the professor's office during one visit by Chen just a week before his death.

A second university investigation, which ended in April, found that Li had destroyed documents and used non-UF approved communication services. Files deleted in the months after Chen's suicide might have been pertinent to the inquiry about how Li treated Chen, the school said. It said Li had lied about using a personal Dropbox account to share files with students and declined to restore the deleted files for the university to review.

Li submitted his resignation three days after the second investigation. Orlando, the university's spokesperson, declined to comment on a third investigation, which is still ongoing more than two years later.

Li's divorce settlement was finalized the day before he resigned from the university. Luo, reached at her home in Gainesville, declined to discuss the divorce or her ex-husband. She insisted on recording a reporter verbally agreeing that she would not be quoted for the record in news coverage about her husband. Luo listed the family's home for sale at nearly $1.2 million 10 days after their divorce.

The Chen family's lawyer, Kevin E. Morgan of Orlando, filed the claim June 1 with no public announcement, and a copy was recently obtained under Florida's public records law. The university has not yet formally responded – either disputing the claim or offering a settlement, according to requests for further records in the matter. Morgan declined to discuss the case.

Deadline for wrongful death lawsuit was earlier this summer

A civil lawsuit for wrongful death must be filed in Florida within two years, a deadline that would have passed in Chen's case earlier this summer. Other civil claims, such as a personal injury lawsuit, can be filed until four years later. The university confirmed it has not extended the statute of limitations to offer more time for the parties to reach a settlement.

The disclosure of the legal claim against UF occurred as a prominent research organization, the Association for Computing Machinery, announced it had revoked Li's membership. In a blistering statement earlier this month, the group cited Li's "repeated violations" of its ethics rules and said Li had "willfully violated scientific research integrity standards." It said Li "coerced Chen to publish the paper after Chen raised concerns that the work contained incorrect or falsified results."

The group also said Li "knowingly and intentionally proposed obvious false theories" to thwart its investigation into his actions.

Willig, the family law expert, said the couple's financially lopsided divorce settlement was unusual. She said Li may have felt guilty about ending the marriage and wanted his wife and children financially stable, or attempted to shield the family's assets from impending legal action by giving them to his ex-wife.

“Even though there is a presumption to divide the marital estate equally, spouses can agree to do something differently if they feel it is equitable,” she said. “The court will not interfere or object to how a couple agrees to divide their property.”

The law firm that represented Luo, Meadors Family Law, declined to discuss their divorce. Michael Meadors, the lawyer who oversaw the couple’s divorce, declined to talk about the case through his criminal defense lawyer, Tim Pribisco of St. Augustine. Meadors himself was released from jail and is facing trial on felony charges in St. Johns County of sexually assaulting an 8-year-old girl after he was arrested last month.

There is help for those in emotional distress, contemplating self harm. Call the National Suicide Prevention Lifeline at 800-273-8255.

This story was produced by Fresh Take Florida, a news service of the University of Florida College of Journalism and Communications.

UF UNIVERSITY of FLORIDA

Office of the Vice President for Research

223 Grinter Hall
PO Box 115500
Gainesville, FL 32611-5500
352-392-1582
Fax 352-392-9697

Notice of Investigation

December 19, 2019

Tao Li, Ph.D.
Professor, Department of Electrical and Computer Engineering
College of Engineering, University of Florida
[redacted]

Dear Dr. Li:

On July 3, 2019, you received written notice that an allegation of research misconduct had been made against you and that the Research Integrity Officer (RIO) within the Division of Research Compliance and Global Support would conduct an inquiry into that allegation. The RIO has concluded the inquiry and submitted to me the attached Inquiry Report, including your written comments on the draft report, recommending that an investigation be conducted pursuant to the University's Regulation 1.0101 Policy for Dealing with Conduct in Research. I have accepted the Inquiry Report and recommendation. The investigation will begin once the investigation committee is impaneled; you will receive written notification of the investigation's start date.

Please note that the research misconduct review process is confidential, consistent with federal and state law. After the entire process is completed, all investigatory records, except those protected by law, will become publically available in response to a valid public records request. Additionally, it is your right to retain legal counsel with regard to this investigation and to request representation from the United Faculty of Florida union, if applicable.

Please contact [redacted] with questions about the investigation.

[redacted]

Enclosure:
Inquiry Report with Attachments

[redacted]

Confidential

University of Florida
Division of Research Compliance and Global Support

Inquiry Report

[redacted]

Date: December 19, 2019

Respondent: Tao Li, Ph.D., Professor, Department of Electrical and Computer Engineering College of Engineering

Complainant: Huixiang Chen, Doctoral Candidate, Department of Electrical and Computer Engineering, College of Engineering

---

I. Executive Summary

On June 18, 2019, the Research Integrity Officer (RIO) received a referral for an allegation of research misconduct from the Associate Dean for Research (ADR) for the College of Engineering. Via email, the ADR provided written statements from the Complainant alleging research misconduct. Subsequently, various UF faculty and staff members forwarded four emails to the RIO. The anonymous emails corroborate the original allegation. Within the written allegations, the Complainant alleges that the Respondent, Dr. Tao Li, Professor in the College of Engineering, directed the Complainant to fabricate or falsify data or results in the paper "3D-based Video Recognition Acceleration by Leveraging Temporal Locality" and present the paper and findings at the International Symposium on Computer Architecture (ISCA) held in June 2019.

The RIO reviewed the allegation and determined that the allegation is subject to the University of Florida's (UF) Policy for Dealing with Conduct in Research, Regulation 1.0101, as well as National Science Foundation (NSF) regulation on Research Misconduct, 49 C.F.R. § 689 (collectively, "regulations").

Based on the criterion laid out in the regulations, the RIO determined that there is a reasonable basis for concluding that the allegation falls within the definition of research misconduct and preliminary fact-finding from the inquiry indicates that the allegation may have substance. Therefore, pursuant to the regulations, the RIO determined that an investigation is warranted.

II. Sources of Funding

Based on the information provided within the acknowledgements section of the paper, the paper was supported by funding from the NSF. Table 1 shows the funding cited within the paper.

NSF Award Number	Award Title	Primary Investigator
1423090	Leveraging Distributed Generation and Adaptive Energy Storage Management for Efficient and Scale-out Renewable Powered Data Center Design	Respondent
1527535	Optimizing Consolidation Efficiency of Emerging Virtualized Cloud Applications on Contemporary Server Architecture	Respondent
1822459	Leveraging the Interplay of RAID and SSD for Lifetime and Reconstruction Optimization of Flash-based SSD RAID Array for Cloud and Big Data Workloads	Respondent
1822989	Enabling Efficient Computer Architectural and System Support for Next-Generation Network Function Virtualization	Respondent
1900713	Enhancing Mobile VR/AR User Experience: An Integrated Architecture-System Approach	Respondent
1320100	Collaborative Research: Exploring Energy-Efficient GPGPUs Through Emerging Technology Integration	[redacted]

Table 1. Sources of funding cited in the paper,"3D-based Video Recognition Acceleration by Leveraging Temporal Locality"

III. Allegation and Relevant Facts

On June 19, 2019, the College of Engineering ADR forwarded to the RIO an allegation of research misconduct that had been submitted to his office. Upon receipt of the allegation, the RIO reviewed the three translated statements written by the Complainant.[1] Only one statement, found in Attachment A, contained specifics related to the allegation of research misconduct. (Note that personal information not related to the allegation is redacted from the statement to protect the Complainant's privacy.) After the submission of the original allegation, anonymous senders sent four emails to UF officials, who subsequently forwarded the emails to the RIO. The emails, found in Attachment B, corroborate the original allegation.

According to the allegation, the Complainant began working on the paper "3D-based Video Recognition Acceleration by Leveraging Temporal Locality" in September 2018 and submitted a proposal and draft paper to the ISCA. The paper was accepted and the Complainant was scheduled to present the paper at the ISCA conference on June 24, 2019. The Respondent, along with three others, are listed as co-authors on the paper.

Once the paper was accepted, the Complainant began to review and rework the paper to address the areas in the original submitted version that used experimental data. In his written statement, the Complainant states that after submitting the initial version of the paper, he began running experiments and discovered that "…much of the data and the design of the experiment did not reflect [the study's] original claim." The Complainant further stated that in the revised version of the paper (Attachment C), the paper,

> "is specifically focused on 3D CNN, [and I] made a structural change to Diffy in order to activate control of the temporal delta and spatial delta so as to maximize functionality. But there are just too many problems in [making] this [claim]. Number 1, Diffy's

[1] The Complainant passed away on June 14, 2019; he left behind three written statements containing the allegations of research misconduct. A College of Engineering employee, who is a native Mandarin speaker, translated the statements, and the ADR then forwarded the non-certified translated statements to the RIO. Note that the RIO will obtain certified translations for the investigation phase.

> structural synchronization is very problematic, if the input feature map's width is very narrow, [with] the lane synchronization [being] overhead, and [so] I was under the impression during then that the temporal dimension of 3D CNN can similarly expand much like Diffy. Number 2, [there is] no way jump-zero cane be achieved, because there is synchronization of lane as well as accumulation of spatial/temporal delta. As such, any revision would mean a complete rewrite of the paper."

According to the anonymous emails, the Respondent directed the Complainant to falsify or fabricate data and findings within the paper and submit a final version of the paper to ISCA that included the falsified information. Specifically: "[The Complainant] claimed that one of the papers he published contained falsified information, and asked to withdrawal. However, [the Respondent] insisted that the paper be published." In the emails and written statement, it is alleged that the Complainant raised his concerns with the Respondent multiple times, but the Respondent insisted that the Complainant submit the revised paper with the allegedly false data to ISCA. In response to the allegation, which was made public by anonymous whistleblower(s), the Respondent released a written statement (Attachment D) about the paper writing and revision process. The Respondent maintained that when the Complainant "told me that he found mistake in his submitted version, I worked closely with him to identify the root cause and suggest solutions." A revised version of the paper was submitted to ISCA on May 28, 2019, and the Respondent claims that, "[t]o the best of my knowledge, our final version paper does not contain the mistake that he identified earlier and he has also confirmed that." On June 24, 2019, the Respondent attended the ISCA and presented the paper. The paper will also be included in the published proceedings of the conference.

IV. Inquiry Process

In the allegation assessment phase of this case, the RIO determined: (1) the allegations fell within the definition of research misconduct; and (2) the allegations were sufficiently credible and specific so that evidence of research misconduct may be identified. As such, the case proceeded to inquiry. During the inquiry process, the RIO provided formal notice of inquiry to the Respondent on July 3, 2019, interviewed the Respondent, engaged a subject matter expert as a consultant, and conducted a preliminary document review.

Prior to or during the notice of inquiry process, the RIO made every reasonable effort to sequester potential evidence, in accordance regulations. Prior to notice of inquiry, the RIO's office sequestered the contents of the Complainant's UF desktop computer as well as an external hard drive stored in his UF workspace. The RIO also attempted several times to sequester relevant files from the Respondent's personal laptop computer[2] to make a forensic copy of all pertinent files contained there. Across several meetings with the Respondent, he shared select files saved to his hard drive and in his personal DropBox account.

On August 29, 2019, the RIO and ARIO met with the Respondent to discuss the location of any files or data that were relevant to the allegation and the ISCA paper. At the meeting, the

[2] The Respondent's department allows faculty to use personal computers in lieu of computers provided by UF. The Respondent purchased the laptop several years ago and uses it to conduct all UF business. Since the computer is a personal laptop, it is not considered an UF asset.

Respondent stated any files related to the allegation were saved to the Complainant's personal laptop[3], UF desktop, or external hard drive, the latter two of which were previously sequestered.

In addition to the written statement discussed in Section III (found in full in Attachment C), the Respondent also provided verbal responses to the allegation at the notice of inquiry and sequestration meetings. According to the Respondent, the original version of the paper that the Complainant drafted contained errors, but the Respondent identified those issues and they were addressed in the final version of the paper. As such, the Respondent maintained that the published paper is accurate and free from any false or misleading information.

At the request of the RIO, a subject-matter expert (SME) reviewed the allegations and the corresponding paper containing the questioned data and analysis. The SME did not have access to any raw data or any other supporting documentation, since the review of supporting data and documentation occurs during the investigation phase. Based on a review of the publication and on his expertise, the SME concluded the allegations of falsification or fabrication may have merit. Specifically, the SME believes that, at a minimum, the concerns raised in the allegation are valid and warrant further review, to include review of original data, initial drafts of the paper, and interviews with the Respondent and witnesses. However, the SME could not make a definitive determination as to the nature of the manipulation without a more complete, in-depth analysis, such as what occurs during the investigation phase.

V. Inquiry Conclusion

The purpose of an inquiry is to determine whether an investigation is required. Pursuant to the regulations, an investigation is required if: (A) there is a reasonable basis for concluding that the allegation falls within the definition of research misconduct, and (B) preliminary fact-finding from the inquiry indicates that the allegation may have substance.

A. Does the Allegation Fall Within the Definition of Research Misconduct?

Research misconduct is defined as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research or in reporting research results. The allegation in this case involves fabrication, which is defined as making up data or results and recording or reporting them and falsification, which is defined as manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

The Complainant alleges that the Respondent instructed the Complainant to fabricate or falsify the data that supports the paper. Taking the allegations as true for purposes of this inquiry, the allegation falls within the definition of research misconduct.

[3] The personal laptop belonging to the Complainant is in the possession of the Complainant's family. The RIO has requested access to the Complainant's personal computer, but, as of the date of this report, the family has not provided the computer to the RIO.

B. Does Preliminary Fact-Finding Indicate The Allegation May Have Substance?

The preliminary fact-finding in this case included the review of the allegations, in-person meetings with the Respondent, as well as consulting with a SME. The SME reviewed the allegations and the paper and concluded the allegations of falsification or fabrication may have merit. Specifically, the SME believes that, at a minimum, the concerns raised in the allegation are valid and warrant further review. The SME noted that the paper did not cover certain design issues and had a relatively brief results section. While those observations alone do not establish research misconduct, combined with the written allegations the preliminary fact-finding indicates that the allegation may have substance. Accordingly, an investigation is required.

VI. Investigation Committee Charge

The purpose of the investigation is to determine whether or not the Respondent committed research misconduct. A finding of research misconduct requires the following elements:

- There be a significant departure from accepted practices of the relevant research community; and
- The misconduct be committed intentionally, knowingly, or recklessly; and
- The allegations be proven by a preponderance of the evidence.

Therefore, the investigation committee is charged with determining:

(1) Based on a preponderance of the evidence, was there fabrication or falsification of data or results in the paper "3D-based Video Recognition Acceleration by Leveraging Temporal Locality"?

(2) If yes to Charge 1, and based on a preponderance of the evidence, was fabrication or falsification committed by the Respondent intentionally, knowingly, or recklessly?

(3) If yes to Charge 1, and based on a preponderance of the evidence, was the Respondent's fabrication or falsification a significant departure from accepted practices of the relevant research community?

In accordance with the regulations, the committee is further charged to:

- Take reasonable steps to ensure an impartial and unbiased investigation;
- Interview the Respondent and any other person reasonably identified as having information relevant to the investigation;
- Diligently pursue all significant issues and leads relevant to the investigation, including potential incidences of additional research misconduct; and
- Continue the investigation to completion.

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Attachment A - Complainant Written Statement

Dear esteemed lab peers,

[redacted]

All of you should know that I have, in last December, written an ISCA within a very short period of time. I submitted it, coincidentally, it got accepted. However the real reason (behind the acceptance), as all of you must surely discern, is due to Dr Li's connection. Of the six reviewers, four are the boss' friends. Yet, this paper in its form then was very problematic. The design does not make sense, the reviewers are also somewhat disingenuous (in their reviews.) Bewilderingly, it got accepted. Yet anyone under these circumstances would have experienced it as unreal (as I have.)

After the deadline, (I) began to make crazy changes. Experiments were done on those (areas) that needed (experimental data.) In the process of doing those experiments, (I) discovered that much of the data and the design of the experiment did not reflect (the study's) original claim. As such, (the claim of) this paper is untenable – from its (research) subject, to its characterization and design. For example, I cl i that this is specifically focused on 3D CNN, (and I) made a structural change to Diff in order to activate control of the temporal delta and spatial delta so as to maximize functionality. But there are just too many problems in (making) this (claim.) Number 1, Diffy's structural synchronization is very problematic, if the input feature map's width is very narrow, (with) the lane synchronization (being) overhead, and (so) I was under the impression during then that the temporal dimension of 3D CNN (which normally the largest being 16, and it follows layer to continuously reduce in size) can similarly expand much like Diffy. Number 2, (there is) no way jump-zero cane be achieved, because there is synchronization of I e as well as accumulation of spatial/temporal delta. As such, any revision would mean a complete rewrite of the paper. A completely new idea would have to be formulated. Yet this is unrealistic just before (the submission of) the final version. After communicating with Dr. Li, (I) forced and numbed myself to conclude the (findings of) the paper. But today, (I) still discovered that all of the problems cannot be fixed, and that the problem is very clear for all to see, (especially) for those who specializes in accelerator. And as for the issue of data not m k g any sense at all, and Dr Li's acquiescence on that, (I) will not judge any further.

[redacted]

Best,

Huixiang

Commented [G1]: All highlighted appear in English in its original form

Commented [G2]: All words within parenthesis are translator's editorialized work.

Commented [G3]: This is a common refrain that is used loosely in colloquial Mandarin, particularly among the young.

Commented [G4]: This sentence is grammatically incorrect in its original form. I have editorialized it to try and make it

Confidential

Attachment B – Anonymous Emails

[redacted]

Subject: FW: Please seriously investigate the recent suicide case of the UFL ECE student
Date: Wednesday, June 19, 2019 9:31:45 AM

Please see the email below.

[redacted]

UF | UNIVERSITY of FLORIDA

CONFIDENTIAL INFORMATION: The information contained in this electronic message and any attachments to it are intended for the exclusive use of all addressees and may contain confidential attorney-client communication and/or other confidential information. If you are not the intended recipient, please destroy all copies of this message and attachments and immediately notify this office by sending a reply e-mail to the sender. Thank you.

[redacted]

Subject: Fwd: Please seriously investigate the recent suicide case of the UFL ECE student

Sent from my iPhone

Begin forwarded message:

[redacted]

Subject: Fwd: Please seriously investigate the recent suicide case of the UFL ECE student

FYI

Begin forwarded message:

> **From:** ISCA tragedy <isca.tragedy@gmail.com>
> **Date:** June 19, 2019 at 6:00:31 AM EDT
> [redacted]
> **Subject: Please seriously investigate the recent suicide case of the UFL ECE student**
>
> Recently an UFL Chinese student Huixiang Chen suicided.
>
> https://www.gainesville.com/news/20190614/body-of-chinese-student-found-in-campus-building
>
> The case is widely covered in Chinese media:
> https://www.chinesenzherald.co.nz/news/education/huixiang-chen-committed-suicide/
>
> The claims in the above link is not verified yet, but ACM and IEEE are investigating the ethic issue.
>
> There is a discussion on Zhihu.com (Chinese version of Quora):
> https://www.zhihu.com/question/329605591
> I hope you can find some people who understand Chinese to review these posts. They are not random posts and show a pattern. The information is disturbing.
>
> From the link, my Chinese colleagues (I cannot read Chinese) told me that the advisor Tao Li was threatening Huixiang's father and mother (came from China) and his ex-girl friend to not disclose anything. Tao Li wanted to make this case isolated and not related to him (to protect his reputation). Even the case is related to him, I don't think there is a crime. But such behavior shows the disrespect to the dead student and is really dishonest. I also heard that Tao Li has asked all group members to not disclose any information, and all group members signed the agreement.
>
> At this point, it is not clear whether the above indeed happened, but it is important to find out the truth. Huixiang's death should be fairly treated. I hope the police and university interview Huixiang's parents, ex girl friend and the group mates, emphasizing that they have nothing to fear, the

serious case should be carefully investigated.

The potential interviews are also helpful for the ethic investigation.

[redacted]
[redacted]
Subject: FW: reporting academic misconduct of a professor
Date: Monday, July 8, 2019 4:09:24 PM

[redacted]
Subject: FW: reporting academic misconduct of a professor

[redacted]

[redacted]
Date: Thursday, June 27, 2019 at 9:48 AM
[redacted]
Subject: reporting academic misconduct of a professor

[redacted]

This email is to outline a few facts that may warrant a thorough and serious investigation regarding Professor Tao Li.

1. Professor Li's student, Hui-Xiang Chen, recently committed suicide. He claimed that one of the papers he published contained falsified information, and asked to withdrawal. However, Professor Tao Li insisted that the paper be published. This is a serious violation of academic integrity.

2. Professor Li had created a hostile work environment for his students, including Hui-Xiang Chen, which resulted in his breakdown and death;

3. Professor Li may hold academic appointment in China, which he did not seem to have declared. This is a violation of university policy, as well as department policy. This may also invite unwanted attention from federal anti-spying investigation.

Please consider the three bullet points and make a solemn determination whether you think Professor Tao Li is worth investigating.

[redacted]

Subject: FW: request for investigation of Dr. Tao Li
Date: Monday, July 8, 2019 4:09:44 PM

[redacted]

Sent: Monday, July 1, 2019 7:07 AM

[redacted]

Subject: Fwd: request for investigation of Dr. Tao Li

---------- Forwarded message ----------
[redacted]
Date: Mon, Jul 1, 2019 at 7:05 AM -0400
Subject: Fw: request for investigation of Dr. Tao Li
[redacted]

fyi

[redacted]

[redacted]

Sent: Monday, July 1, 2019 2:28 AM

[redacted]

Subject: request for investigation of Dr. Tao Li

Dear UF Dean of CoE and Chair of ECE,

I'm writing yo request an investigation of Dr. Tao Li. I would like to remain my anonymity because of the sensitivity of this matter.

As a concerned researcher in academia, I would like to bring to your attention several pieces of information regarding Prof. Tao Li and the recent suicide of an UF ECE grad student. I do not know or have any conflict of interest with either Dr. Tao Li or his student who committed suicide. Some of the following information is what I read from online (i.e., no confirmation), while some has solid source of confirmation.

- An article posted at https://medium.com/@huixiangvoice/the-hidden-story-behind-the-suicide-phd-candidate-huixiang-chen-236cd39f79d3 reporting the suicide note of the student and more conversations between him and a friend regarding Dr. Tao Li. [un-confirmed source]

- In forums discussing the matter https://www.zhihu.com/question/329605591/answer/718575301 (in Chinese), there are mentioning of Dr. Tao Li being part of a talent program in China and getting funding from several Chinese universities, while Dr. Li had ongoing NSF funding. [un-confirmed source]

- Dr. Tao Li asking conference reviewers to review and favor his papers. [confirmed source]

Because several pieces of the information above have no official source, I do not want to jump to any conclusion and would like to request UF for a formal investigation into the matter (if none has begun yet). I would also request UF to post the investigation result openly.

Thank you for your attention!

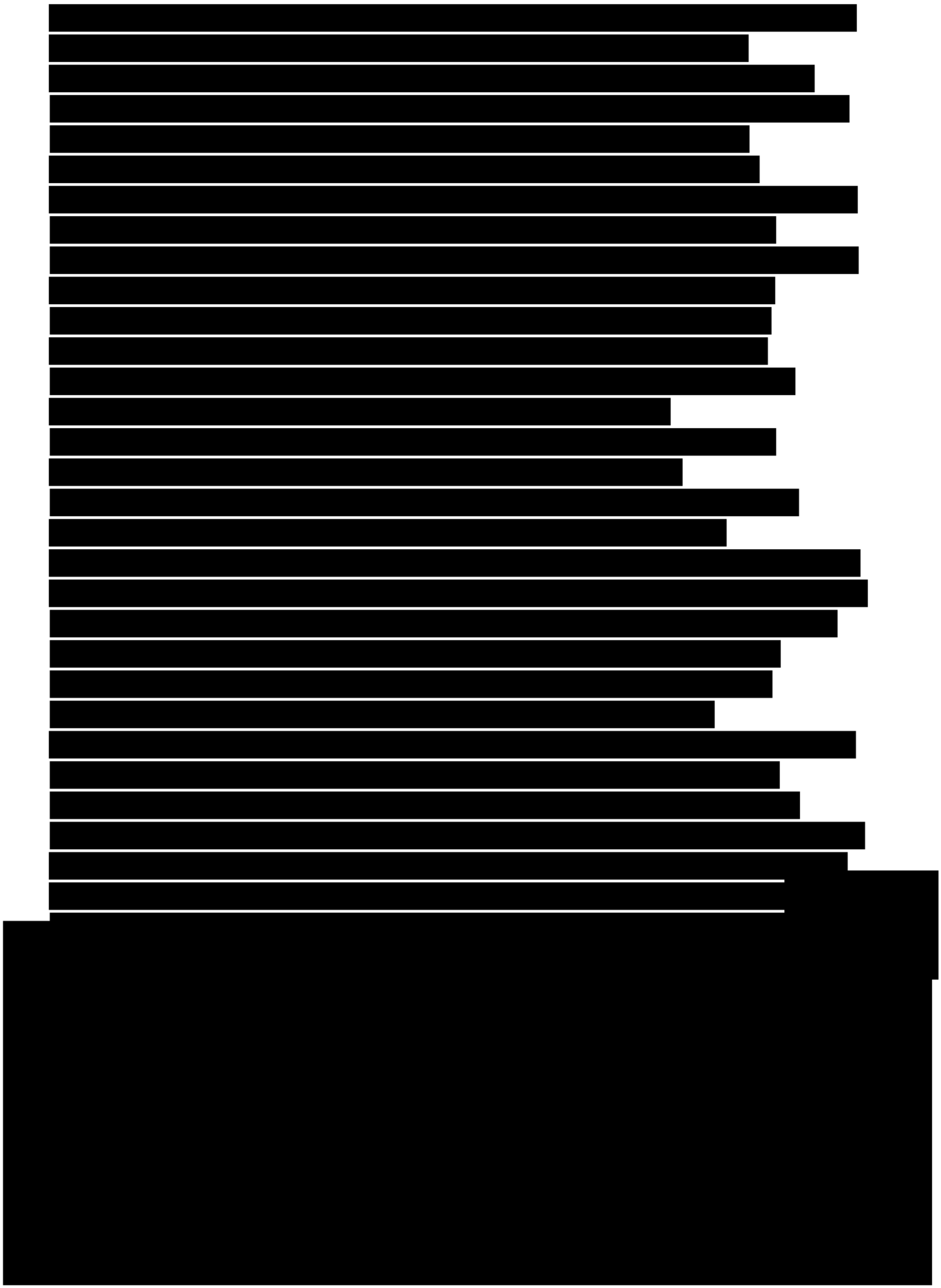
[redacted]

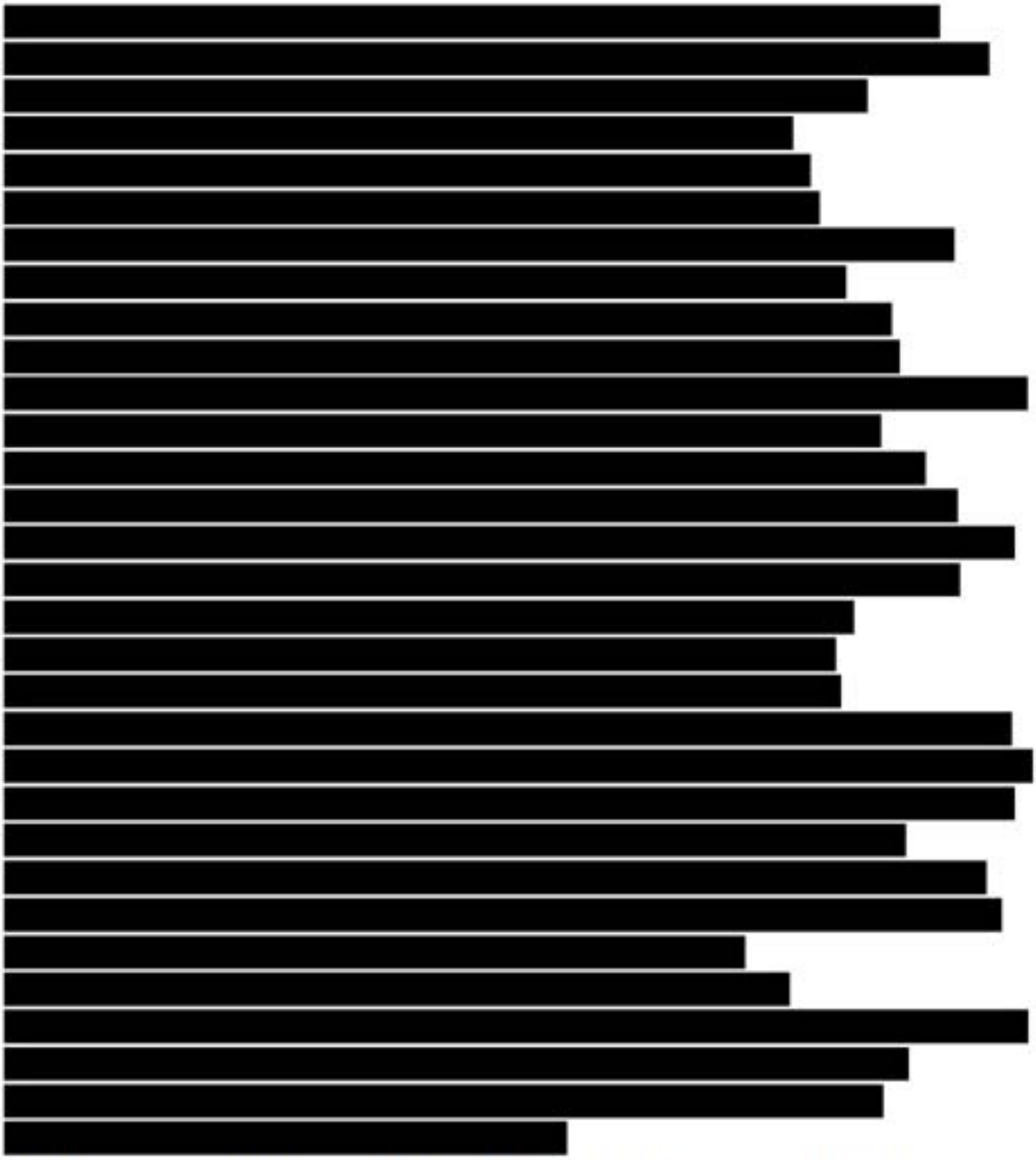
Subject: FW: A Suicide Happened in UF-ECE Which Maybe Related to Academic Misconduct
Date: Monday, July 8, 2019 4:10:06 PM
Attachments: image019.png
image020.png
image021.png
image022.png
image024.png
image025.png
image028.png
image029.png
image030.png
image031.png
image033.png
image036.png

[redacted]
Sent: Monday, July 1, 2019 11:02 AM
[redacted]
Subject: FW: A Suicide Happened in UF-ECE Which Maybe Related to Academic Misconduct

[redacted]

From: Voice Huixiang <voice.for.huixiang@ieee.org>
Date: Monday, July 1, 2019 at 11:00 AM
To: [redacted]





Subject: A Suicide Happened in UF-ECE Which Maybe Related to Academic Misconduct

Dear [redacted]

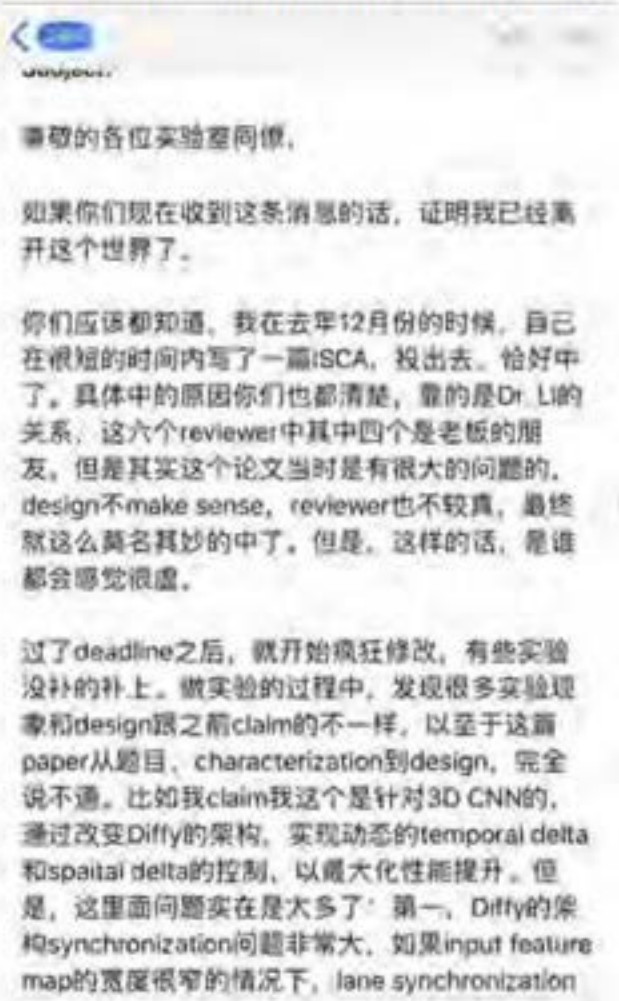
At June 13 2019, a suicide happened in the ECE faculty Tao Li's lab (IDEAL). A doctoral candidate, whose paper will be published in the coming ISCA conference, hanged himself in the lab.

As more and more information comes out, we find that there

should be a lot of hidden stories behind his suicide. The most important one maybe related to his struggling against an academic misconduct.

A suicide note was sent towards his friends, lab colleges, and especially his mentor Doctor Tao Li, a full professor (with preeminence professorship) in the Department of Electrical and Computer Engineering of University of Florida, also the third author of the paper mentioned in Huixiang's suicide note.

The original version of the suicide note is in Chinese:

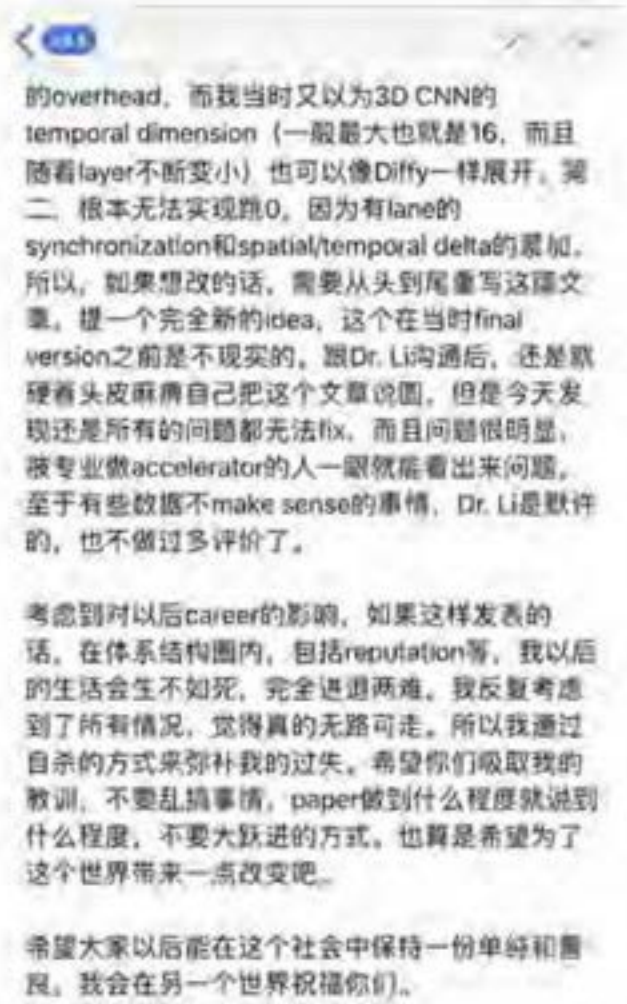


尊敬的各位实验室同僚，

如果你们现在收到这条消息的话，证明我已经离开这个世界了。

你们应该都知道，我在去年12月份的时候，自己在很短的时间内写了一篇ISCA，投出去。恰好中了。具体中的原因你们也都清楚，靠的是Dr. Li的关系，这六个reviewer中其中四个是老板的朋友，但是其实这个论文当时是有很大的问题的，design不make sense，reviewer也不较真，最终就这么莫名其妙的中了。但是，这样的话，是谁都会感觉很虚。

过了deadline之后，就开始疯狂修改，有些实验没补的补上。做实验的过程中，发现很多实验现象和design跟之前claim的不一样，以至于这篇paper从题目、characterization到design，完全说不通。比如我claim我这个是针对3D CNN的，通过改变Diffy的架构，实现动态的temporal delta和spaital delta的控制，以最大化性能提升。但是，这里面问题实在是太多了：第一，Diffy的架构synchronization问题非常大，如果input feature map的宽度很窄的情况下，lane synchronization



的overhead，而我当时又以为3D CNN的temporal dimension（一般最大也就是16，而且随着layer不断变小）也可以像Diffy一样展开，简二，根本无法实现跳0，因为有lane的synchronization和spatial/temporal delta的累加。所以，如果想改的话，需要从头到尾重写这篇文章。提一个完全新的idea，这个在当时final version之前是不现实的，跟Dr. Li沟通后，还是默硬着头皮麻痹自己把这个文章说圆，但是今天发现还是所有的问题都无法fix，而且问题很明显，被专业做accelerator的人一眼就能看出来问题，至于有些数据不make sense的事情，Dr. Li是默许的，也不做过多评价了。

考虑到对以后career的影响，如果这样发表的话，在体系结构圈内，包括reputation等，我以后的生活会生不如死，完全进退两难。我反复考虑到了所有情况，觉得真的无路可走。所以我通过自杀的方式来弥补我的过失。希望你们吸取我的教训，不要乱搞事情，paper做到什么程度就说到什么程度，不要大跃进的方式。也算是希望为了这个世界带来一点改变吧。

希望大家以后能在这个社会中保持一份单纯和善良。我会在另一个世界祝福你们。

Here we translated it into English (This is not a certified legal translation):

> *Dear fellow colleagues:*
>
> *If you get this message, that means I have already passed away.*
>
> *As you know, since last year December, I wrote an ISCA paper in a very short time and it was submitted and accepted very quickly. As all of you know the reason, it was owe to our professor Dr.Tao Li 's networking. Among the six reviewers of my paper, four of them are friends of Tao Li. But this paper has very severe issues: the design doesn't make any sense and the reviewers also pay no attention to it. The paper was accepted at no reason which can make anyone feel guilty in this case.*
>
> *After the deadline, crazy modifications of the paper were made and I started to make up for the missing experiments. During those experiments, I found that the phenomenon of the experiments and the design was different from what was claimed before, which made this paper doesn't make any sense*

from title to characterization and to design. For example, It was claimed that this (the accelerator) is targeted for 3D CNN, which can maximize the performance by changing Diffy architecture to achieve the dynamic control of the temporal delta and spatial delta. But there are too many issues with this. First of all, the Diffy architecture has a serious problem of synchronization. If the width of the input feature is too narrow, the overhead of lane synchronization ... . But it was assumed that the temporal dimension of 3D CNN (the maximum is generally 16 and it will decrease with layer) will expand with Diffy. Secondly, it can't skip zero, because of the synchronization of lane and the incremental of spatial/temporal delta. So if I want to make a change the whole paper need to be rewrite. It is unrealistic to propose a totally new idea before the final version. After I communicated with Tao Li, it turned out that I have to fix the paper by myself. Until today I am still unable to patch up any of those issues. These issues are too obvious which can be easily caught by any experts of accelerator. I have no words to comment that Dr. Li acquiesced to the data which makes no sense.

Considering that this will have an impact on my career in the future and my reputation in the area of Computer Architecture, my future life will be worse than death and I will be totally in a dilemma. I considered all the cases, I really can't work them around. In order to make up for the fault, I decide to suicide. I hope you can learn my lessons and don't mess around things. We shall never claim too much in the paper before we can really achieve it. I hope this will make a change in this world.

I hope you can keep simple and stay honest in this society. I will bless you in another world.

Best

Huxiang

After the tragedy, some dialogues between Huixiang Chen and his friends are exposed, which also shed some light on the his struggling against an academic misconduct and the intense relationship between him and Dr. Tao Li. (Translations here are not certified legal translation. To protect the information providers, we cover the content of their words.)

没法睡 I can't sleep

必须fix了才能睡 I have to fix them

我现在design都是错的 My design was wrong

妈的 Shit

六个reviewer瞎了眼
Those six reviewers were blind

把我paper收了
They accept my paper

May 22, 2019 23:31

不发对我老板影响很大
Withdrawing the paper will cause a big impact to my mentor (Tao Li)

他让我必须搞完
He (Tao Li) asked me that I have to finished it

跟我说了 He just said to me

May 22, 2019 23:37

真是生不如死啊 My life is worse than death

我觉得 I feel
我老板 My mentor (Tao Li)
没有学术道德 Has no academic integrity
我骨子里感到恶心 I feel disgusting
May 23, 2019 00:19
我真改的想死 I really want to die when patching up this paper
尽量吧 I am doing my best

圆不了的东西
I can't patch up the paper
嗯
Hmm
没事
It doesn't matter
我就是说 不用着急回
I said I won't respond in hurry
而且
And
我很serious在考虑离开实验室这个问题
I am seriously thinking about leaving this Lab
因为这算是我做了恶事情
Because this time I am doing evil
May 23, 2019 02:47
Even it is a top conference (ISCA 2019), so what?
即便是顶会 又so what
我现在有点固执了
I am a little bit stubborn now
真不想读了
I really don't want to continue my PhD
做学术本来是挺开心的事情
Doing research should be a happy thing
现在靠造假活着
But now, it relies on lie and fake
有啥意思
What's the meaning?
May 24, 2019 01:11

我好难受 I am feeling so bad
马上要结束了 It will finish soon
我最后这些数据实在是写不出来了
I really can't fabracating those data
真的好难啊 It is really hard

你应该能懂
You should know
这是一个paradox
It's like
a paradox
跑完了实验，也没有speedup
The experiment finished.
There is no performance speed up
所以只能在范围内做出来一点类似的可信的数据
So I have to fabricate some conviencable data in a range
嗯
Hmm
真的很揪心
Really sad
May 27, 2019 04:11
你知道这是一种什么感觉不
Do you know this feeling
就是说
So, like...

How is the talking with your mentor

你跟老板谈得咋样嘛

他死活不让我撤

he refused to withdraw my paper resolutely

还跟我说八月份

He said August

不吃饭不睡觉也得把paper给投出去

Even without eating or sleeping, I have to publish the paper

马勒戈壁

Shit!

？？？

这个论文 让我好好做ppt

I have to do PPT for the paper

August? submit for what?

八月是投什么

丢人也得上去讲

I have to do a speech even in shame

hpca

HPCA

他就是个商人啊
He is a business man

而且他现在也不关心这些paper
He doesn't care about these paper

也不帮我们改了
He doesn't help us

把关也不把
And no review for the paper

原则就是，实验室人一起上
And the principle is,
everyone writes paper

写个很多篇
writing a lot paper

哪篇中了算哪篇
no matter which
one get accepted

他逼我造假 如果我在deadline之前
投不出去的话
He push me to fake, if I can't publish
the paper before deadline

我也无怨无悔
I have no regrets

至少认真做了
At least I have
done my best

这样做的东西

Doing things like this

和汉芯造假

has no difference with

又有半毛钱区别么

faking in the 'Hanxin events'

[redacted]

[redacted]

I prefer not get the degree

我宁可不要学位

不仅仅是违背道德

This is not only violating my moral codes

而是局面不属于我控制范围之内

The result is out of my control

在我看来 他这种属于下三滥

From my perspective, his behavior is disgusting

毫无底线

Without any integraty

局面不受我控制
Things are out of my control

你觉得作为一个导师
Do you think as a mentor

纵容鼓动学生数据造假
He connived and encouraged his student faking data

是一个什么样的行为
What kind of behavior is this?

Jun 5, 2019 01:06

[redacted]

而想到我还需要在这种人手下做事
And I have to work under him

我就觉得 I feel

不敢想象 Unimagenable

Jun 5, 2019 10:42

弄完了 I finished (communicate with Tao li)

如何

结论就是，老板绝对不会撤稿
The result is he will never withdraw the paper

他不怕出问题?
He is not afraid of having problem

What's his opinion 他什么意见?

第一，毕业遥遥无期 First of all, I will never graduate
第二，处于精神崩溃的边缘 Secondly, My mental almost breakdown
其实也没事 Nothing else

这个事情如果挺得过去的话，我再坚持三个月试试 If I can survive from here, I will persist another 3 month
我刚才跟他吵了一架 I had a fight with him.
差点叫警察了 And the police almost come
他坚决不撤稿 He refused to withdraw the paper resolutely

Only a suicide note and several pieces of dialogues may not uncover all the truth. University of Florida and ECE department should have an elaborate and responsible investigation on this event.

Confidential

Attachment C – Final Paper Submitted to the International Symposium on Computer Architecture

3D-based Video Recognition Acceleration by Leveraging Temporal Locality

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*IDEAL Lab, University of Florida; †Guizhou University
[redacted]

Abstract

Recent years have seen an explosion of domain-specific accelerator for Convolutional Neural Networks (CNN). Most of the prior CNN accelerators target neural networks on image recognition, such as AlexNet, VGG, GoogleNet, ResNet, etc. In this paper, we take a different route and study the acceleration of 3D CNN, which are more computational-intensive than 2D CNN and exhibits more opportunities. After our characterization on representative 3D CNNs, we leverage differential convolution across the temporal dimension, which operates on the temporal delta of imaps for each layer and process the computation bit-serially using only the effectual bits of the temporal delta. To further leverage the spatial locality and temporal locality, and make the architecture general to all CNNs, we propose a control mechanism to dynamically switch across spatial delta dataflow and temporal delta dataflow. We call our design temporal-spatial value aware accelerator (TSVA). Evaluation on a set of representation NN networks shows that TSVA can achieve an average of 4.24× speedup and 1.42× energy efficiency. While we target 3D CNN for video recognition, TSVA could also benefit other general CNNs for continuous batch processing.

1. Introduction

The end of Moore's law [1] and Dennard scaling [2], and the consequently dark silicon phenomenon [3] has led to the end of rapid improvement of general-purpose program performance. Instead of improving the general-purpose computing, domain-specific architecture is considered the most effective way. Recent years, neural networks (NN) are gaining lots of interests as they achieve state-of-the-art performance on many tasks [4], including image recognition [5], speech recognition [6], video understanding [7] and analytics [8][9], autonomous driving [10][11]. Towards the domain-specific acceleration for better performance and energy efficiency, various hardware accelerators have been designed [12][13][14][15][16][17][18][19][20].

Given the recent fast development of neural network on image recognition, the deep learning-based approaches have also significantly improved video recognition performance. Action recognition from videos would require capture context from the entire video (i.e. a sequence of frames) rather than just capturing information from each frame [21]. Video recognition also received numerous attention from computer vision community [22][7][23][24][25][26], with different datasets developed for different domains [27][28][29]. Deep 3-dimensional convolution neural networks (3D-CNN) have demonstrated their outstanding classification performance in video recognition.

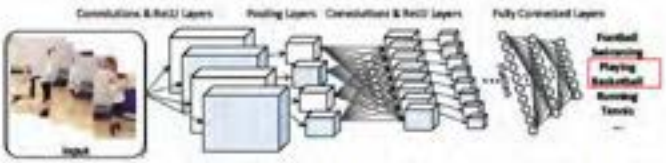


Figure 1. A real 3D CNN Model for video action recognition.

Video-based 3D CNN inferences the activity based on a sequence of frames extracted directly from the video. It involves the identification of different actions across video clips (i.e. a sequence of frames) where the action may or may not be performed throughout the entire duration of the video [21]. It has been tough for the following reasons: (1) High computational cost. For instance, a simple 2D convolution network for image classification for 101 classes has just ~5M parameters, whereas the same architecture inflated to a 3D structure results in ~33M parameters [21]. It also takes 3 to 4 days to train a 3D convolutional neural network on UCF101 datasets [27] and about two months on Sports-1M [7]. (2) Capturing long context action involves capturing spatiotemporal context across frames [21]. There is a local as well as global context (motion information) which needs to be captured for robust predictions.

The algorithm complexity and memory bandwidth demand of 3D CNN put great pressure on the processing speed. Different acceleration options have been leveraged to accelerate 3D CNN, including FPGAs [30][31], ASIC [32]. 3D CNN exhibits some characteristics that challenge the option of directly applying 2D acceleration option infeasible: (1) working set size exceeds on-chip memory; (2) 3D CNN is much more computation-intensive than memory-intensive based on the Roofline model [33]; (3) 3D CNN exhibits more reuse opportunities: it also has temporal dimensional data reuse besides spatial reuse.

Since video processing and analytics is popular in people's daily life, and video traffic is predicted to account for most of the internet traffic in the future [34]. Accelerating 3D CNN for video recognition will shed light on the development of future video analytics, saving power and making users' life easier.

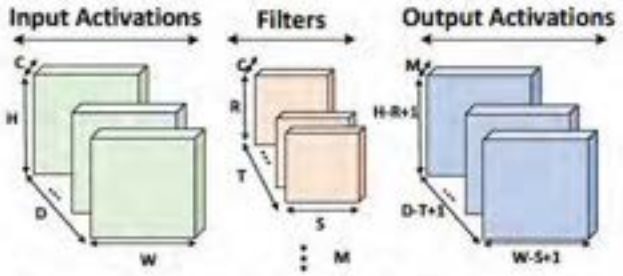


Figure 2. Illustration of 3D CONV. The illustration shows when stride=1, which is the most common case.

Thus, this paper explores the acceleration architecture of 3D CNN. 2D CNN accelerator mainly focuses on designing dataflow that exploits the spatial data reuse and across filters effectively. For 3D CNN, there is one more dimension: the temporal dimension, which indicates the data reuse across continuous frames. Since the change of consecutive frames sending to a 3D CNN are not arbitrary, there are large data overlaps, which exist in not only the first layer as continuous input frames, but also the input activations maps (imaps) within the intermediate layers of 3D NN. Towards this, we first conduct characterization and prove that: (1) there is large redundancy between imaps across the temporal dimension; (2) quantization of input activations could further increase the data overlap.

Towards this opportunity, we then leverage differential convolution across the temporal dimension, which operates on the temporal delta of imaps for each layer, and process the computation only using the effectual bits of the temporal delta. While using only the temporal delta dataflow could not benefit all layer's execution of 3D CNN, and it only benefits 3D CNN, we then propose a control mechanism to switch between spatial delta dataflow and temporal delta dataflow. We call this temporal-spatial aware accelerator (TSVA). It could not only cause higher speedup, but also makes the acceleration architecture general to all CNNs. In summary, we make the following contributions:

First, we study a very important CNN: 3D CNN for video recognition. Our characterizations show that large data overlap exists between *imaps* across the temporal dimension, and quantization of *imaps* could increase the overlap. This implies architectural optimization opportunities.

Second, we leverage the data overlap across the temporal dimension and process the computation of effectual items for 3D CNN efficiently. Then to further leverage both the spatial locality and temporal locality that makes our architecture general to all CNNs, we propose a dynamic control mechanism to switch between spatial delta dataflow and temporal delta dataflow dynamically.

Third, we evaluate across multiple 3D CNNs and some state-of-the-art 2D CNNs by comparing it with other NN accelerators [12][13][35], and show that our accelerator achieves an average of ×4.24 speedup and ×1.42 energy efficiency.

```
for m = 0 to M
  for d = 0 to Dout (temporal information: number of frames)
    for h = 0 to Hout (Row)
      for w = 0 to Wout (Column)
        for c = 0 to C
          for t = 0 to T
            for r = 0 to R
              for s = 0 to S do
                Filter=F[m][c][t][r][s]
                In-
put=In[c][d*stride+t][h*stride+r][w*stride+s]
                Output[m][d][h][w] += Filter * Input
```

Listing 1. 3D Convolution in 3D CNN.

The rest of this paper is organized as follows: Section 2 describes the necessary background for 3D CNN, and characterization the data overlap. Section 3 introduces the architecture design. Section 4 introduces the benefits of our architecture towards other general 2D CNNs. Section 5 evaluates our design. Section 6 concludes the paper.

2. Background and Motivation

2.1 3D Convolution Operation

The computation of 3D CONV is more complicated than that of 2D CONV, which can be described as follows:

$$O[m][h][w][c] = \sum_{c=0}^{C}\sum_{t=0}^{T}\sum_{r=0}^{R}\sum_{s=0}^{S} F[m][c][t][r][s] * In[c][d * stride + t][h * stride + r][w * stride + s]$$

Where F and In represents the $M\times C\times R\times S\times T$ dimension filter and $C\times D\times H\times W$ dimension input activation map. In each layer, a set of C input feature maps of size $D\times H\times W$ are convolved by M sets of $C\times Ksize$ filters ($Ksize = R\times S\times T$), outputting M feature maps of size $D_{out}\times H_{out}\times W_{out}$ while D_{out}=floor((D-T)/stride) + 1, H_{out}=floor((H-R)/stride) + 1, W_{out}=floor((W-S)/stride) + 1. D is the temporal dimension which indicates the number of consecutive frame sequences sending to the neural network for video recognition. For example, D is 16 for C3D network for the first layer's input. 2D convolution is the special case of 3D when D equals to 1 and T equals to 1. The computational complexity of the 3D convolution is much higher than 2D convolution: $2\times M\times C\times H\times W\times R\times S$ for 2D convolution, $2\times M\times C\times D\times H\times W\times R\times S\times T$ for 3D convolution. The pseudo-code of 3D CONV is shown in Listing 1 and illustrated in Figure 2 with stride equals to 1, which indicates the most common case (D_{out}=D-T+1, H_{out}=H-R+1, W_{out}=W-S+1).

The computation pattern of the FC layers in 3D CNN is a matrix-vector multiplication, which is the same as the FC layers in 2D CNN. CONV layer in 3D CNN is more computation-intensive and occupies more percentage than in 2D CNN. For example, C3D (including RELU) occupies over 99.6% of the computation time [31]. (2) the amount of intermediate data (i.e. psums) is much larger than the weights (356.7MB versus 66.5MB for C3D, even though C3D is still a small-scale network compared to other 3D CNN [36][37].

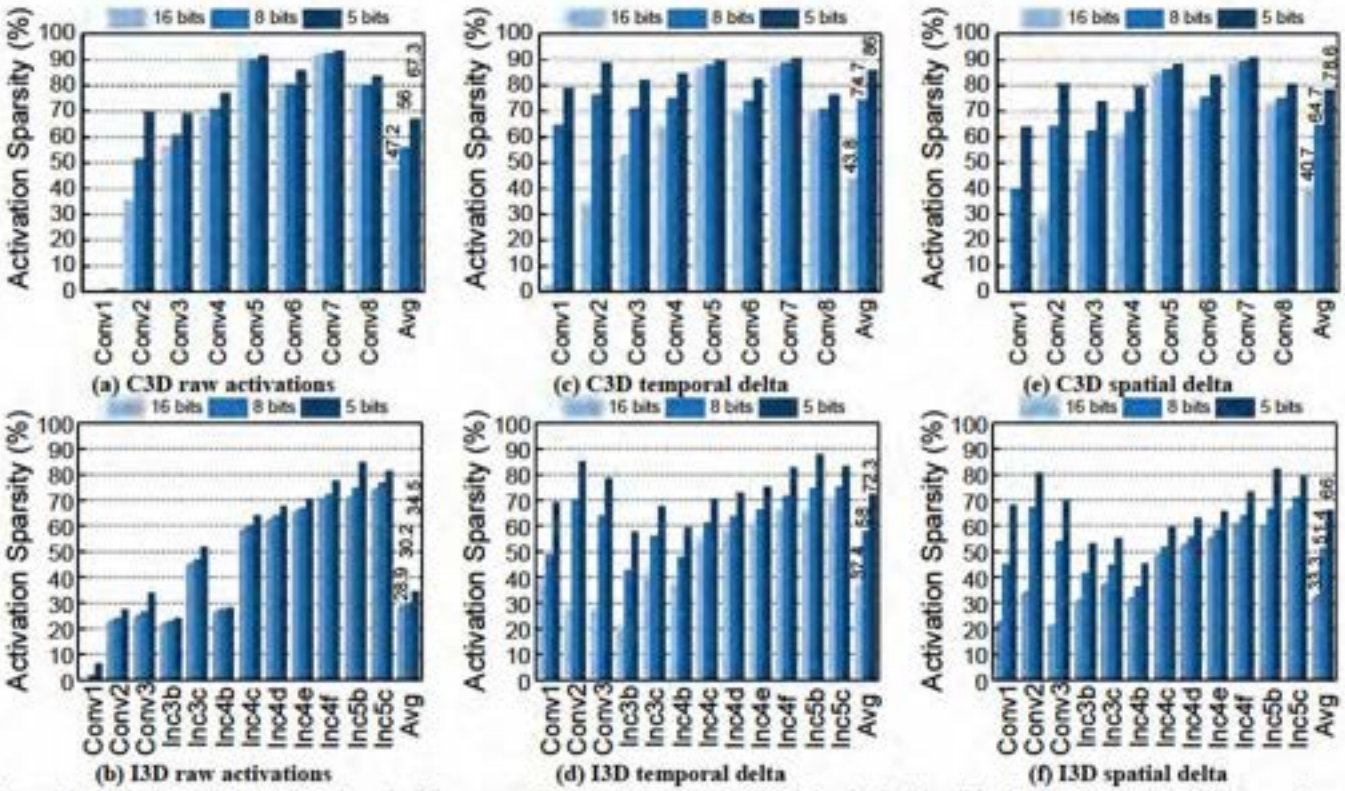


Figure 3. Sparsity of input activations (a, b), temporal delta (c, d), and spatial delta (e, f). "Avg" is the sparsity across all layers; inc stands for inception module [36]. The sparsity across all layers are denoted in the Figures.

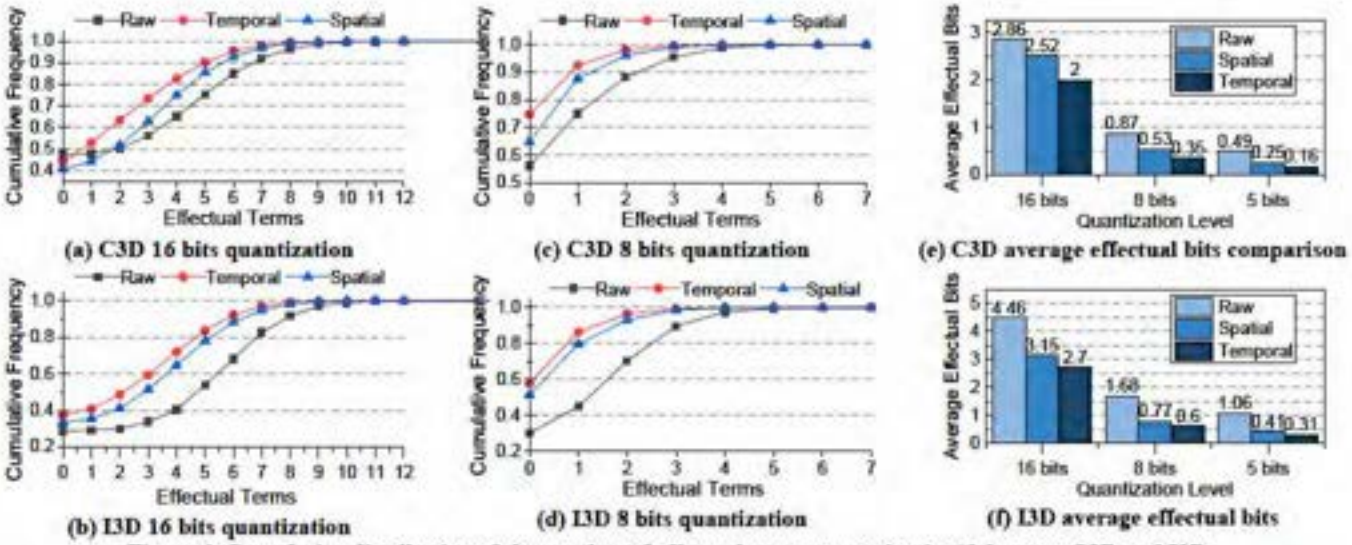
A typical CNN accelerator consists of three levels of hierarchy: (1) external memory, (2) on-chip buffers, (3) processing engines (PEs) and register files. The basic flow is to fetch data and weights from the external memory to on-chip buffer, and feed them into registers and PEs. After the PE computation completes, results are transferred back to on-chip buffers and to the external memory if necessary, which will be used as the next layer inputs.

2.2 Activation Sparsity in 3D CNN

Sparsity in a layer of CNN is defined as the fraction of zeros in the layer's weight and input activation matrices. Weight sparsity mainly comes from the pruning (unstructured [38][39] or structured [40]) process during training. There are already plenty of works on weight pruning algorithms [39][41][42] and hardware accelerators [16][43][12]. Activation sparsity occurs dynamically during inference and is highly dependent on the data being processed. To measure the activation sparsity, we execute two typical 3D CNNs: C3D [23] and I3D [37]. We instrument code to inspect the activation sparsity of the CONV layers. Quantizing [44][45][46][35] the input activations within a specific range could reduce the computation overhead with the inference accuracy decreases within the minimal range. 16 bits storage of the activations is the baseline, while weights are always stored as 16 bits in our paper based on the well-recognized 16-bit multiplier [13]. Prior works have shown that linear quantization [39] to 8 bits [47][48][49][50] does not cause accuracy loss, and further quantizing the input activations to fewer bits (more or equal than 5) cause less than 1% accuracy loss. Our experiment also verified that, we run C3D with a pre-trained network model (we didn't do retraining) and then evaluate the accuracy using UCF101 [27] datasets. The accuracies are 88.3% for 8 bits, 87.7% for 5 bits (0.7% accuracy loss), and 84.5% when further quantizing to 4 bits (4.3% accuracy loss in this case), which shows that quantizing the imaps less than 5 bits could cause intolerable accuracy loss. I3D also exhibits similar trends. Thus, we choose 16, 8 and 5 bits to analyze the input activation characteristics.

Figure 3(a) and 3(b) shows the activation sparsity across the CONV layers, referenced to as the y-axis. (1) First, 3D CNN has similar activation sparsity characteristics with 2D NN [51][17]. For 16 bits, the activation sparsity is 47.2% for C3D and 28.9% for I3D. (2) Activation sparsity varies across layers, with sparsity typically low in the earlier layers and increase gradually in later layers. (3) With quantization, the activation sparsity increases from 47.2% (16 bits) to 56% (8bits), and then 67.3% (5 bits) for C3D, and 28.9% (16bits) to 30.2% (8bits), and then 34.5% (5 bits) for I3D.

Prior works have leveraged the activation sparsity to design hardware accelerators [19][51], either by prediction-based [19] or speculation-based method [51]. However, none of them considered combining it with temporal locality: the high degree of the input activation redundancy across the temporal dimension. Since 3D CNN adds the temporal dimension D (D is 16 consecutive frames for C3D and 64 for I3D), which provides acceleration opportunities. Next, we



(a) C3D 16 bits quantization (c) C3D 8 bits quantization (e) C3D average effectual bits comparison

(b) I3D 16 bits quantization (d) I3D 8 bits quantization (f) I3D average effectual bits

Figure 4. Cumulative distribution of the number of effectual terms per activation/delta over C3D and I3D.

characterize the temporal locality and corresponding effectual bits.

2.3 Input Activation Temporal Locality

Video is a sequence of consecutive frames. There are large overlaps between these consecutive frames, which is the temporal locality. The input activations $In[D][C][H][W]$ are represented as: $In[d][C][H][W]$, $In[d+1][C][H][W]$, $In[d+2][C][H][W]$..., d=(0,1,2.....D-1). We define the temporal delta T_delta as:

$$T\_delta = In[d+1][C][H][W] - In[d][C][H][W]$$

If an element in T_delta is zero, the input activations in the same position of $In[d+1][C][H][W]$ and $In[d][C][H][W]$ are the same. Thus, the sparsity of T_delta represents the overlap/redundancy between consecutive input activations ($In[d+1][C][H][W]$ and $In[d][C][H][W]$).We characterize the sparsity T_delta across all the layers, which are shown in Figure 3(c) and 3(d).

(1) First, the sparsity of temporal delta tends to be more compared to the raw activations across layers, especially when the bits are quantized smaller. Specifically, the first few layers tend to have higher sparsity (especially after quantization) comparing to raw activations, while the latter layers tend to be a little lower. Note that the reason for the low sparsity for the first two CONV layers is caused by data normalization. Removing normalization would give higher sparsity for 16 bits: 56% on average, with first two layers 56% and 49.6%; while normalization has less effect on 8- and 5-bits quantization, with 77% and 87% respectively. Second, the temporal delta sparsity dramatically increases with quantization, i.e. quantization makes consecutive imaps more redundant. Third, compared to raw activation, temporal delta tends to be sparser with quantization: 56% (8 bits) and 67.3% (5 bits) for C3D raw activations to 74.7% (8 bits) and 86% (5 bits) for C3D temporal delta for example.

Related work [52] leveraged the spatial data locality of adjacent CONV window to design DNN accelerators. We further analyze the characteristics of spatial delta (which are defined as $S\_delta=In[D][C][H][w+1]-In[D][C][H][w]$, w=(0,1,2,.....W-1).), and show that temporal delta tends to be more sparse compared to spatial delta, as shown in Figure 3(e) and 3(f).

(2) Another insight is that temporal delta needs less effectual bits than raw activations. Let's first give the definition of effectual bits: a multiplication $a \times w$ of an activation a with a weight w. If a is represents by p bits, the multiplication amounts to adding p terms where the i-th term is the result of multiplying the i-th bit of the multiplier a with the shifted by i-th bit positions multiplicand w:

$$a \times w = \sum_{i=0}^{i=p} a_i \cdot (w \ll i)$$

It is only those bits of a are 1 that yield effectual work. The effectual bits are defined as the bits in a that is 1. Figure 4(a)-(d) shows the cumulative distribution of the number of effectual terms per raw activation, temporal delta spatial delta for 16- and 8-bits quantization respectively across all neural network layers. The distribution is measured over all input data. These figures show that there is significant potential for reduction in the number of computations needed if temporal delta is processed using bit-serial multiplier [46][35] as temporal deltas contain considerably few effectual terms per value. Figure 4(e) and (f) show the average effectual bits under different quantization levels: temporal delta contains the lowest effectual bits on average, which indicates potential speedup. For example, under 8-bit quantization, average effectual bits for raw activations and temporal delta is 0.87 and 0.35 for C3D, and 1.68 and 0.6 for I3D, which indicates ×2.49 and ×2.8 potential speedup. To be specific, assuming that a is an activation of $In[d][C][H][W]$, a' is the corresponding in the same position of $In[d+1][C][H][W]$. Rather than calculating $a' \times w$ directly, we could instead calculate it relative to $a \times w$:

$a' \times w = (a \times w) + (a' - a) \times w = (a \times w) + (\Delta a \times w)$. Note that if we change d to w,

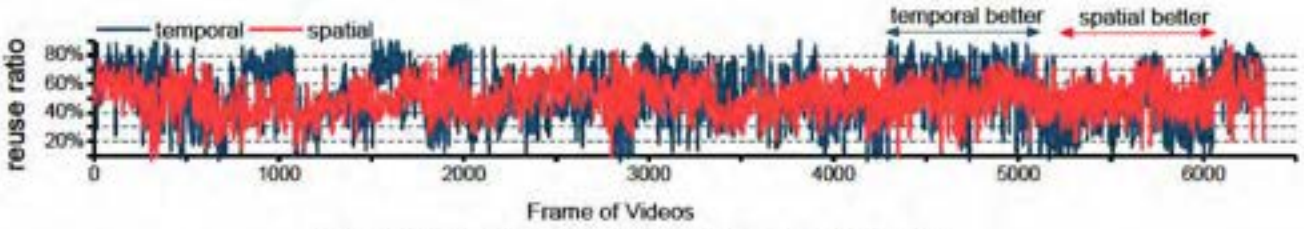


Figure 5. Reuse ratio across different input frames of UCF-101.

S_delta=*In*[*D*][*C*][*H*][*w*+1]-*In*[*D*][*C*][*H*][*w*], *w*=(0,1,2,.....W-1). This is called S-Flow, which could also be applied in 2D CONV.

(3) Third, even though on average temporal delta tends to have sparser and contains less effectual bits than spatial delta, it still varies across different inputs. We argue that dynamic control logic to change between spatial delta dataflow (S-Flow) and temporal delta dataflow (T-Flow) should be leveraged. First, figure 5 shows the computation reuse ratio across spatial dimension and temporal dimension for the different input in UCF-101 [27] datasets. As discussed previously, temporal delta on average has better sparsity and less effectual bits on average, but the benefits also vary across different inputs. Some inputs benefit more from T-Flow (most), while others benefit from S-Flow. Second, in some layers, D is very small (ranging from 2-4 for the last four layers of C3D). If directly using T-Flow, makes the PE along the row (as shown later in our design) underutilized, since the temporal/spatial dimension is unrolled to 8 (P_d or P_w) in our design. Thus, to maximize the benefits, a dynamic control mechanism to switch between spatial and T-Flow is needed, varying across different inputs and layers.

Prior works leveraged the temporal locality of consecutive frames in continuous mobile vision to design accelerators [53][54]. However, they do not consider the additional effectual bit savings. Besides, they only consider the temporal locality of *imaps* of the 1st CONV layer. We leveraged a tile-based computation dataflow that can process temporal delta bit-serially only on effectual bits. Besides, we leverage a dynamic control mechanism to switch between T-Flow and S-Flow to maximize the benefits. This can not only be applied to 3D CNNs, but also to other general 2D CNNs.

3. Architecture Design

3.1 Baseline Accelerator

We first describe our baseline accelerator bit-parallel value-agnostic accelerator (BVA) modeled after *DianNao* [12] and *DaDianNao* [55]. We choose this because this is a well-understood design and inspires many new accelerators later. Figure 6 shows a tile of BVA, which has a weight buffer (WB) which provides 16×16 weights per cycle, one per weight lane. The tile also has an input activation memory (NB_{in}) which provides 16 neurons per cycle, one per activation lane, and an output activation buffer (NB_{out}) which can accept 16 output activations per cycle. We use P_c and P_w to denote the number of input activations and weights to be processed in each cycle, P_c=16, P_w=16 here in each tile. In each cycle, 16 activations are broadcasted to 16 filter lanes. Only one AM slice (16-activation slice) operates per cycle and all tiles see the same set of 16 activations. The neuron buffer (NB) is single-ported and banked, which is the last-level on-chip SRAM. Half of the banks are used for the *imaps* and the other half for the *omaps*. Both activations and weights are read and written to the off-chip memory. The number of filters (P_w), tiles (Figure 6 is just one tile), weights per filter (P_c), precision B (Figure 6 shows the precision as 16-bit) are all design parameters that are configurable as necessary.

BVA features a dataflow that performs P_c input feature maps and P_w output feature maps in parallel. At each clock cycle, it handles P_c imaps and P_w omaps, one activation of each output feature map, and one weight of each kernel. It is used not only in *DianNao* [12] and *DaDianNao*, but also in many state-of-the-art FPGA accelerators [56][57][58]. We name this as the MIFM-MOFM dataflow.

For 3D convolution, there are some challenges when directly applying the baseline accelerator: (1) Put every data including *imaps*, *omaps*, and weights on chip is infeasible since 3D CNN has two more dimensions that make the working dataset exceed the on-chip memory easily. Actually, this is a problem for not only 3D CNN, but also 2D CNN [59]. Loop tiling should be leveraged. (2) *DaDianNao* [55] is based on the premise that the storage needed for the input activations are far less than the weights. However, for 3D CNN, this is not the case. For example, the storage requirements of input activations exceed the weight size for the first four CONV layer. Memory fragmentation overheads will be larger if applying a uniform on-chip buffer design and partition. (2) Since this dataflow is value agnostic, there is no way to leverage the temporal dimension for 3D CNN, and the

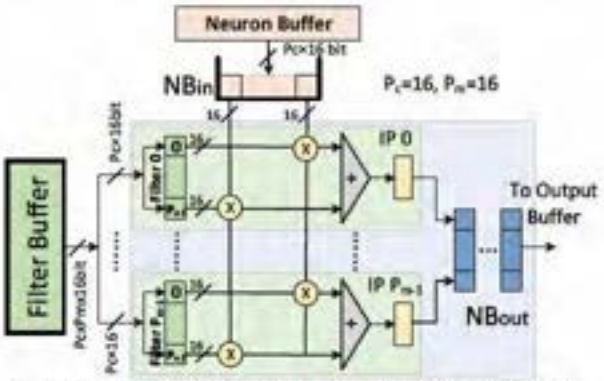


Figure 6. Baseline bit-parallel value-agnostic accelerator.

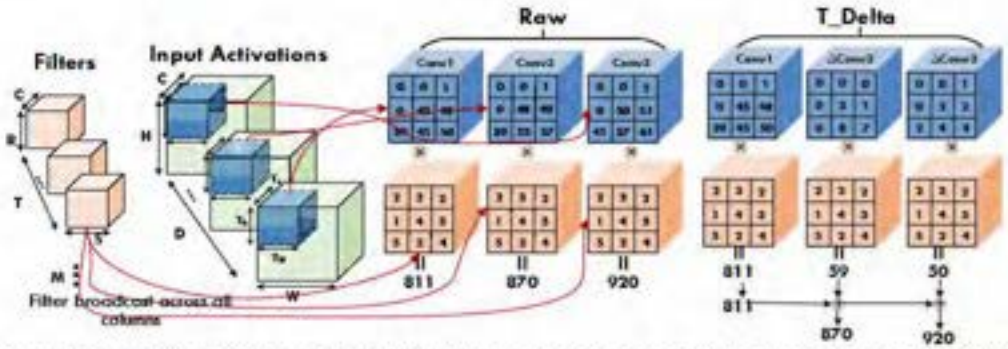


Figure 7. Differential convolution of the temporal delta output activation propagating across the temporal (D) dimension from one column to the next, each column corresponds to one *i*. *i*=0,1,2…*D*-1.

effectual bits reduced by the temporal delta. These factors are needed to be considered for accelerator design.

3.2 Delta Value-Aware Accelerator

In Section A-E, we first discuss our design using T-Flow, and later we add the design about flexibility.

A. Architectural Factors to be Considered

Loop Tiling. Since the on-chip buffer is not enough to store the feature maps and weights for 3D CNN. The efficient way should be to tile the data so that each tile fits the on-chip buffer. We use T_x to represent the tile of a parameter X. When the *imap* does not fit on chip, the input activation of $[C, D, H, W]$ should be broken into tiles of $[T_c, T_d, T_h, T_w]$. When not all M filters fit in on-chip memory, the $[M, C, T, R, S]$ should be broken into tiles of $[T_m, T_c, T, R, S]$. T, R, and S are generally small values (that ranges between 1 and 7 [23][36]) and not considered for tiling. Since Section 2 already characterizes that the data reuse along the D dimension is high. To ensure the high performance along with the temporal delta calculation, we want the data along the D dimension to fit into the on-chip buffer as large as possible. For example, if the input activation buffer is 108 KB (which the total SRAM of Eyeriss [15]). CONV2 layer in C3D has the largest input activation size: C=64, D=16, H=56, W=56 (activations stored using 1 Byte), choosing a tile factor of T_c=64, T_d=16, T_h=10, T_w=10 is more favorable than T_c=64, T_d=4, T_h=20, T_w=20. We cannot store all the input activations and weights on-chip. As discussed previously, we opt T_d as close as D. While the first tile of $In[T_h][T_w]$ and the next tile have overlap along H-dimension or W-dimension (referred as "data halo" [60]), we opt to take advantage of the overlap and do not re-fetch the overlapped region in the H- and W-dimension.

Loop Unrolliug/Parallelizatiou. While tiling ensures loading the data on-chip partially with better data reuse, loop unrolling ensures some dimension can be spatially expanded across PEs to ensure the parallelizing multiply-and-adds. We leverage MIFM-MOFM dataflow that unrolls along the C-dimension and M-dimension, and extend it by unrolling along the D-dimension with unroll factors P_c, P_m, and P_d respectively. T_c, T_m, T_d, T_h, T_w denotes the tiling factor to define the on-chip buffer size, P_c, P_m, and P_d are not necessarily equal to T_c, T_m, and T_d. But we are sure: $P_c \le T_c, P_m \le T_m, P_d \le T_d$. For example, as discussed in Section A, T_d should be as close as D to maximize temporal reuse. However, P_d should not since D ranges as long as 64 in I3D, if we choose the largest one, there will be no design space for P_c and P_m due to area limitation. As for P_c and P_m, *DianNao* [12] has P_c=P_m=16 with area 3.02 mm^2, *DaDianNao* [13] has P_c=16, P_m=256 with area of 67.7 mm^2 in total. These parameters can be configurable based on chip area, design purposes, and using scenarios.

B. Temporal Delta Convolution

After tiling and unrolling, we consider the temporal delta convolution on-chip: for a given output activation $out(m, d, h, w)$, it is possible to compute $out(m, d+1, h, w)$ differentially using the equation as follows:

$$out(m, d+1, h, w) = out(m, d, h, w) + CONV(filter[m], \Delta In)$$

ΔIn refers to the element-wise deltas of the *imap* windows corresponding to $out(m, d+1, h, w)$ and $out(m, d, h, w)$:

$$\Delta In(m, k, i, j) = In(c, k + stride * (d+1), i + stride * h, j + stride * w) - In(c, k + stride * d, i + stride * h, j + stride * w)$$
$$c = 0,1,2 \ldots . C$$

stride is the stride between two adjacent *imap* window. Figure 7 shows an example of differential convolution, which applies a 3×3 on three convolution windows along the temporal dimension (D). While all columns on the T-Flow architecture shares the same filters, each column processes one convolution activation window along the D-dimension. Direct convolution directly applies to the raw activations; however, differential convolution only computes the raw activations for the first window and temporal deltas on the rest. All three convolution windows are computed concurrently. Then the differential convolution is constructed in a cascaded fashion, as shown in the rightmost part of the figure. First, the $\Delta CONV2$'s output activation is calculated as 59, and the $\Delta CONV3$'s output activation is calculated as 50. The output activation of CONV2 and CONV3 is calculated by adding 811+59=870, and 870+50=920.

C. Basic Processing Engine (PE)

The basic PE builds upon the *Bit-Pragmatic* accelerator (PRA) [35], which processed only effectual bits of input activations bit-serially, as shown in Figure 8. After loading P_c×8 bits (P_c=16, activations stored as 8bits) input activations,

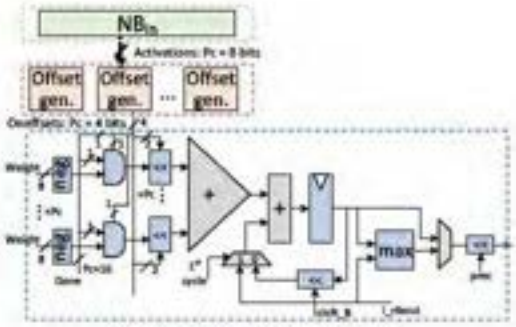


Figure 8. Basic bit-serial PE.

the offset generators convert the activations into a stream of effectual powers of two after applying a modified booth coding. PRA multiplies a weight of the power of two or *oneffset* each cycle using a shifter. To rate match the throughput of bit-parallel baseline, we unroll P_d to 8 since the activations are stored in 8-bit. In that way, $P_c \times P_d$ activations can be computed concurrently in multiple bit-serial cycles. PRA uses an optimized two-stage shifter scheme, during which each *oneffset* consists of 4 bits: 2-bit for the one-offset, 1 sign bit and 1 valid bit. Each bit-serial PE has P_c-input adder tree and P_c-shifters (instead of multipliers). Each of them shifts the weight directed by the offset. Multiplying activations by filters is implemented by feeding the activations bit-serially using the generated *oneffsets*, and weights bit-parallelly.

D. Scale-out Design

We present the scale-out design as shown in Figure 9, where the PE is duplicated in two dimensions to improve the processing throughput. Since PE uses a bit-serial multiplier to perform multiplications only on the effectual bits, it takes multiple cycles to accomplish one multiplication. Even though the average is only 2-3 cycles, in the worst case, it can still take up to 8 cycles (when one input activation is 11111111) to calculate one product. To maintain the comparable performance of the baseline bit-parallel accelerator, we need to simultaneously process P_d output activation (only the first one is raw output activation, the rest are output activation of the temporal delta) along the D-dimension. As shown in Figure 9, the vertical parallelism granularity is the number of *omaps* P_m, the horizontal parallelism granularity is P_d. The parallelism of P_c has already been discussed in Section C, which is hidden inside the PE itself. The red arrow shows the cascaded accumulation along the temporal dimension.

E. T-Flow

The parallelism of the temporal dimension offers a multitude of options for processing neurons in parallel. We opt to process P_d windows in parallel using a neuron brick to from the window in the same row and column pointwise, so that the accelerator can process $P_c \times P_m$ output neurons in parallel. For example, for a layer with stride 1 in the D-dimension, the accelerator can process P_d neuron bricks[1] $InB(c, d, h, w)$, $InB(c, d+1, h, w) \ldots InB(c, d+P_d-1, h, w)$. Where each column processes the same convolutional window along the D-dimension. The first CONV window is calculated using the raw activations, while the rest along the column is computed using the temporal delta. We conservatively unroll P_d to 8 to compensate for the cycle loss by bit-serial processing.

Figure 9. Scale-out USPE array, one Processing Unit (PU).

In this architecture, we only need to calculate the first imaps in the D-dimension and the remaining outputs along D differentially. We do this so that we can buffer the data along D completely using the height T_h and width T_w. Once all the input activations along $T_h \times T_w$ are consumed, the next sets of $T_h \times T_w$ input activations are loaded on-chip. The on-chip SRAM is double-buffered so that the on-chip MAC computation can be pipelined with the loading of the next set of data from off-chip.

The accelerator computes each output in the temporal dimension in two phases: (1) first, T-Flow calculates the first imap using raw data in parallel with computing the rest using the temporal delta; (2) second, the data are propagated in cascaded fashion with just a single addition per output. Since the first phase needs tens of hundreds of cycles, the second phase just takes several cycles to finish using a set of adders. The second phase can pipeline with the computation of the next set of windows along the temporal dimension. The data path of the second phase for cascaded accumulation is shown in Figure 9 as the red arrow.

We use the scheme of store "the first column input activations as raw, and the rest as deltas" way. Since storing all values along the D-dimension as raw activations incur recomputing overhead every time activations are read out. Besides, this can save additional off-chip memory traffic. Each column's NB_{out} refers to the output neuron brick of next layer. We use a SIMD engine, $Delta_{out}$, containing (1) a P_d-to-1 multiplexer, (2) ALUs to perform activation function to generate the activation deltas of the next layer, and (3) output activation neuron brick buffer. Computing the delta bricks of the next layer contains two phases: (1) read out the output bricks to the stride ($Stride_{next}$) left to NB_{out}, going through the NB_{out}, and store them into the output brick buffer of the

[1] The neuron brick $InB(c, d, h, w)$ equals to $InB(c, d, h, w)$, $InB(c+1, d, h, w) \ldots InB(c+P_c-1, d, h, w)$.

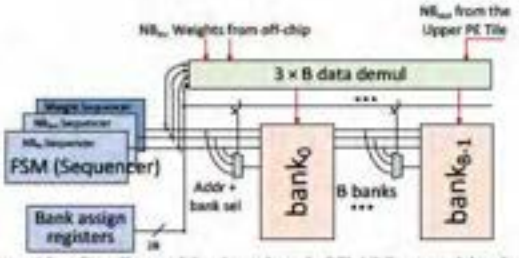


Figure 10. Configurable last-level SRAM, on-chip buffer. Blue blocks are programmable. The bank assign logic outputs a 2B-bit vector to indicate whether each bank belongs to input, output or weight.

engine; (2) reading the output brick of current column's NB_{out}, passing through the activation function, and use the SIMD-adder to perform element-wise subtractions to generate delta of next layer, and then store them into the last-level on-chip SRAM. The delta values can be stored as dynamic precisions [61] of groups to reduce off-chip energy.

Supporting S-Flow: note that all the above discussions from Section A-E refer to temporal delta dataflow. To support spatial delta dataflow, we just need to replace all the above discussions relating to d to w. That is, processing the spatial delta (instead of the temporal delta) of different input CONV window along W-dimension. The loop unrolling factor is P_c, P_m and P_w. P_d is replaced with P_w, which both indicates the PE columns in the scale-out design in Figure 9. Next, let's talk about configurability.

F. Configurability

Configurable last-level on-chip SRAM: The goal of providi ng buffer configurable on the last level on-chip SRAM is to consider that the optimal tile size (input activations, output activations, and weights) varies across layers. I.e. Since the on-chip SRAM is fixed after design decision is made, for one layer, the on-chip buffer should be allocated more to the activations and less to the weights, and for other layers, the on-chip buffer should be allocated more to the weights and less to the activations. Configurability allows that and minimize the internal fragmentation. The design is only used in the last-level SRAM. Banks are allocated to each data type contiguously, and "Bank Assign" registers are configured at each layer start time to denote the range of banks used to store each data type. The parallel demultiplexer is used to index into and read/write data into/out of each group of banks. The output (read) mux is replicated for each of the three types reads one word per access, there are no bank conflicts. Programmable FSMs (Sequencers) are used to generate address patterns into each group of banks. High-order address bits, along with the bank assignment registers, determine which bank is responsible for each type. We configure this with 16 banks, and banking does not show very little overhead [62]. The traffic between the last-level SRAM and the tiles of PUs (as shown in Figure 9) are implemented through NoC. The NoC manages the data delivery between buffer and PE arrays. It is implemented using broadcast style network.

Dyuamic switch between S-Flow and T-Flow: The difference between T-Flow and S-Flow [52] is: (1) the former is unrolled into P_c, P_m, and P_d (current number of frames unrolled in temporal dimension), the latter is also unrolled into P_c, P_m, and P_w (concurrent number of adjacent CONV window unrolled in spatial dimension W). (2) The former opts to accommodate enough *imaps* across the D-dimension by making T_d as large as possible; while the latter accommodates enough *imaps* by making T_w as large as possible.

The priority of loading data on-chip along which dimension first is decided by the control logic of the on-chip buffer, which is decided by the loop order $[d, h, w, m, c]$. Thus, the control logic of the on-chip buffer decides either the order of loading which on dimension first complete on-chip.

Loop order determines the sequential data loading order of the CONV loops. There are two kinds of loop order: intra-tiling and inter-tiling loop orders. Inter-tiling loop orders determine the data movement from off-chip memory to on-chip buffer. The intra-tiling loop order determines the pattern of data movement from the on-chip buffer to PEs. We consider the inter-tiling loop orders, which indicates the dynamic FSM (sequencer) in Figure 10. To dynamically switch between S-Flow and T-flow, we leverage a dynamic FSM to generate addresses into the on-chip buffer.

The sequencer is used to generate address into the on-chip buffer, count how many MACCs to perform, and when to read/write psums relative to performing MACs, when processing all tiles are done. When the loop order of loading data on-chip changes, loop bounds and memory access to each tile changes. To ensure the control flexibility, the FSM is programmed by setting two sets of configurable registers that denote the loop bounds and loop steps and use loop counter to iterate between the specified loop orders. I.e. the loop bound for $[D, H, W, M, C]$ is [0->D, 0->H, 0->W, 0->M, 0->C], while the loop step is $[T_d, T_h, T_w, T_m, T_c]$. The FSM walks through the loop using the loop bounds and accumulates a step into an output register. For the L-level (L=5) loop, the user specifies bounds $b_0,\ldots b_{L-1}$, and steps $s_0,\ldots s_{L-1}$. And the iteration indexes are $i_0,\ldots i_{D-1}$. The data loading order behaves like the software iterations. When entering each state, the FSM outputs the current value in the output register and one of the steps s_j is added to that register for the next iteration (similar to [32][63]). j equals to which loop is currently terminating. Different loop orders and steps give different address sequences need by the on-chip buffer.

There are two different kinds of loop orders and steps to choose for the registers, which are determined by the S-Flow and T-Flow. We leverage the offline software optimization framework [64] that pre-analyzes 3D CNNs and finds the optimal tiling and inter-tiling loop order of S-Flow and T-Flow, with S-Flow has restrictions that W=T_w, T-Flow has restrictions that D=T_d. We use two signals: "temporal_signal" and "temporal_flow" signal to choose whether to use T-Flow or S-Flow. Before entering the CONV layer, the input is first profiles to compare the reuse ratio of spatial delta and temporal delta: if the temporal delta is sparser, "temporal_signal" is set on, else set off. Then for each layer, if temporal_signal is set on, and D>=the number of PE columns, temporal_flow

signal is set on and set the optimal T-Flow's loop order and tiling in the on-chip buffer's sequencer, else always set temporal_flow signal to off, indicating to use S-Flow and set the optimal S-Flow's loop order and tiling in the sequencer. With this control flow, we ensure the optimal off-chip loading energy efficiency.

The temporal_flow signal also controls the unrolling factors. The computation order for S-Flow is p_w->p_m->p_c, and for T-Flow is p_d->p_m->p_c. To achieve that, we also change the data address generation pattern from the on-chip buffer to PEs. For T-Flow, different columns of PEs in the scale-out design are loaded with the inputs corresponding to different CONV windows in the *D*-dimension; for S-Flow, different columns of PEs are loaded with the inputs corresponding to different CONV windows in the *W*-dimension. Besides, 2D CONV is directly supported using S-Flow by setting temporal_flow to off.

Note that under our control flow, only two cases can happen for all layer's execution: (1) the former layers use T-Flow, the latter layers use the S-Flow. In this case, during the layer that switches from T-Flow to S-Flow in the next layer, the spatial delta value of the next layer needs to be computed separately. (2) all layers use S-Flow. In this case, all inputs are stored as spatial delta.

4. Benefits to Other CNNs

Our TSVA dataflow could not only benefit 3D CNNs, but also 2D CNN inferences. First, for those workloads running under continuous mobile vision scenario, pixel changes across continuous frames are not arbitrary. Also, in most cases, several continuous frames contain the same objects to be detected. Thus, it is possible to send multiple frames into neural networks and fuse several imaps (with *D* larger than 8) running concurrently into the neural networks using T-Flow if the users care more about throughput instead of latency. In that case, lots of redundant computations can be saved. Based on the statistics published by Google, at least 29% of Google's data center workloads are sequence processing. Besides, S-Flow can be directly applied to 2D CNN.

5. Evaluation

This section evaluates the performance and energy consumption of TSVA. First, we present our evaluation methodology. Second, we present our speedup by TSVA. Then, we present the area information, power breakdown, energy efficiency, and off-chip memory energy savings.

A. Evaluation Methodology

We have developed a cycle-accurate simulator to model the performance of all architectures. We model an accelerator of four tiles. The designs are implemented in Verilog and synthesized through the Synopsys Design Compiler [65], with the TSMC 65nm library. We use CACTI [62] to model the area and power consumption of the on-chip SRAM memories. The accelerator frequency is set at 1GHz. We model a DRAM with 4GB LPDDR4-2400 channels, the DRAM energy is estimated using information in Micron technote [66]. We compare our design with state-of-the-art schemes, including the BVA tile design by *DianNao* [12] and *DaDianNao* [13], bit-serial accelerator *Bit-pragmatic* [35]. Since our accelerator only targets inference, as prior work claimed that 8 bits is already good enough for inference [50]. We store the weights/activations using 8 bits, both for the baseline and our design. We further compare the speedup when the activations are quantized to 5 bits.

Table I. Parameters for the accelerator

# of Tiles	4
SRAM Banks	64KB×16
Technology	65nm
Off-chip Memory	4GB LPDDR4-2400
Filters/Tile	16
Weights/Filter	16
Frequency	1GHz
NB_{in}/Tile	2KB
NB_{out}/Tile	2KB

The hardware unrolling parameters for the baseline BVA design is 4 PU tiles with each P_c=16, P_m=16. To match the performance, for bit-serial design, we choose a 4 PU tiles with each PU's P_c=16, P_m=16, with P_d=8. There are total 64KB×16 banks, which works as the last-level on-chip SRAM to store input, output, and weights. The data dispatcher, offset generator, engine for calculating and cascading delta value, and control logic also has some overhead that need to be considered. The default configurations are reported in Table I.

B. Evaluated Networks

We evaluated the following 3D CNNs based on their popularity and state-of-the-art research: (1) C3D [23], one of the most widely used 3D CNN for video recognition by Facebook. To evaluate C3D, we use videos from UCF101 [67] benchmark suite; (2) I3D [36], since it currently holds state-of-the-art results on Kinects [36] video dataset. (3) 3D ResNet-50 [37], a 3D version of ResNet-50. We also use UCF101 dataset for 3D Resnet-50; (4) YOLO [68] and SSD [69], two most widely used object detection neural networks. The public object detection benchmarks (Pascal VOC or COCO datasets) cannot be used since they mainly contain standalone images. Instead, we capture a series of videos and extract image sequences. Each image is manually annotated with bounding boxes and labels. We fuse 8 frames as a batch for every layer's execution. (i.e. D=8, T=1).

C. Speedup

We first compare the speedup of TSVA with the baselines. Note that the baseline BVA also use 8-bit multiplier. The bit-serial always unroll and processes different neuron bricks along the *W*-dimension (P_w). The speedup is shown in Figure 11, which mainly demonstrates the speedup caused by reduced effectual bits processed. On average, the speedup is 1.35× towards bit-serial, and 4.24× towards BVA. The speedup is caused by the dynamic control between spatial delta and temporal delta to maximize the delta's effectual bit saving in computation. To further shows the benefits of TSVA, we quantize the input activations to 5-bits to consider

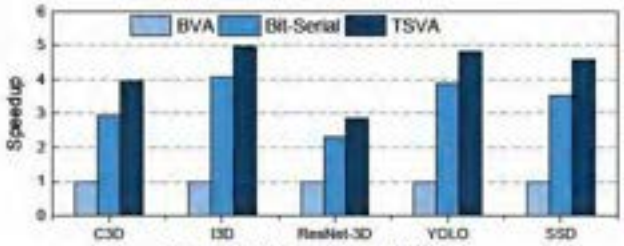


Figure 11. Speedup of TVSA.

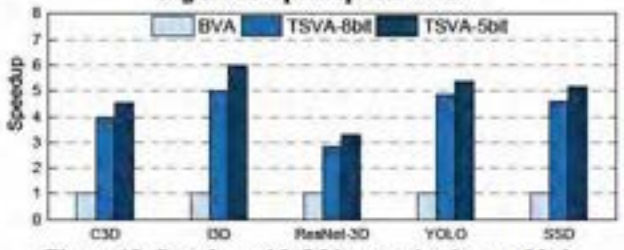


Figure 12. Speedup with 5-bit quantization enabled.

the speedup with a little loss of NN accuracy. As shown in Figure 12, it further brings a speedup of an additional 15.3% using the same architecture. The additional speedup is caused by the decreased effectual bits saving by quantization.

E. Area and Energy Efficiency

We also evaluate the area information of TSVA. The results are shown in Figure 13. Since we leveraged an 8-bit parallel multiplier instead of a 16-bit multiplier in the baseline, the PE area greatly decreases and consumes much less area percentage than the on-chip SRAM subsystem. The control logic for S-Flow and T-Flow switching added is not significant, comparing to the computation PE and the SRAM on-chip buffer. Overall, the area is ×1.64 more than the BVA accelerator, mainly increased by the computation logic. TSVA is 22.3 mm^2, while BVA is 13.58 mm^2 in total.

Figure 14 reports a breakdown of the power for the TSVA and BVA. While TSVA consumes more power than BVA (around ×2.98), the speedup is higher than the increase in power consumption, which results in an overall ×1.42 more energy efficient than the baseline. Note that this is only the on-chip computation energy consumption, the off-chip memory transmission consumption is orders or magnitude than on-chip memory accesses.

While storing the deltas using dynamic precisions can save the off-chip DRAM access energy greatly, we also show that our configurable buffer that determines the optimal loop order could save another 38%, 33%, and 27% of off-chip DRAM access energy for the three 3D CNNs respectively.

6. Related Work

Neural network accelerators. The huge computational requirements and applicability of deep neural networks have prompted researchers to design numerical accelerators, either on FPGA [70][57] [56][58][71], ASIC [12][13][14][72] [15] [50][60], or leveraging efficient memory technologies [73][74]. The representative works are *DianNao* [12], *DaDianNao* [13] utilize large global buffer as shared storage to minimize the DRAM access energy consumption. *Eyeriss* [15] proposes a row stationary dataflow by exploiting local data

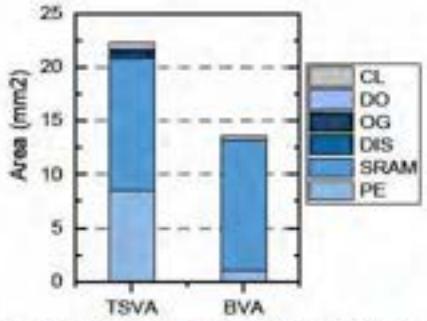


Figure 13. Area breakdown [mm^2] TSVA vs BVA. CL: control logic, DO: Delta$_{out}$: the SIMD engine for delta calculation of net layer., OG: Offset generator, DIS: Dispatcher.

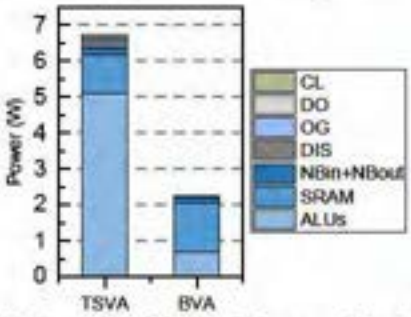


Figure 14. Power breakdown. CL: control logic, DO: Delta$_{out}$, OG: Offset generator, Dis:Dispatcher.

reuse for both filters and input activation maps. Several recent works that leverage bit-serial multiplier [46][35][19] and bit-serial cache [75].

3D CNN accelerators. Prior work on 3D CNN acceleration also lies in either FPGA [31][76], or ASIC [32]. Hedge at al. [32] designed a flexible 3D CNN accelerator that features flexible buffer and loop control. We believe that bit-serial processing will benefit more.

Accelerators that exploiting spatial and temporal locality. There are several research works that leverage the spatial [52] and temporal locality [53][54][45] to accelerate the execution of CNN. *Diffy* takes advantages of the spatial correlation between adjacent convolution windows and introduces "Differential Convolution" architecture and store the spatial delta values both off- and on-chip reducing the amount of storage and communication needed. We can leverage the benefits of both the spatial and temporal delta. Zhu et al. [53]leverage motion information of continuous frames using motion estimation to improve the execution of DNN. The same idea was proposed [54] by implementing an embedded vision accelerator as a co-processor for DNN at the same time. Riera et al. [45] propose an input reuse design that can leverage the temporal locality within layers. Our design is different since we only need to cache the input and output activations of one layer, instead of all layers.

7. Conclusion

In this paper, we propose TSVA, an accelerator for 3D CNN and other NNs under continuous frame batch processing scenario. The evaluation shows that TSVA achieves ×4.24 speedup and ×1.42 energy efficiency. While the video

based inference is more and more important in people's daily life, we believe that our work will benefit more in the future.

ACKNOWLEDGEMENT

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Attachment D – Respondent Statement

A statement about ISCA paper

Dear colleagues:

Last week, a tragedy happened to one of my Ph.D. students. I, like all members of IDEAL lab, feel deeply sad and shocked on the sudden lost of Huixiang. Right now, both university and police are investigating this tragedy and no official conclusions and news have been released.

Recently, someone (anonymous) exploited this unfortunate incident to spread untrue statements over the Internet. I strongly condemn this immoral and disturbing behavior.

To clarify, I hereby want to share the following information:

After ISCA notification, I asked Huixiang to start paper revision and camera-ready version preparation. As a first step, I suggested him to perform more characterization work to strengthen the motivation of this paper. I helped him to purchase new hardware for his experiments. When he told me that he found mistake in his submitted version, I worked closely with him to identify the root cause and suggest solutions. We further requested the publication chair to extend our final version submission deadline. With all these efforts, we submitted the final version of this paper on May 28.

To the best of my knowledge, our final version paper does not contain the mistake that he identified earlier and he has also confirmed that. As far as I recalled, he has not mentioned that he wanted to withdraw the paper after the final submission. He told me that he wants to go to the ISCA conference to present this paper. I worked with the department travel office staffs for his travel paperwork and wrote a student travel grant application support letter for him to the ISCA travel grant chair.

During the entire paper revision period, I have always been available, supportive and encouraging whenever he needed my help. I encouraged him to continue to explore this topic by exploiting approximate computing and dynamic working-set adaption to amortize the synchronization overhead of his current design. Up on his request, I wrote a RA support letter for his I-20 extension and graduation.

Huixiang has been in my research group as a research assistant since Aug. 2013. During the past six years, he has published three papers (one ICCD paper and two ISPASS papers) as the first author and has been a co-author for several other papers. I have always being very supportive for his graduation thesis research and career even during the period when my funding is low. To help him enrich his industry experience, I have also assisted him for obtaining an internship at Facebook Inc.

I hope the above information can clarify the untrue statements made by the anonymous person.

Professor Tao Li

Confidential

Attachment E – Respondent Comments on Draft Inquiry Report

[redacted]

November 12, 2019

[redacted]

Research Compliance

[redacted]

RE: University of Florida Inquiry Report regarding Huixiang Chen's complaint

Dear [redacted]:

This inquiry comes on the heels of a tragic situation, the suicide of Ph.D. candidate Xuixang Chen. Mr. Chen, in his final communications, blamed Dr. Tao Li for his suicide. Mr. Chen further complained—presumably to a close friend—that Dr. Li forced publication of false information and data in their research. Mr. Chen then took his own life. These actions and allegations precipitated this inquiry into research misconduct by Dr. Tao Li.

The university's Division of Research Compliance and Global Support draft inquiry report concludes with the recommendation that an investigation is warranted. This conclusion is premature.

The inquiry began with a seemingly valid basis. But Dr. Li takes issue with the very first paragraph of the report and the lynchpin of the reports finding—anonymous emails that "corroborate" the initial allegations. These four separate emails, however, offer nothing in the way of corroboration.

The first email was sent under a fake name of *ISCA tragedy* from an email address handled ISCA.tragedy@gmail.com. ISCA is the International Symposium on Computer Architecture, which, coincidentally—or not so—is the symposium that Dr. Li and Mr. Chen were to present at in June 2019. While there is no direct evidence that this email and name was created for the sole purpose of contacting the University of Florida, it seems likely under the circumstances.

The report does not include any follow up communication with the unidentified person via ISCA.tragedy@gmail.com, and apparently not even an attempt to communicate in this manner. Inside the lone email from ISCA.tragedy@gmail.com were three items. First, a link to a Gainesville Sun article which merely reported on the publicly known facts and allegations. Second, a link to a Chinese news article which also merely reported publicly known facts and allegations. Lastly, it included a link to an online forum with voluminous posts by anonymous persons. No single bit of information on this forum was verifiable or even reported as verified in the report. Therefore, this first email could not be corroboration of Mr. Chen's allegations as it was nothing more than a reiteration of the same allegations from the same source—Mr. Chen.

The second email proffered as corroboration was sent by a person identified as [redacted] who even claims anonymity. There is no [redacted] in Dr. Li's lab, or presumably at all. The inquiry report does not indicate that there was any follow up communication with the purported [redacted]." The report does not include whether there was any further communication with the email address [redacted], used by [redacted]

This second email contains three points. The first point is a summary of Mr. Chen's allegations—which were, again, very publicly disseminated online. The second point is an

allegation that Dr. Li had created a hostile work environment, which "Mr. [redacted]" blames for Mr. Chen's suicide. While a hostile work environment, if true, is problematic, it has no relevance to allegations of falsified data, and it merely confuses RIO's true job. Similarly, point number three by "Mr. [redacted]" is an attack on Dr. Li unrelated to RIO's inquiry into an allegation of falsified research data. Therefore, nothing in this second email corroborates Mr. Chen's allegations of compromised research by Dr. Li.

The third email supposedly corroborating Mr. Chen's allegations is also from a pseudonym: [redacted]" from the email address [redacted]. The inquiry report lists no further communication with the "[redacted]" or email address [redacted]

This [redacted] also brings up three points. The first two, the writer admits, are from unconfirmed sources and cites two hyperlinks. The first hyperlink is the publicly disseminated text messages that prompted the international attention, and the second is the very same forum linked in the first email. The third point the anonymous writer brings up is that Dr. Li asked conference reviews to favor his papers. The [redacted] claims this is from a confirmed source—which is convenient for an anonymous writer to do without providing that source who purportedly confirmed. Still, even if this third point is true, that is precisely how any well-connected presenter would act at a conference. It is the professional equivalent of the trendy online phrase asking viewers and readers to "like, comment, and subscribe." Therefore, these three "points" raised in the third anonymous email corroborate no allegations of research misconduct.

The fourth and final anonymous email sender is named "Voice Huixiang" and is sent from the address voice.for.huixiang@ieee.org. This name is strikingly similar to the name of the

widely disseminated online post with Mr. Chen's text messages: "Huixiang Voice." The inquiry report does not contain any follow up communication with "Voice Huixiang" or the email address voice.for.huixiang@ieee.org; this is a pattern.

Inside this fourth anonymous email is the exact same information as produced on the widely disseminated medium.com article previously discussed. There is no new information from any person, just more repetitions of Mr. Chen's text messages and allegations.

In sum, the report uses the circular reasoning that Mr. Chen's allegations are corroboration of Mr. Chen's allegations. While these allegations must be taken seriously, they simply cannot support themselves as self-affirming and self-proving. The allegations are, therefore, uncorroborated and must be treated accordingly. The question of whether Mr. Chen's allegations have any credibility can be answered only by the underlying data from his experiments.

The entire purpose of an inquiry is to review the evidence and determine "whether an investigation is warranted." An investigation is only warranted if the inquiry shows the "preliminary information gathering and preliminary fact-finding indicates the allegation may have substance." The investigators enlisted a subject matter expert to assist with their inquiry. This is precisely what the situation called for: an inquiry into the data itself which required expertise.

The subject matter expert reviewed Mr. Chen's allegations and the published paper. The expert did not, however, participate in the interview with Dr. Li, and the report does not indicate the expert was given any of Dr. Li's responses from the interview. The expert, therefore, had uncorroborated allegations and a published paper without any underlying data or explanations

from Dr. Li. Had the subject matter expert met with Dr. Li as part of the inquiry, any ambiguity could have been resolved.

In Mr. Chen's suicide note, he raised two complaints about the technical aspects of his research and paper. Dr. Li has explained why Mr. Chen appears to have been confused and mistaken. The first complaint by Mr. Chen revolved around the Diffy's structural synchronization. Dr. Li explained that the work is built on Diffy's approach to accelerate the emerging 3D-CNN applications by adaptively leveraging both temporal and spatial localities. No prior works have done that before (e.g. tracking both temporal and spatial localities). For instance, Diffy only focused on 2D images and couldn't exploit temporal opportunity in 3D. As 3D-CNN becomes deeper in its temporal dimension (such as 64 in I3D, and recent generative models) due to fine-grained processing capability and complex tasks beyond video action recognition, exploring the temporal locality is more critical and there are abundant opportunities for doing so.

Mr. Chen also lamented that a "jump-zero" could not be achieved and "any revision would mean a complete rewrite of the paper." In this area, Mr. Chen was both correct and unfortunately mistaken. He was correct that the zero-skipping mechanism was problematic. He was not correct in his assessment that a complete re-write was necessary. The true benefit of the zero-skipping mechanism was only incremental contributions to the entire paper. Dr. Li completely removed the zero-skipping mechanism from the final paper presented at ISCA 2019 without compromising any of the technical advancements the rest of the paper offered. A careful review of the final paper and Dr. Li's revisions by the subject matter expert would have shown this.

Nearly any one-sided allegation of falsified data could sustain a preliminary determination that the allegation may have substance. The data must be inquired into, but the substantiating of a scandalous allegation should not be based on an inappropriately limited review of the evidence available. The inquiry by the expert was inappropriately limited in scope. Mr. Chen's laptop must be recovered and examined before any further steps are taken.

This point seems self-evident, and presumably the university knows that no true investigation can move without the data. If the university still is trying to retrieve the data, held in electronic devices controlled by Mr. Chen's family, then this inquiry should be paused until that data can have at least a cursory review by the subject matter expert.

Justifying an investigation through an inappropriately shallow inquiry on uncorroborated allegations jeopardizes the reputation of an esteemed professor and this University. The conclusions in the inquiry report are premature and run the risk of causing more harm than help if RIO blindly moves forward.

Dr. Li also has one potential issue with one of the inquiry committee members. Dr. Li previously informed RIO that he did not have any conflicts of interest. However, much later he realized that Dr. [redacted] previously submitted a proposal to CCF Core Solicitation – Software and Hardware Foundations Program in November of 2016. Dr. Li was the program director at that time. Dr. [redacted]'s proposal was declined after review by a panel. This previous negative result could create a conflict of interest for Dr. [redacted]

Respectfully submitted,

[redacted]

[redacted]

December 6, 2019

[redacted]

RE: University of Florida Inquiry Report regarding Huixiang Chen's complaint

Dear [redacted]

On November 12, 2019, we responded to the initial inquiry report regarding Huixiang Chen's complaint. Please accept this as a supplemental response.

One of Mr. Chen's allegations in his suicide note was that Dr. Li improperly orchestrated the acceptance of the research paper at ISCA 2019 through his connections. Specifically, Mr. Chen alleged that four of the six reviewers were Dr. Li's friends and that this was the "real reason" the paper was accepted. Mr. Chen went on to say it was "Bewildering" that the paper was accepted. As I previously said, this was unfortunately an area where Mr. Chen was confused and wrong. Attached is the proof that Mr. Chen was mistaken.

The previously relied upon anonymous email address ISCA.tragedy@gmail.com sent letters to not just UF but also "SIGARCH, TCCA and MICRO leadership, the ISCA chairs, and . . . ACM ethics." (Attachment A). Naturally, these organizations were concerned that the process of acceptance of papers was compromised. IEEE Computer Society TCCA and ACM SIGARCH

addressed this concern and jointly appointed a committee to investigate the allegation that Dr. Li manipulated the acceptance of the paper at ISCA 2019. (Attachment B).

This committee determined there was no evidence of any kind that misconduct took place. (Attachment B). The committee determined that as with any other paper submitted to the conference, it was peer reviewed through industry-standard double blindness to ensure against exactly what Mr. Chen complained about. The committee further determined that there was no contact or discussions outside the designated review process.

I understand that we are outside the deadline for replying, but this information just came in. It is incumbent on me to forward it in the interest of providing a full picture of what transpired. I reiterate that before RIO deems an investigation is warranted on a confirmed *non*-corroborated allegation, there must be at least a preliminary look by a subject matter expert at the underlying data in paper submitted to ISCA.

Respectfully submitted,

From: ISCA tragedy <isca.tragedy@gmail.com> **Sent:** Sunday, June 16, 2019 9:07 PM [redacted] **Subject:** Tragic suicide related to an coming ISCA paper, please investigate

Dear Everyone,

I am a computer architect concerned with a recent event. My Chinese colleagues forwarded me the following recent news:

https://www.gainesville.com/news/20190614/body-of-chinese-student-found-in-campus-building

Later, there were news coverage in Chinese media (I only know this from my colleagues since I cannot read Chinese) with more details that concerned me. https://www.chinesenzherald.co.nz/news/international/collegedaily-20190616/

In summary, what happened were:

The student (Huixiang Chen) found mistakes in his paper and wanted to retract a paper in an upcoming conference. But the advisor refused to do so. If the student retracts the paper, the advisor threatened that he cannot get the Ph.D after 6 years. But apparently the student believed that there is fundamental flaws in the paper and publishing it will put his integrity and academic career at risk. After conflicting with his advisor for months (I guess after ISCA notification), he had no option and committed suicide.

It appears that the student's name and the paper are already in the coming ISCA program: https://iscaconf.org/isca2019/program.html
3D-based Video Understanding Acceleration by Leveraging Temporal Locality and Activation Sparsity - Huixiang Chen, Mingcong Song, Jiechen Zhao (University of Florida); Yuting Dai (Guizhou University); Tao Li (University of Florida)

We should not directly trust the facts in the news article, but it is a really tragic story and the facts must be seriously investigated. If the above is true, the advisor's approach is definitely not tolerable. Given that ISCA is in a week, I urge the leadership in computer architecture community pay attention to the serious matter. I am sending

this email to SIGARCH, TCCA and MICRO leadership, the ISCA chairs, and forwarding to ACM ethics.

I am sorry for being anonymous to protect the identities of people who told me the story.

A concerned computer architect

ANNOUNCEMENTS:

Outcome of investigation on ISCA 2019 paper

Posted on **December 1, 2019**

Dear members of the computer architecture community,

The jointly appointed committee of the IEEE Computer Society TCCA and ACM SIGARCH has concluded its investigation into the peer-review process of ISCA 2019. This investigation was undertaken because of anonymous emails distributed broadly within the computer architecture community, related to an accepted conference paper. The committee which conducted the investigation included members from the IEEE Computer Society TCCA and ACM SIGARCH, as well as members of the ISCA Program Committee.

The committee evaluated whether the paper in question was reviewed according to the established conference guidelines and the review practices of maintaining double blindness, without any contacts from the outside or discussions outside the review process. The committee has determined that there was no evidence of misconduct as part of the paper review process.

While there was no evidence of improper action found during the peer review process the investigation, we are assessing current processes to improve them for the future.

SIGARCH & TCCA Chairs

[redacted]

Submit an Announcement

Request an Edit for this Posting

From: Dropbox <no-reply@dropboxmail.com>
Sent time: 07/08/2019 05:58:45 AM
To: taoli@ece.ufl.edu
Subject: You deleted 4209 files from Dropbox

Hi Tao,

You recently deleted 4209 files from your Dropbox account. If you want these files back, you can still restore them until **8/4/2019**. After that, they'll be permanently deleted.

These are the files you deleted:

NSF-CNS-Nov-5.doc and 4,031 files	7/5/2019 5:51 PM using Mac OS X 10.10.5	See deleted files
虚拟化，云计算-Section-2.3-LI-Rev.docx and 59 files	7/5/2019 5:43 PM using Mac OS X 10.10.5	See deleted files
2017-03-09 17.40.43.mov and 58 files	7/5/2019 6:11 PM using Mac OS X 10.10.5	See deleted files

And 58 more files

Thanks,
The Dropbox Team

Dropbox, Inc.
PO Box 77767, San Francisco, CA 94107
View Privacy Policy | Unsubscribe
© 2019 Dropbox

Dr. Le Song
Georgia Tech Research Corporation

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

April 21, 2021

To: [redacted]

From: [redacted]

Subject: Recommendation to Suspend NSF Awards CCF-1836822 and CNS-1704701to the Georgia Tech Research Corporation (OIG Case I-21-0008-O)

Attached is our recommendation to suspend NSF awards CCF-1836822 and CNS-1704701 to the Georgia Tech Research Corporation, the contracting entity for the applicable sponsored activities within the Georgia Institute of Technology (Georgia Tech). Each of these awards lists Dr. Le Song as either PI or Co-PI. It is alleged that Dr. Song engaged in long-term absences from Georgia Tech without the university notifying NSF as required by the Proposal and Award Policies and Procedures Guide (PAPPG). Additionally, it appears that the university did not follow proper PAPPG guidance to either notify NSF or nominate an appropriate substitute upon Dr. Song's resignation from the university. Based on our investigation to date, we recommend taking this action to protect NSF funds.

[redacted]

Attachment

cc: [redacted]

Recommendation to Suspend Awards

OIG Case Number I-21-0008-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

April 15, 2021

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Introduction

We recommend that NSF suspend two awards made to the Georgia Tech Research Corporation (GTRC):[1] CCF-1836822, entitled "FMitF: Collaborative Research: Synergies between Program Synthesis and Neural Learning of Graph Structures," and CNS-1704701, entitled SaTC: CORE: Medium: Understanding and Fortifying Machine Learning Based Security Analytics." Dr. Le Song is the PI for CCF-1836822 and a Co-PI on CNS-1704701.[2]

CCF-1836822 started on January 1, 2019 and expires on December 31, 2022. It was funded for $450,001 and, at present, nearly $372,000 remains unspent. CNS-1704701 started on August 1, 2017 and expires on July 31, 2021. It was funded for $1,216,000 and, at present, nearly $635,200 remains unspent.

Dr. Song was an associate professor on a 9-month contract with the College of Computer Science, School of Computational Science and Engineering, at the Georgia Institute of Technology (Georgia Tech) until January 17, 2021, the date of his resignation from Georgia Tech. As also set forth below, we learned that Dr. Song was away from Georgia Tech for extended periods of time during his roles as NSF PI or Co-PI in the two above-named awards.

OIG Investigation

We reviewed Georgia Tech records obtained pursuant to an IG subpoena and discovered that the university approved two separate leaves of absence (LOAs) for Dr. Song. The first LOA ran from August 15, 2017 to May 15, 2018,[3] while the second LOA ran from August 15, 2018 to May 15, 2019.[4] As stated in the second LOA, "[t]his will be an extension of his current leave that he started on August 15, 2017."[5] Effectively, therefore, Dr. Song was absent from Georgia Tech for 2 years. NSF was never notified of these absences.

In our discussions with university officials, we also learned Dr. Song worked for a company during his two LOAs. We learned the university was investigating whether Dr. Song continued to work for this company after his second LOA ended. According to Georgia Tech, Dr. Song notified the university that he resigned his full-time company position on or around October 15, 2020. Ultimately, Dr. Song also resigned his university position, effective January 17, 2021.[6]

---

[1] GTRC is "the contracting entity for all sponsored activities for colleges and other units at Georgia Tech that are not part of the Georgia Tech Research Institute (GTRI), the applied research division of the institute." TAB 1. GTRC is the recipient of the associated NSF awards in this case.
[2] Dr. Song was PI or Co-PI on three other active NSF awards: IIS-1841351 (PI), IIS-1350983 (PI), and CHE-1900017 (Co-PI). Georgia Tech notified NSF in these instances that Dr. Song resigned from the university, and either requested to substitute a new PI or completely remove the Co-PI role from the award.
[3] TAB 2
[4] TAB 3
[5] TAB 3: LOA 2018 - 1, p. 1
[6] TAB 4

To date, the university has not offered a satisfactory substitute PI in CCF-1836822. In CNS-1704701, Georgia Tech has not notified NSF that Dr. Song is no longer with the university and has not submitted a request to substitute Co-PI. Not notifying NSF of Dr. Song's long-term LOAs and his resignation from the university are violations of the Proposal & Award Policies & Procedures Guide (PAPPG).

According to the PAPPG, project oversight arrangements must be sent to NSF for approval for a PI or Co-PI that is away from an NSF project for greater than 3 months (e.g., sabbatical leave). At least 30 days' notice is required before departure or as soon as practicable after the prospective absence is known. If the arrangements are unsatisfactory to NSF, the grant(s) in question may be terminated. Furthermore, if a PI or Co-PI severs their relationship with the university, NSF must be notified by the grantee organization – either to nominate a substitute PI or Co-PI or to initiate grant closeout procedures.

Our investigation into these matters, as well as other potential wrongdoings not described in this memorandum, is ongoing.

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend awards CCF-1836822, and CNS-1704701 pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

Attachments

TAB 1 – GTRC website
TAB 2 – Leave of Absence 2017 (request and approval)
TAB 3 – Leave of Absence 2018 (request and approval)
TAB 4 – Song Resignation Letter

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

Dr. Tim Li
University of Hawaii
Hawaii Earth Science Consulting

U.S. NATIONAL SCIENCE FOUNDATION
Office of Inspector General

MEMORANDUM

DATE: January 15, 2025

TO: [redacted]

FROM: [redacted]

SUBJECT: Recommendation for Governmentwide Suspension (OIG Case I-21-0009-O)

Attached is our investigation report concerning Dr. Tim Li and Hawaii Earth Science Consulting (HESC). Dr. Li and HESC were suspended governmentwide from November 10, 2022, until May 10, 2024, based on evidence that Dr. Li fraudulently obtained grant funds from NSF by concealing outside employment and research funding he was receiving from foreign entities. This report sets out the probable cause that Dr. Li submitted false certifications in proposal AGS-2512932, which was submitted to NSF on November 22, 2024.

To protect the Federal government, we recommend that NSF suspend governmentwide Dr. Li and HESC while our investigation is ongoing. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for the subject's counsel:

[redacted]

Recommendation for Governmentwide Suspension

OIG Case Number I-21-0009-O

U.S. NATIONAL SCIENCE FOUNDATION
Office of Inspector General

January 13, 2025

REPORT RELEASE RESTRICTION

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At a Glance

Recommendation for Governmentwide Suspension
OIG Case Number I-21-0009-O | January 13, 2025

WHAT WE FOUND

NSF suspended Dr. Tim Li, a professor in the Department of Meteorology at the University of Hawaii (UH) at Manoa, and his business, Hawaii Earth Science Consulting (HESC), governmentwide from November 10, 2022, until May 10, 2024, based on evidence Dr. Li fraudulently obtained grant funds from NSF by concealing outside employment and research funding he was receiving from foreign entities. Specifically, a Federal magistrate judge determined that there was probable cause to issue a search warrant for Dr. Li, his home, and his workplace to search for evidence of 18 U.S.C. § 1343 (wire fraud), 18 U.S.C. § 1001 (false statements), 31 U.S.C. §§ 5314, 5322 (failure to file report of foreign bank account), and 26 U.S.C. § 7206 (fraud or false statement on tax return).

Six months after the suspension was lifted, on November 22, 2024, UH submitted proposal AGS-2512932, *"Propagation and Initiation Diversities of the Madden-Julian Oscillation"* to NSF. The proposal listed Dr. Li as the principal investigator. We have identified two potential false certifications provided by Dr. Li in the proposal. Specifically, he certified twice "that, at the time of submission, I am not a party to a malign foreign talent recruitment program." However, evidence collected through this investigation suggests he is currently part of a malign foreign talent recruitment program.

This case is still active with the U.S. Attorney's Office for the District of Hawaii.

WHAT WE RECOMMEND

We recommend that NSF suspend Dr. Li and HESC governmentwide pending the conclusion of the ongoing investigation and legal proceedings to protect the U.S. Government from further fraud.

CONTACT

[redacted]

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- Adequate Evidence that Cause for Suspension Exists 5
- Immediate Need 8

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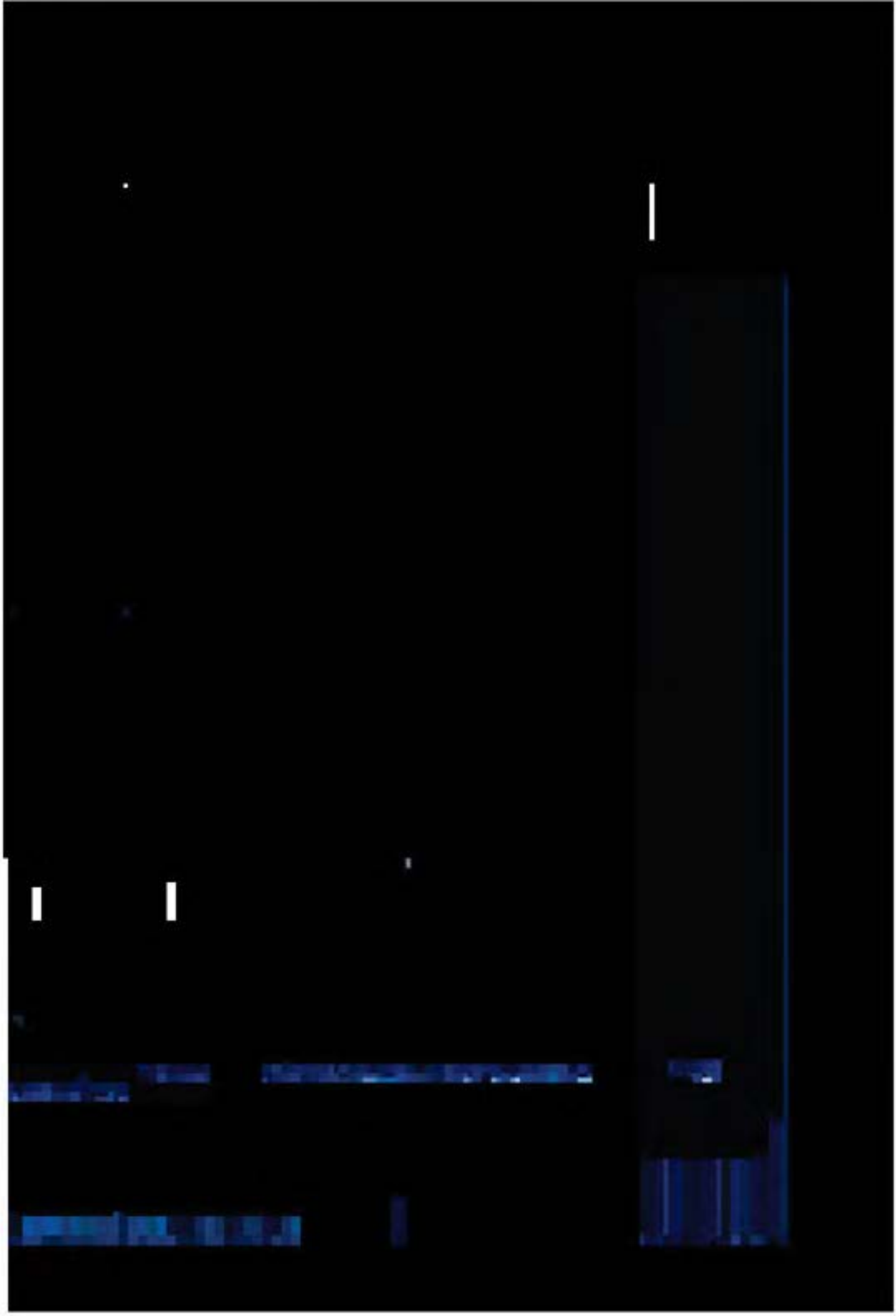


the serious nature of suspension actions. Per this section, the suspending official may impose suspension only when that official determines that:

1. There exists an indictment for, or other adequate evidence to suspect an offense listed under § 180.800(a), or
2. There exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d); and
3. immediate action is necessary to protect the public interest.

Unlike debarment actions, suspensions are effective upon signature of the suspending official and are generally imposed prior to notification to the suspended party.[25]

NSF may suspend a person or entity for the same reasons listed in 2 C.F.R. § 180.800(a), -(b), -(c), or -(d), if there is adequate evidence that there may be a cause for debarment, such as:

- Commission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public or private agreement or transaction (2 C.F.R. § 180.800(a)(1));
- Commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, receiving stolen property, making false claims, or obstruction of justice (2 C.F.R. § 180.800(a)(3));
- Commission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects the subject's present responsibility (2 C.F.R. § 180.800(a)(4)); or
- Violation of the terms of a public agreement or transaction so serious as to affect the integrity of an agency program, such as a willful violation of a statutory or regulatory provision or requirement applicable to a public agreement or transaction (2 C.F.R. § 180.800(b)(3)).
- Any other cause so serious or compelling in nature that it affects the subject's present responsibility (2 C.F.R. § 180.800(d)).

Adequate Evidence that Cause for Suspension Exists

In suspension actions, the burden of proof lies with the Federal agency to demonstrate that adequate evidence exists to support a suspension action. The debarment regulation lists 19 factors that the suspending official may consider, if applicable,[26] when determining whether there is adequate evidence that a cause for suspension exists. The following factors are pertinent to this case:

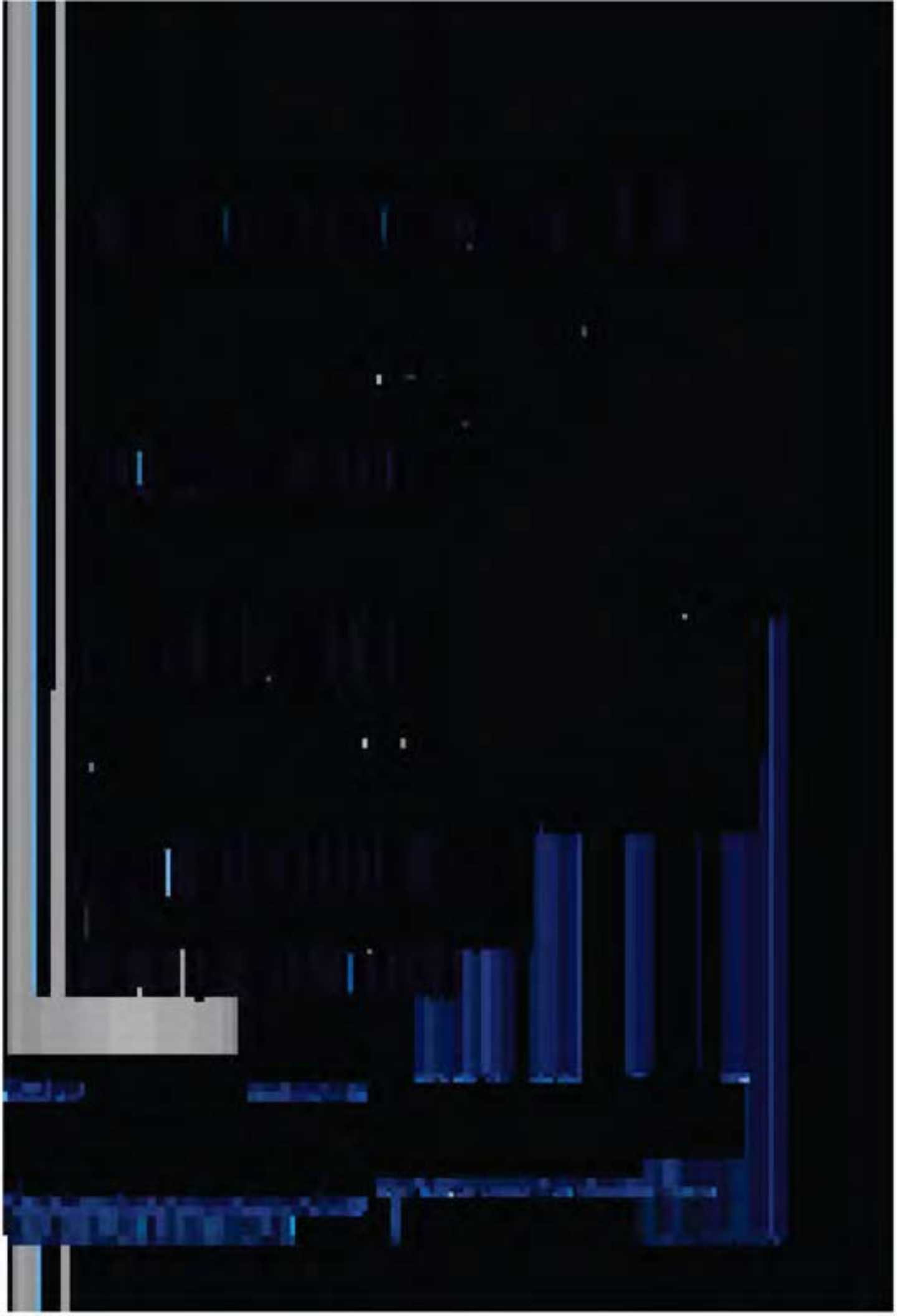
1. **Actual or Potential Harm or Impact (2 C.F.R. § 180.860(a))**

[25] 2 C.F.R. § 180.710; *see* 2 C.F.R. § 180.605 for a description of the differences between suspension and debarment.
[26] 2 C.F.R. § 180.860

Dr. Li's actions continue to cause significant potential harm to NSF and the U.S. Government. In October 2022, Dr. Li was suspended governmentwide for repeatedly not disclosing material information regarding his foreign affiliations, funding, and positions as required by NSF.[27] Ironically, Dr. Li is now aware of the nature of our investigation, and he disclosed NUIST affiliations and NSFC funding through NUIST for the first time. In the Proposal, regarding his NUIST contract, Dr. Li claimed, "The primary responsibility of this contract is to supervise atmospheric science graduate students at [NUIST]."[28] However, the Contract that Dr. Li provided to us indicates he has significantly more responsibilities than claimed in his disclosure.[29] The evidence obtained through our investigation shows he likely remains under contract with NUIST and is carrying out his obligations the Contract requires, as listed *supra*. For example:

- Dr. Li disclosed that he has been an affiliated professor with NUIST from 2013 to the present.[30] These dates align with the NUIST contracts he, through his attorney, voluntarily provided the government.
- Dr. Li disclosed that his current contract with NUIST is from 2022 through 2026.[31] These dates align with the Contract.[32]
- Dr. Li disclosed that the U.S. dollar value of the in-kind contribution was $126,000. Depending on the historical date used for the conversation, this amount closely aligns with the Contract of 900,000 Yuan per year. According to Oanda FX Data Services, on January 1, 2022, the date the Contract began, 900,000 Yuan equaled $141,419[33]; however, on November 7, 2024, the date Dr. Li certified the Proposal, 900,000 Yuan equaled $125,624.[34] It is likely the contract Dr. Li disclosed in the Proposal is the Contract.
- Dr. Li disclosed that he is a "Participant, non-PI" for a current NSFC project, and NUIST is the primary place of performance. Hosting a foreign research project, which can include an NSFC major research plan or an NSFC key project, is a requirement of the Contract. Additionally, Dr. Li acknowledged support from an NSFC project in six publications.
- Dr. Li listed NUIST as his first unit in 41 of 62 publications since 2022.[35] Additionally, he is the corresponding author in 28 of the 62 publications. This comports with his publishing obligations under the Contract.

[27] *See* Attachment 3 - Notice of Governmentwide Suspension
[28] *See* Attachment 7 - 2512932 Current and Pending Support
[29] *See* Attachment 9 - Translated 2022 NUIST Contract
[30] *See* Attachment 6 - 2512932 BioSketch
[31] *See* Attachment 7 - 2512932 Current and Pending Support
[32] *See* Attachment 8 - 2022 NUIST Contract and Attachment 9 - Translated 2022 NUIST Contract
[33] Attachment 10 - Oanda FX Data Services, p. 1
[34] Attachment 10 - Oanda FX Data Services, pp. 2-3
[35] *See* Attachment 11 – Dr. Li's Publications



Dr. Li appears to be a well-known figure in his field of study. For example, in May 2019, Dr. Li received the UH Regents' Medal for Excellence in Research, which is "awarded by the Board of Regents in recognition of scholarly contributions that expand the boundaries of knowledge and enrich the lives of students and the community."[42] The article described Dr. Li as "one of most influential scientists in tropical climate dynamics worldwide" and lauded that, as a PI, he has acquired $6 million in research grants for UH. The same article noted that for over 20 years Dr. Li has been an advisor to 25 PhD candidates and 42 postdoctoral research fellows and visiting scientists. Dr. Li is also well-known abroad. For example, a NUIST publication dated June 12, 2017, described Dr. Li as the "Chief Scientist of the 973 Program of the Ministry of Science and Technology" and "[a] world-renowned expert in tropical meteorology, monsoon, typhoon and climate dynamics research."[43]

Further, given how prolifically Dr. Li applies for and receives federal funding,[44] he is well-versed in the requirements of and certifications for NSF grants.

7. **Other Factors (2 C.F.R. § 180.860(s))**

Dr. Li is still the subject of a criminal investigation involving wire fraud, false statements, failure to file a report of a foreign bank account, and fraud or false statements on a tax return.

Immediate Need

In deciding whether immediate action is needed to protect the public interest, the suspending official has wide discretion.[45] As an example, the suspending official "may infer the necessity for immediate action to protect the public interest either from the nature of the circumstances giving rise to a cause for suspension or from potential business relationships or involvement with a program of the Federal Government."[46]

As highlighted in our initial governmentwide suspension recommendation in September 2022,[47] Dr. Li has a significant history of receiving Federal grants. Throughout his career, he was the PI or co-PI on eight (8) NSF awards totaling approximately $3.3 million. His conduct before and after his suspension – and by affiliation, HESC – indicates that he is not presently responsible for receiving Federal funds. There is an immediate need for another suspension because he has submitted, and likely will continue to submit, additional proposals for funding to Federal agencies containing false certifications on matters material to NSF.

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[42] https://www.hawaii.edu/news/2019/05/13/bor-excellence-in-research-2019/ (accessed December 18, 2024)
[43] Attachment 13 - NUIST article describing LI (translated from Chinese to English using Google Translate)
[44] *See* Attachment 1 - NSF PI History
[45] 2 C.F.R. § 180.705(c)
[46] 2 C.F.R. § 180.705(c)
[47] *See* Attachment 2 - Recommendation for Governmentwide Suspension September 2022

OIG Recommendation

It is imperative that the ability of Dr. Li and his business, HESC, to obtain and spend Federal funds be suspended for the duration of this active investigation being conducted in conjunction and coordination with the U.S. Attorney's Office for the District of Hawaii. Therefore, OIG recommends that NSF suspend Dr. Li and HESC governmentwide, pending the conclusion of this ongoing criminal investigation.

List of Attachments

Attachment 1 - NSF PI History
Attachment 2 - Recommendation for Governmentwide Suspension September 2022
Attachment 3 - Notice of Governmentwide Suspension
Attachment 4 - Notice of Extension of Suspension
Attachment 5 - 2512932 Cover Sheet
Attachment 6 - 2512932 BioSketch
Attachment 7 - 2512932 Current and Pending Support
Attachment 8 - 2022 NUIST Contract
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Attachment 11 - Dr. Li's Publications
Attachment 12 - Search Warrants
Attachment 13 - NUIST article describing Li

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

September 2, 2022

To: [redacted]

From: [redacted]

Subject: Recommendation to Suspend NSF Award AGS-2006553 to the University of Hawaii (OIG Case I-21-0009-O)

Attached is our recommendation to suspend NSF award AGS-2006553 to the University of Hawaii. This award lists Dr. Tim Li, a professor in the Department of Meteorology at the University of Hawaii at Manoa, as the PI. Li did not disclose his affiliations with Nanjing University of Information Science and Technology (NUIST) or research funding received through NUIST in this and other NSF proposals, as required by the Proposal & Award Policies and Procedures Guide. Based on our investigation to date, we recommend taking this action to protect NSF funds.

[redacted]

Recommendation to Suspend Award

OIG Case Number I-21-0009-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

September 2, 2022

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Introduction

We recommend that NSF suspend an award made to the University of Hawaii (UH): AGS-2006553, entitled "El Nino-Southern Oscillation (ENSO) Interactions with Tropical Atlantic and Indian Oceans," in which Dr. Tim Li is the PI. The award's period of performance started on July 1, 2020 and ends on June 30, 2023. It was funded for $599,339 and, at present, nearly $436,714 remains unexpended.

In late 2020, we received information alleging that Li (also known as Tianming Li), a professor of Atmospheric Sciences and Meteorology at UH, was actively affiliated with Nanjing University of Information Science and Technology (NUIST) located in the People's Republic of China. We substantiated this claim through open-source internet searches, multiple subpoenas, interviews, and federal search warrants. We further determined that Li did not disclose this position nor foreign funding sources he obtained through NUIST in his NSF proposals going back as early as 2015, as required by the Proposal & Award Policies and Procedures Guide (PAPPG).

OIG Investigation

We discovered that Li has a faculty webpage on the NUIST School of Atmospheric Sciences website, which at the time of review, was last updated on June 25, 2022. The "Personal Profile" section listed Li as a tenured professor at UH and the director of the Climate Dynamics Research Center at NUIST.[1] Additionally, the "Recent research projects" section listed seven foreign funded awards in which Li was identified as the PI, Chief Scientist, Project Leader, or Sub-project Leader.[2] The funding sources included the National Key Basic Research and Development Program (973 Program), the Jiangsu Basic Research Program, and the National Natural Science Foundation of China (NSFC). The total period of performance for these awards cover 2015 through 2025.

Multiple open-source publications corroborated that Li received foreign funding that he did not disclose to NSF. For example:

- A NUIST article dated April 23, 2015, referenced Li receiving foreign funding for a "double innovation team".[3]
- A document published by the Chinese Academy of Sciences and NUIST listed Li as the project leader for two foreign awards, one of which was funded by the Key Research and Development Program "Global Change and Response" Key Project with a duration from July 2017 through June 2022.[4]
- A NUIST Key Laboratory of Meteorological Disaster webpage listed Li as the project leader for three of its projects, one of which was an NSFC project spanning 2017 to 2021.[5]

[1] Attachment 1 (NUIST webpage) at p. 3 (translated from Chinese to English using Silo's translate function)
[2] Attachment 1 (NUIST webpage) at p. 20 (translated from Chinese to English using Silo's translate function)
[3] Attachment 2 (highlights added) (translated from Chinese to English using Google Translate)
[4] An NSF OIG investigator fluent in Chinese reviewed this document in Chinese and reported on its contents as produced above.
[5] Attachment 3 at items 34, 35, and 47 (translated from Chinese to English using Google Translate).

- In a publication dated June 12, 2017, from the NUIST website, Li is described as the Chief Scientist of the 973 Program of the Chinese Ministry of Science and Technology, and director of the Climate Dynamics Research Center of NUIST. [6]

We also learned that between October 2016 and October 2020, Li co-authored six publications that specifically acknowledged that Li was supported by foreign funding sources.[7]

The PAPPG requires PIs and Co-PIs to disclose all forms of current and pending support. Specifically, NSF PAPPG version 19-1, which was applicable to proposal AGS-2006553 states, "[a]ll current project support from whatever source (e.g., Federal, State, local, foreign, public or private foundations, industrial or other commercial organizations, or internal funds allocated toward specific projects) must be listed." According to our investigation, Li had at least two foreign awards that should have been disclosed in proposal AGS-2006553, but neither one was listed in his current and pending support document. Additionally, PIs and Co-PIs must submit biographical sketch ("biosketch") information, including a list, in reverse chronological order, of all academic/professional appointments. Li did not disclose his NUIST affiliation in the biosketch document submitted in proposal AGS-2006553.

Our investigation into these matters, as well as other potential wrongdoings not described in this memorandum, is ongoing. We are working with the U.S. Attorney's Office for the District of Hawaii on this matter.

OIG Recommendation

Based on the information set forth above, we recommend that NSF suspend award AGS-2006553 pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

[6] Attachment 4 (NUIST article describing Li) (translated from Chinese to English using Google Translate)
[7] Attachment 5 at pp. 1, 6, 11, 16, 20, and 24 (publications) (highlights added).

Attachments

Attachment 1 – NUIST faculty webpage
Attachment 2 – NUIST article describing Double Innovation Team
Attachment 3 – NUIST article with three awards
Attachment 4 – NUIST article describing Li
Attachment 5 – Publications with foreign funding

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

National Science Foundation
Office of the Director

November 10, 2022

BY ELECTRONIC MAIL

[redacted]

Re: Notice of Government-wide Suspensions for Tim (Tianming) Li, Ph.D., and Hawaii Earth Science Consulting LLC

Dear Mr. [redacted]

This letter serves as formal notice that, based on a recommendation by NSF's Office of Inspector General ("NSF OIG"), NSF is suspending your clients, Tim (Tianming) Li, Ph.D., and Hawaii Earth Science Consulting LLC ("HESC"), from directly or indirectly obtaining the benefits of Federal grants and contracts, effective immediately, pursuant to 2 C.F.R. Part 180. During the government-wide suspensions, Dr. Li and HESC will be precluded from receiving Federal financial and non-financial assistance and benefits under nonprocurement Federal programs and activities. In addition, Dr. Li and HESC will be prohibited from receiving any Federal contracts or approved subcontracts under the Federal Acquisition Regulation ("FAR"). Finally, Dr. Li and HESC are prohibited from serving as NSF reviewers, advisors, or consultants during the period of their suspensions.

Background

Dr. Li is a professor of Meteorology and Atmospheric Science at the University of Hawaii at Manoa ("UH"). He is also the owner and registered agent of HESC, a company registered with the Hawaii Secretary of State on September 14, 2014, for which the mailing address is his home address.

Dr. Li began his career at UH in 1999, following research positions with the U.S. Department of the Navy ("Navy"). Since joining UH, he has been a Principal Investigator ("PI") or co-PI on 24 proposals for NSF funding, of which 3 were funded in the past 5 years, totaling approximately $1.5 million. Most recently, he is the PI for (a) NSF Award No. AGS-2006553 to UH, funded for $599,339, now suspended, and (b) NSF Proposal No. AGS-2240872, requesting $692,392 in

NSF funds, now withdrawn. Dr. Li has also served as the PI or co-PI on awards to UH from the Navy and the National Oceanic and Atmospheric Administration.

Open-source internet searches, including publications and a university website, as well as subpoenas and Federal search warrants, reveal that Dr. Li has been affiliated with Nanjing University of Information Science and Technology ("NUIST") in the People's Republic of China ("PRC") since at least 2015, in parallel to his position at UH. As recently as June 25, 2022, the NUIST website listed Dr. Li as a professor and the director of NUIST's Climate Dynamics Research Center. A publication from the website also described him as the Chief Scientist of the 973 Program of the Chinese Ministry of Science and Technology. In addition, NUIST's faculty page for Dr. Li listed seven foreign awards for which the total period of performance reportedly covers 2015 to 2025. Finally, Dr. Li has co-authored several publications between 2016 and 2020 acknowledging support from foreign funding sources.

Available information indicates that Dr. Li certified annually from 2017 to 2021, inclusive, on UH's Conflicts of Interest Disclosure Form that neither he nor his immediate family participated in, or had any other financial transactions with a domestic or foreign non-UH entity that could create a potential conflict of interest with his UH responsibilities. In 2020 and 2021, Dr. Li further certified on UH's Conflicts of Interest Disclosure Form that neither he nor his immediate family held any positions in or had any affiliations with a domestic or foreign non-UH entity that could relate to his UH responsibilities. Finally, there appears to be no evidence that Dr. Li has reported outside employment to UH.

Dr. Li has represented that he writes the grant proposals submitted through UH for which he is the PI and that he is responsible for the information contained therein. In one funded proposal, NSF Award No. AGS-1643297, Dr. Li disclosed an $800,000 joint agreement between NUIST and UH for a Ph.D. training program under the current and pending report section. Otherwise, in his proposals to NSF from 2015 to present, including NSF Proposal Nos. AGS-200653, AGS-2014091, AGS-2102256, and AGS-2240872, Dr. Li has not disclosed (a) any foreign positions in the appointment or employment sections of his biosketches; or (b) any other foreign funding in the current and pending support sections. Further, NSF is not aware of any such disclosures to the Navy in at least one proposal for funding.

Most recently, on August 18, 2022, a U.S. District Court issued three search warrants, directed to Dr. Li, his home, and his UH office, on the basis that there was probable cause to believe evidence exists of violations of 18 U.S.C. § 1343 (wire fraud), 18 U.S.C. § 1001 (false statements), 31 U.S.C. §§ 5314, 5322 (failure to file report of foreign bank account), and 26 U.S.C. § 7206 (fraud or false Statement on tax return).

Reason for Suspensions

Based on a recommendation by the NSF OIG, there is adequate evidence to suspect cause of so serious or compelling a nature that it affects Dr. Li's present responsibility. More specifically, an ongoing, active investigation has matured to the stage at which an independent authority, a Federal magistrate judge, has determined that there is probable cause that searches of Dr. Li, his home, and his workplace will reveal evidence of multiple criminal violations, encompassing 18

U.S.C. § 1343 (wire fraud), 18 U.S.C. § 1001 (false statements), 31 U.S.C. §§ 5314, 5322 (failure to file report of foreign bank account), and 26 U.S.C. § 7206 (fraud or false statement on tax return). In addition, there is adequate evidence to suspect that Dr. Li repeatedly failed to disclose required information to UH in certified documents and in proposals to NSF and the Navy. As such, there is adequate evidence to suspect that Dr. Li is not presently responsible and should not be trusted with Federal funds.

Further, immediate action is necessary to safeguard Federal funds and protect the public interest in view of Dr. Li's continued pursuit of Federal funding over the past several years, including submitting a proposal to NSF only days before a U.S. District Court issued search warrants on his person, home, and office as part of an ongoing criminal investigation. HESC, owned by Dr. Li, is suspended in view of its affiliation with him. *See* 2 C.F.R. § 180.715(b)(4).

Regulatory Basis for Suspension

Pursuant to 2 C.F.R. § 180.700, suspension may be imposed when the suspending official determines that:

(a) There exists an indictment for, or other adequate evidence to suspect, an offense listed under § 180.800(a); or
(b) There exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d); and
(c) Immediate action is necessary to protect the public interest.

In this case, we have determined that basis for the suspension exists under 2 C.F.R. § 180.700 (b) and (c).

Under 2 C.F.R. § 180.700(b), there is adequate evidence to suspect a cause of so serious or compelling a nature that it affects Dr. Li's and, by affiliation, HESC's present responsibility, as set out in Section 180.800(d). More specifically, the Federal court's issuance of three search warrants involving Dr. Li, his home, and his workplace was predicated on the Court's assessment that, based on its review of affidavits, there was probable cause to search and seize Dr. Li's property and that such searches would reveal, *inter alia*, information related to wire fraud, false statements, failure to file a report of a foreign bank account, and fraud or false statement on a tax return.

I further note that there is adequate evidence that Dr. Li has failed to make required disclosures under NSF's Proposal and Award Policies and Procedures Guide ("PAPPG") of foreign affiliations or positions and foreign funding in his proposals to NSF since at least 2015. Similarly, at present, there is adequate evidence that Dr. Li had affiliations and/or engaged in transactions with NUIST or other foreign entities that run counter to his representations on his annual UH Conflict of Interest Disclosure Forms from 2017 to 2021, inclusive. Dr. Li's suspected omissions have risked UH's ability to manage conflicts of interest and commitments, a requirement for all recipients of NSF funds.

At minimum, in view of the issuance of search warrants, as well as the evidence of failures to disclose required information in proposals to NSF and UH Conflict of Interest Disclosure Forms over an extended period, NSF can have no confidence in the accuracy and completeness of Dr. Li's proposals, thereby constituting cause of so serious or compelling a nature that it affects his present responsibility.

Under 2 C.F.R. § 180.700(c), immediate action against Dr. Li and HESC is necessary to protect the public interest, in view of both the seriousness and nature of the circumstances of Dr. Li's suspected conduct. NSF has "wide discretion" to decide "whether immediate action is needed to protect the public interest." *Id.* at § 180.705(c). In this case, Dr. Li's record of sustained pursuit of Federal funds over an extended period, his status as the subject of an ongoing criminal investigation, and adequate evidence of ongoing foreign affiliations and/or transactions for which Dr. Li has not made required disclosures to Federal funding agencies and UH necessitate immediate action to safeguard Federal funds and protect the public interest.

NSF's suspension of Dr. Li's most recent award, NSF Award No. AGS-2006553, and UH and Dr. Li's withdrawal of his most recent proposal, NSF Proposal No. AGS-2240872, do not mitigate the immediate risk to Federal funds. Only through NSF's actions were awarded funds safeguarded. Further, Dr. Li did not bring to NSF's attention his suspected foreign affiliations and/or funding when he withdrew the proposal. In sum, there is adequate evidence to suspect that Dr. Li and, by affiliation, HESC, are not presently responsible and that immediate action is necessary to mitigate further risk to Federal funds.

Length of Suspensions

The suspensions are for a temporary period not to exceed 12 months except, if legal or debarment proceedings are initiated at the time of or during the suspensions, then the suspensions may continue until the conclusion of those proceedings. Further, NSF may extend the suspensions for an additional six months at the request of a prosecuting official. *See* 2 C.F.R. § 180.760. During the period of the suspensions, Dr. Li and HESC are also prohibited from serving as NSF reviewers, advisors, or consultants.

Procedures Governing Suspensions

The provisions of 2 C.F.R. §§ 180.700 through 180.760 govern suspension procedures and decision-making. Under these regulations, Dr. Li and HESC each have 30 days after receipt of this notice to submit, in person, or in writing, or through a representative, information and argument in opposition to their suspension. *See* 2 C.F.R. §§ 180.720, 180.725. Comments submitted within the 30-day period will receive full consideration and may lead to a termination or modification of the corresponding suspension. If NSF does not receive any response to this notice within the 30-day period, then the suspensions will remain in effect.

Any responses should be addressed to Alex Tang, National Science Foundation, Office of the General Counsel, 2415 Eisenhower Avenue, Alexandria, VA 22314. To ensure prompt consideration, please submit comments electronically to Mr. Tang at altang@nsf.gov. For your

information, we are attaching a copy of the Government-wide Nonprocurement Debarment and Suspension Regulations and FAR Subpart 9.4.

Sincerely,

[redacted]

Enclosures:
Nonprocurement Debarment and Suspension Regulations
FAR Regulations

Nanjing University of Information Science and Technology High-Level Talent Work Agreement (Chief Scientist)

Party A (hiring party)
Unit Name: Nanjing University of Information Science and Technology

Legal representative: [redacted]

[redacted]

Date of birth: [redacted]

In order to strengthen the construction of world-class disciplines and promote scientific research innovation and high-level talent training, Nanjing University of Information Science and Technology (Party A) hired Professor Li Tianming (Party B) to work in the School of Atmospheric Sciences of Party A as a professor, doctoral supervisor and team leader. To clarify both parties
COULD NOT TRANSLATE

Article 1 Appointment term
The appointment period is 5 years, starting from the first day of January 2022 to the first day of January 2026.

Article 2 The benefits and conditions provided by Party A during the appointment period
1. During this employment period, Party A will provide Party B with an annual allowance of 900,000 yuan (the currencies in this agreement are all in RMB unless otherwise specified.
Personal income tax is handled by yourself).

Party A provides an annual operating fund of RMB [illegible]0,000 to the Climate Dynamics Center.
3. Party A shall provide Party B with necessary office and laboratory space.
4. Regarding the special funds for high-level innovation and entrepreneurship teams issued by Jiangsu Province, Party A maintains the original financial account number and uses the funds exclusively for its main purpose.
Project research on Party B's innovation and entrepreneurship, improvement of production and scientific research conditions and personal subsidies, etc.
5. Party A provides Party B with the admissions quota for graduate students in accordance with school policy.
Article 3 Responsibilities and tasks of Party B during the appointment period
1. Comply with national laws and regulations and Party A's rules and regulations, and accept Party A's management and annual assessment.
2. In principle, the working time for Party A is at least 6 months per year.
3. Party B will provide at least one course for undergraduates or graduate students every year (not less than 32 class hours throughout the year), and may provide centralized teaching or organize group teaching.
4. In charge of the construction of the Climate Dynamics Center, he led the team to conduct research on the multi-scale interaction of weather and climate systems, and developed physical and numerical models suitable for extended period forecasting of disastrous weather in my country.
5. During this employment period, complete the following tasks:

1. Host 1 National Key Research and Development Plan project or 1 National Natural Science Foundation of China major research plan (key support project) or host 1 National Natural Science Foundation of China key project or host 1 other project of the same level;
2. Cultivate or introduce 1-2 Siken talents, or 3 Jiangsu Distinguished Professors, Jiangsu Mass Entrepreneurship Talents, Jiangsu Province 333 Project second-level talents;
3. With Party A as the first unit and Party B as the first author or corresponding author, the paper will be published in the Nature or Science sub-journal (IF>COULD NOT TRANSLATE
Published 2 papers in lower-level journals: PNAS, Nature Climate Change, Nature Geoscience, Nature Communications, Nature Plants, Nature Ecology and Evolution, Science Advances;
4. Strive to obtain innovative research groups from the National Natural Science Foundation of China and the Ministry of Education Changjiang Scholars and Innovation Team Development Program
Funded by innovation teams and other national-level scientific research and innovation teams.
6. Actively promote international exchanges and cooperation, integrate high-quality international research resources, and attract outstanding talents.
7. When using the work results completed by Party A to publish papers (therapeutics), apply for awards and patents, Party A must be regarded as the author. Article 4 Supplementary Provisions
1. If there are any matters not covered in this agreement, they will be resolved through negotiation between the two parties.
2. This agreement is made in two copies and will take effect after being signed and sealed by both parties.

Various Principle Investigators / Co-PIs
Stanford University

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

October 11, 2022

To: [redacted]

Subject: Recommendation to Suspend NSF Awards to Stanford University (OIG Case No. I-20-0078-O)

Attached is our recommendation to suspend 14 awards made to awardee Stanford University. The basis of this recommendation is Stanford's failure to disclose foreign funding obtained by Stanford Principal Investigators (PIs) and Co-PIs. The awards and PIs/Co-PIs are as follows:

Award Number	Title	PI/Co-PI		Award Number	Title	PI/Co-PI
CNS-1900638	CNS Core: Large: Autonomy and Privacy with Open Federated Virtual Assistants	Co-PI James Landay		IIS-1941722	CAREER: Safe and Influencing Interactions for Human-Robot Systems	PI Dorsa Sadigh
ECCS-2037304	SenSE: Artificial Intelligence-enabled Multimodal Stress Sensing for Precision Health	PI Zhenan Bao		CBET-1940865	EAGER: A Shock Tube Study of Laminar Flames in Transportation Fuels at Engine Relevant Temperatures	PI Ronald Hanson
IIS-2024247	NRI: FND: Computational and Interactive Design of Soft Growing Robot Manipulators	PI Allison Okamura		CHE-1904108	Nanoscale Control over Surface Functionalization by Molecular Layer Deposition	PI Stacey Bent
IIS-2006388	CHS: Small: Learning and Leveraging Conventions in Human-Robot Interaction	PI Dorsa Sadigh		DUE-1821449	Collaborative Research: Scaling the Early Research Scholars Program	PI James Landay
MCB-2001189	Unraveling biofilm matrix composition, architecture, and function	PI Lynette Cegelski		OCE-1736830	Collaborative Research: Evaluating how abalone populations in the California Current are structured by the interplay of large-scale oceanographic flowing and nearshore variability	PI Fiorenza Micheli
DMS-1953415	Collaborative Research: Statistical Optimization for Barcoding and Decoding Single-Cell Dynamics via CRISPR Gene Editing	PI Le Cong		MCB-1714723	Collaborative Research: Systematic Investigation of the Structure, Dynamics, and Energetics of Hydrogen Bonds and the Protein Interior Using Ketosteroid Isomerase and Model Systems	Co-PI Todd Martinez
ECCS-1953032	Collaborative Research: Mixed Autonomy Traffic Networks: Routing Games and Learning Human Choice Models	PI Dorsa Sadigh		PHY-2110256	Coherent Control of Cold Collision by Preparing Molecular Eigenstates Using Stark-Induced Adiabatic Passage	PI Richard Zare

[redacted]

Based on our investigation to date, we recommend taking these actions to protect NSF funds.

[redacted]

Attachment

cc: [redacted]

Recommendation to Suspend Awards

OIG Case Number I-20-0078-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

[redacted]

October 6, 2022

REPORT RELEASE RESTRICTION

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[redacted]

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Introduction

The NSF Proposal and Award Policies and Procedures Guide requires that Principal Investigators (PI) and Co-PIs disclose all forms of current and pending sources of funding, both foreign and domestic. [1] As part of a proactive investigation to determine if U.S. institutions are complying with such requirements, we reviewed foreign contracts/awards received by Stanford over the past five years. Specifically, we attempted to determine if Stanford had disclosed foreign awards with PIs or Co-PIs who were also recipients of NSF awards. To date, our investigation has identified at least 26 NSF awards under the direction of awardees who had been named as investigative staff on foreign funded research projects at Stanford. Although these awards were between Stanford and foreign entities, Stanford did not disclose these foreign funded projects in their NSF proposals. To date, the total costs claimed on these awards is more than $12.8 million, and 13 of these awards are still active.[2]

Stanford is responsible for ensuring the accuracy and completeness of NSF proposals, to include the disclosure of funding their PIs/Co-PIs receive from non-federal sources. The investigation determined that Stanford failed to disclose sources of foreign funding obtained by certain Stanford PIs and Co-PIs. We recommend NSF suspend the following awards made to Stanford, based on our ongoing investigation:

- CNS-1900638 entitled "CNS Core: Large: Autonomy and Privacy with Open Federated Virtual Assistants," with assigned Co-PI James Landay. The continuing award has been funded for $3 million of which $332,269.34 remains.[3] The award began in April 2019 and is expected to end on July 29, 2023.[4]
- ECCS-2037304 entitled "SenSE: Artificial Intelligence-enabled Multimodal Stress Sensing for Precision Health," under the direction of PI Zhenan Bao. The award has been funded for $750,000 of which $289,307.83 remains.[5] The award began in September 2020 and is expected to end on December 29, 2023.[6]
- IIS-2024247 entitled "NRI: FND: Computational and Interactive Design of Soft Growing Robot Manipulators," under the direction of PI Allison Okamura. The award has been funded for $766,000.00 of which $16,000 remains.[7] The award began in October 2020 and is expected to end on January 28, 2024.[8]
- IIS-2006388 entitled "CHS: Small: Learning and Leveraging Conventions in Human-Robot Interaction," under the direction of PI Dorsa Sadigh. The award has been funded for $500,000.00

[1] https://www.nsf.gov/pubs/policydocs/pappg18_1/index.jsp
[2] Attachment 1 – Award Costs
[3] Attachment 2 - 1900638 - ACM$ w amend
[4] Attachment 3 - 1900638 - ACM$
[5] Attachment 4 - 2037304 - ACM$ w amend
[6] Attachment 5 - 2037304 - ACM$
[7] Attachment 6 - 2024247 - ACM$ w amend
[8] Attachment 7 - 2024247 - ACM$

of which $474,716.32 remains.[9] The award began in October 2020 and is expected to end on January 28, 2024.[10]

- MCB-2001189 entitled "Unraveling biofilm matrix composition, architecture, and function," under the direction of PI Lynette Cegelski. The award has been funded for $999,999.00 of which $363,811.63 remains.[11] The award began in July 2020 and is expected to end on October 28, 2024.[12]
- DMS-1953415 entitled "Collaborative Research: Statistical Optimization for Barcoding and Decoding Single-Cell Dynamics via CRISPR Gene Editing," under the direction of PI Le Cong. The award has been funded for $360,000.00 of which $204,889.63 remains.[13] The award began in August 2020 and is expected to end on November 28, 2023.[14]
- ECCS-1953032 entitled "Collaborative Research: Mixed-Autonomy Traffic Networks: Routing Games and Learning Human Choice Models," under the direction of PI Dorsa Sadigh. The award has been funded for $180,000.00 of which $166,813.34 remains.[15] The award began in August 2020 and is expected to end on November 28, 2023.[16]
- IIS-1941722 entitled "CAREER: Safe and Influencing Interactions for Human-Robot Systems," under the direction of PI Dorsa Sadigh. The award has been funded for $316,686.00 of which $108,640.00 remains.[17] The award began in February 2020 and is expected to end on May 31, 2025.[18]
- CBET-1940865 entitled "EAGER: A Shock Tube Study of Laminar Flames in Transportation Fuels at Engine Relevant Temperatures," under the direction of PI Ronald Hanson. The award has been funded for $200,000.00 of which $2,070.47 remains.[19] The award began in December 2019 and is expected to end on March 30, 2023.[20]
- CHE-1904108 entitled "Nanoscale Control over Surface Functionalization by Molecular Layer Deposition," under the direction of PI Stacey Bent. The award has been funded for $475,516.00 of which $115,403.12 remains.[21] The award began in September 2019 and is expected to end on December 29, 2023.[22]
- DUE-1821449 entitled "Collaborative Research: Scaling the Early Research Scholars Program," under the direction of PI James Landay. The award has been funded for $452,435.00 of which

[9] Attachment 8 - 2006388 - ACM$ w amend
[10] Attachment 9 - 2006388 - ACM$
[11] Attachment 10 - 2001189 - ACM$ w amend
[12] Attachment 11 - 2001189 - ACM$
[13] Attachment 12 - 1953415 - ACM$ w amend
[14] Attachment 13 - 1953415 - ACM$
[15] Attachment 14 - 1953032 - ACM$ w amend
[16] Attachment 15 - 1953032 - ACM$
[17] Attachment 16 - 1941722 - ACM$ w amend
[18] Attachment 17 - 1941722 - ACM$
[19] Attachment 18 - 1940865 - ACM$ w amend
[20] Attachment 19 - 1940865 - ACM$
[21] Attachment 20 - 1904108 - ACM$ w amend
[22] Attachment 21 - 1904108 - ACM$

$270,281.11 remains.[23] The award began in October 2018 and is expected to end on January 28, 2024.[24]

- OCE-1736830 entitled "Collaborative Research: Evaluating how abalone populations in the California Current are structured by the interplay of large-scale oceanographic forcing and nearshore variability," under the direction of PI Fiorenza Micheli. The award has been funded for $959,921.00 of which $2,630.65 remains.[25] The award began in October 2017 and is expected to end on January 28, 2023.[26]
- MCB-1714723 entitled "Collaborative Research: Systematic Investigation of the Structure, Dynamics, and Energetics of Hydrogen Bonds and the Protein Interior Using Ketosteroid Isomerase and Model Systems" with assigned Co-PI Todd Martinez. The award has been funded for $903,036.00 of which $148,001.00 remains.[27] The award began in August 2017 and is expected to end on November 28, 2023.[28]

In addition to the awards listed above, Stanford recently informed us that Dr. Richard Zare, a PI from one of the awards associated with our investigation, had previously revealed to them his position as a Thousand Talents recruit with a foreign university. That position required Zare to work 3 months per year at the foreign university. This position was not originally disclosed to NSF as required, although our investigation had already determined Zare was overcommitted based on a review of his funding history. While details of Zare's foreign position are forthcoming, Stanford has been aware of Zare's Thousand Talent position since May 2019. Notwithstanding Stanford's knowledge of Zare's position, they still have not made an official notification to NSF. As a result, we recommend that NSF suspend the following, additional award:

- PHY-2110256 entitled "Coherent Control of Cold Collision by Preparing Molecular Eigenstates Using Stark-Induced Adiabatic Passage," under the direction of PI Richard Zare. The award has been funded for $463,606.00 of which $71,701.76 remains.[29] The award began September 2021 and is expected to end on October 28, 2022.[30]

OIG Investigation

We interviewed Michiko Pane, Stanford's Senior Director of Pre-Award Operations in the Office of Research Administration who told us her staff assists PIs with the development of scientific proposals. However, the office does not independently verify the information provided to them by PIs in the proposals. When asked if her office referenced other internal systems to verify additional ongoing research, Pane confirmed that the accurate disclosure of funding is 100 percent the responsibility of the

[23] Attachment 22 - 1821449 - ACM$ w amend
[24] Attachment 23 - 1821449 - ACM$
[25] Attachment 24 - 1736830 - ACM$ w amend
[26] Attachment 25 - 1736830 - ACM$
[27] Attachment 26 - 1714723 - ACM$ w amend
[28] Attachment 27 - 1714723 - ACM$
[29] Attachment 28 - 2110256 - ACM$ w amend
[30] Attachment 29 - 2110256 - ACM$

PI. Pane said her office only has visibility over matters designated as "sponsored projects." If a funded project is not designated as such, her office would not be aware of the funding.

Our investigation into these matters, as well as other potential wrongdoings not described in this memorandum, is ongoing. We are working with the U.S. Attorney's Office for the District of Maryland on this matter.

OIG Recommendation

Based on the information set forth above, we recommend NSF suspend the above noted awards pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

Attachments

Attachment 1 – Award Costs
Attachment 2 - 1900638 - ACMS w amend
Attachment 3 - 1900638 - ACMS
Attachment 4 - 2037304 - ACMS w amend
Attachment 5 - 2037304 - ACMS
Attachment 6 - 2024247 - ACMS w amend
Attachment 7 - 2024247 - ACMS
Attachment 8 - 2006388 - ACMS w amend
Attachment 9 - 2006388 - ACMS
Attachment 10 - 2001189 - ACMS w amend
Attachment 11 - 2001189 - ACMS
Attachment 12 - 1953415 - ACMS w amend
Attachment 13 - 1953415 - ACMS
Attachment 14 - 1953032 - ACMS w amend
Attachment 15 - 1953032 - ACMS
Attachment 16 - 1941722 - ACMS w amend
Attachment 17 - 1941722 - ACMS
Attachment 18 - 1940865 - ACMS w amend
Attachment 19 - 1940865 - ACMS
Attachment 20 - 1904108 - ACMS w amend
Attachment 21 - 1904108 - ACMS
Attachment 22 - 1821449 - ACMS w amend
Attachment 23 - 1821449 - ACMS
Attachment 24 - 1736830 - ACMS w amend
Attachment 25 - 1736830 - ACMS
Attachment 26 - 1714723 - ACMS w amend
Attachment 27 - 1714723 - ACMS
Attachment 28 - 2110256 - ACMS w amend
Attachment 29 - 2110256 - ACMS

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

SETTLEMENT AGREEMENT

This Settlement Agreement (Agreement) is entered into among the United States of America, acting through the United States Department of Justice and on behalf of the Department of the Army (Army), the Department of the Navy (Navy), the Department of the Air Force (Air Force), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF) (collectively, the United States); and The Board of Trustees of the Leland Stanford Junior University (Stanford), through their authorized representatives. Collectively, all of the above will be referred to as "the Parties."

RECITALS

A. Stanford is a private university in Palo Alto, California that receives research grant funding from the Army, Navy, Air Force, NASA, and NSF.

B. The United States contends that it has certain civil claims against Stanford arising from false claims submitted by Stanford to Army, Navy, Air Force, NASA, and NSF between July 2015 and December 2020 based on the following alleged conduct:

(1) Stanford, despite requirements to do so, failed to disclose to Army, Navy, NASA, and NSF current and pending support from foreign sources for eleven Stanford faculty members who were principal investigators (PI) or co-PIs on the federal research grant proposals listed in Exhibit A from which Stanford received funding (collectively, the Subject Grants).

(2) Stanford failed to disclose affiliations with and/or funding from Fudan University, a public university in China, and the National Natural Science Foundation of China in connection with a Stanford professor's work as a PI or co-PI on the federal research grants listed in Exhibit B submitted to Army, Air Force, and NSF from which Stanford received funding (collectively, the Fudan/NNSFC Grants). In particular, despite Army, Air Force, and NSF

requirements that research grant proposals disclose foreign government support received by PIs and co-PIs, Stanford did not disclose that the professor received or would receive funding during the period of the Fudan/NNSFC Grants from: (i) the professor's employment at Fudan University through a Contract of Engagement for "High-Level Talent Initiative" of Fudan University, and (ii) a grant to the professor from the National Natural Science Foundation of China. Stanford further did not disclose to the Army, Air Force, and NSF that based on the professor's contractual commitments (including those associated with the professor's Fudan/NNSFC Grants), the professor was overcommitted during a portion of the period of the Fudan/NNSFC Grants because of the undisclosed Fudan University affiliation and/or research funding and other undisclosed research support from additional foreign entities.

The conduct set forth in this Recital B is referred to below as the Covered Conduct.

C. As separately agreed upon by NSF and Stanford, Stanford will work with the NSF Office of the Chief of Research Security Strategy and Policy on best practices in the areas of gifts funding research projects and current and pending support disclosures to address issues and concerns identified by the United States.

D. This Settlement Agreement is neither an admission of liability by Stanford, nor a concession by the United States that its claims are not well-founded.

To avoid the delay, uncertainty, inconvenience, and expense of protracted litigation of the above claims, and in consideration of the mutual promises and obligations of this Settlement Agreement, the Parties agree and covenant as follows:

TERMS AND CONDITIONS

1. Stanford shall pay to the United States One Million Nine Hundred Thirty-Eight Thousand Six Hundred Eighty-Two Dollars ($1,938,682.00) (Settlement Amount), of which One

Million Three Hundred Thirty-Four Thousand Four Hundred Four Dollars and Fifty-Seven Cents ($1,334,404.57) is restitution, by electronic funds transfer pursuant to written instructions to be provided by the Civil Division of the United States Department of Justice no later than fifteen (15) days after the Effective Date of this Agreement.

2. Subject to the exceptions in Paragraph 3 (concerning reserved claims) below, and conditioned upon the United States' receipt of the Settlement Amount, the United States releases Stanford from any civil or administrative monetary claim the United States has for the Covered Conduct under the False Claims Act, 31 U.S.C. §§ 3729–3733; the Program Fraud Civil Remedies Act, 31 U.S.C. §§ 3801–3812; or the common law theories of breach of contract, payment by mistake, unjust enrichment, and fraud.

3. Notwithstanding the release given in Paragraph 2 of this Agreement, or any other term of this Agreement, the following claims and rights of the United States are specifically reserved and are not released:

a. Any liability arising under Title 26, U.S. Code (Internal Revenue Code);

b. Any criminal liability;

c. Except as explicitly stated in this Agreement, any administrative liability or enforcement right, or any administrative remedy, including the suspension and debarment rights of any federal agency;

d. Any liability to the United States (or its agencies) for any conduct other than the Covered Conduct;

e. Any liability based upon obligations created by this Agreement;

f. Any liability of individuals; and

h. Any liability for failure to deliver goods or services due.

4. Stanford waives and shall not assert any defenses Stanford may have to any criminal prosecution or administrative action relating to the Covered Conduct that may be based in whole or in part on a contention that, under the Double Jeopardy Clause in the Fifth Amendment of the Constitution, or under the Excessive Fines Clause in the Eighth Amendment of the Constitution, this Agreement bars a remedy sought in such criminal prosecution or administrative action.

5. Stanford fully and finally releases the United States, its agencies, officers, agents, employees, and servants, from any claims (including attorneys' fees, costs, and expenses of every kind and however denominated) that Stanford has asserted, could have asserted, or may assert in the future against the United States, its agencies, officers, agents, employees, and servants, related to the Covered Conduct and the United States' investigation and prosecution thereof.

6. a. Unallowable Costs Defined: All costs (as defined in the Federal Acquisition Regulation, 48 C.F.R. § 31.205-47) incurred by or on behalf of Stanford, and its present or former officers, directors, employees, shareholders, and agents in connection with:

(1) the matters covered by this Agreement;

(2) the United States' audit(s) and civil investigation(s) of the matters covered by this Agreement;

(3) Stanford's investigation, defense, and corrective actions undertaken in response to the United States' audit(s) and civil investigation(s) in connection with the matters covered by this Agreement (including attorneys' fees);

(4) the negotiation and performance of this Agreement;

(5) the payment Stanford makes to the United States pursuant to this Agreement,

are unallowable costs for government contracting purposes (hereinafter referred to as Unallowable Costs).

b. Future Treatment of Unallowable Costs: Unallowable Costs will be separately determined and accounted for by Stanford, and Stanford shall not charge such Unallowable Costs directly or indirectly to any contract with the United States.

c. Treatment of Unallowable Costs Previously Submitted for Payment: Within 90 days of the Effective Date of this Agreement, Stanford shall identify and repay by adjustment to future claims for payment or otherwise any Unallowable Costs included in payments previously sought by Stanford or any of its subsidiaries or affiliates from the United States. Stanford agrees that the United States, at a minimum, shall be entitled to recoup from Stanford any overpayment plus applicable interest and penalties as a result of the inclusion of such Unallowable Costs on previously submitted requests for payment. The United States, including the Department of Justice and/or the affected agencies, reserves its rights to audit, examine, or re-examine Stanford's books and records and to disagree with any calculations submitted by Stanford or any of its subsidiaries or affiliates regarding any Unallowable Costs included in payments previously sought by Stanford, or the effect of any such Unallowable Costs on the amount of such payments.

7. Stanford agrees to cooperate fully and truthfully with the United States' investigation of individuals and entities not released in this Agreement. Upon reasonable notice, Stanford shall encourage, and agrees not to impair, the cooperation of its directors, officers, and employees, and shall use its best efforts to make available, and encourage, the cooperation of

former directors, officers, and employees for interviews and testimony, consistent with the rights and privileges of such individuals. Stanford further agrees to furnish to the United States, upon request, complete and unredacted copies of all non-privileged documents, reports, memoranda of interviews, and records in its possession, custody, or control concerning any investigation of the Covered Conduct that it has undertaken, or that has been performed by another on its behalf.

8. This Agreement is intended to be for the benefit of the Parties only.

9. Each Party shall bear its own legal and other costs incurred in connection with this matter, including the preparation and performance of this Agreement.

10. Each Party and signatory to this Agreement represents that it freely and voluntarily enters into this Agreement without any degree of duress or compulsion.

11. This Agreement is governed by the laws of the United States. The exclusive venue for any dispute relating to this Agreement is the United States District Court for the District of Maryland. For purposes of construing this Agreement, this Agreement shall be deemed to have been drafted by all Parties to this Agreement and shall not, therefore, be construed against any Party for that reason in any subsequent dispute.

12. This Agreement constitutes the complete agreement between the Parties. This Agreement may not be amended except by written consent of the Parties.

13. The undersigned counsel represent and warrant that they are fully authorized to execute this Agreement on behalf of the persons and entities indicated below.

14. This Agreement may be executed in counterparts, each of which constitutes an original and all of which constitute one and the same Agreement.

15. This Agreement is binding on Stanford's successors, transferees, heirs, and assigns.

16. All Parties consent to the United States' disclosure of this Agreement, and information about this Agreement, to the public.

17. This Agreement is effective on the date of signature of the last signatory to the Agreement (Effective Date of this Agreement). Facsimiles of signatures shall constitute acceptable, binding signatures for purposes of this Agreement.

THE UNITED STATES OF AMERICA

DATED: 9/29/23

[redacted]

DATED: 9/29/23

THE BOARD OF TRUSTEES OF THE LELAND STANFORD JUNIOR UNIVERSITY

DATED: Sept. 28, 2023

[redacted]

DATED: Sept. 28, 2023

EXHIBIT A

The Subject Grants

Agency	Award No
Army	W911NF-17-1-0420
Navy	N00014-16-1-2894
Navy	N00014-19-1-2477
Navy	N00014-20-1-2322
NASA	80NSSC19M0203
NASA	80NSSC20K0258
NSF	1563113
NSF	1609688
NSF	1613091
NSF	1636442
NSF	1640078
NSF	1706154
NSF	1714723
NSF	1821449
NSF	1900638
NSF	1940865

EXHIBIT B

The Fudan/NNSFC Grants

Agency	Award No.
Army	W911NF1910163
Army	W911NF1610161
Air Force	FA9550-16-1-0113
NSF	1734082
NSF	1844119
NSF	1464640
NSF	2028776

Wenlu Zhu, Wenlu Zhu, Chunsheng Wang,
and Ming C. Lin
University of Maryland College Park

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

November 14, 2022

To: [redacted]

From: [redacted]

Subject: Recommendation to Suspend NSF Awards to University of Maryland College Park (OIG Case No. I-20-0081-O)

Attached is our recommendation to suspend four awards made to awardee University of Maryland College Park (UCMP). The basis of this recommendation is UMCP's failure to disclose foreign funding obtained by UMCP Principal Investigators (PIs) and Co-PIs. The awards and PIs/Co-PIs are as follows:

Award Number	Title	PI/Co-PI
EAR-1761912	Observations of Fault Growth Under Elevated Fluid Pressure Using Dynamic Microtomography	Zhu, Wenlu (PI)
EAR-1926627	Research Coordination Network: In situ Studies of Rock Deformation (ISRD)	Zhu, Wenlu (PI)
CBET – 1805159	Mechanism for Lithium Dendrite Formation in Solid State Electrolytes	Wang, Chunsheng (PI)
IIS – 1910940	CHS: Small: Audio-Visual Reconstruction for Immersive Virtualized Reality	Lin, Ming C. (PI)

Based on our investigation to date, we recommend taking these actions to protect NSF funds.

[redacted]

[redacted]

Attachment

cc: [redacted]

Recommendation to Suspend Awards

OIG Case Number I-20-0081-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

[redacted]

November 8, 2022

REPORT RELEASE RESTRICTION

This report contains protected personal information, the unauthorized disclosure of which may result in personal criminal liability under the Privacy Act, 5 USC 552a. This report will only be disclosed outside NSF if such disclosure is required or consistent with standards allowing disclosure under the Freedom of Information and Privacy Acts, 5 USC 552 & 552a. This report may be further disclosed within NSF only to individuals who must have knowledge of its contents to facilitate NSF's assessment and resolution of this matter. Please take appropriate precautions handling this report.

[redacted]

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CUI//PRVCY

Introduction

The NSF Proposal and Award Policies and Procedures Guide requires that Principal Investigators (PI) and Co-PIs disclose all forms of current and pending sources of funding, both foreign and domestic.[1] As part of a proactive investigation to determine if U.S. institutions are complying with such requirements, we reviewed foreign contracts/awards received by the University of Maryland College Park (UMCP) over the past 5 years. Specifically, we attempted to determine if UMCP had disclosed foreign awards with PIs or Co-PIs who were also recipients of NSF awards.

To date, our investigation has identified at least seven NSF awards totaling more than $2.3 million, of which four awards are currently active with funds available. These four grants are under the direction of PIs or Co-PIs who have been named as investigative staff on foreign funded research projects at UMCP.

The involved foreign awards or gifts were known to UMCP but were not disclosed to NSF, as required. The awards either were made between the foreign entity and UMCP, or the foreign entity and through the University of Maryland College Park Foundation (UMCPF). If funding was provided through UMCPF, UMCP and UMCPF personnel communicated and coordinated so that funds were wired directly to UMCP's accounts from the foreign source.[2] Also at times, the same UMCP personnel signed both the respective foreign agreement and the NSF proposal. At no time were the associated time and effort commitments for the involved PIs or Co-PIs listed in their NSF proposals.

There is currently more than $800,000.00[3] in available award funds for the four NSF awards detailed below.

UMCP is responsible for ensuring the accuracy and completeness of its NSF proposals, to include the disclosure of funding their PIs/Co-PIs receive from non-federal sources. The investigation determined that UMCP did not disclose sources of foreign funding obtained by certain UMCP PIs and Co-PIs as required. We recommend NSF suspend the following awards made to UMCP:

- EAR-1761912 entitled "Observations of Fault Growth Under Elevated Fluid Pressure Using Dynamic Microtomography," with assigned PI Wenlu Zhu. The proposal was submitted on September 18, 2017, and awarded on May 21, 2018 for $358,589.00, of which $97,222.00 remains.[4] The award began in June 2018 and is expected to end on May 31, 2023.[5]
    - Unreported Foreign Funding. Dr. Zhu received a $108,600.00 foreign award titled, "Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks," from the United States-Israel Binational Science Foundation. The award was accepted by UMCP on August

[redacted]

[1] https://www.nsf.gov/pubs/policydocs/pappg21_1/index.jsp
[2] See Attachment 08, pp. 8-11 for supporting documentation
[3] As of November 2, 2022
[4] Attachment 01 – 1761912 - ACMS w amend
[5] Attachment 02 - 1761912 - ACMS

1 Recommendation to Suspend Awards – OIG Case Number I21-0008-I-U

10, 2015, and the period of performance was from September 1, 2015 through August 31, 2019.[6]

- EAR-1926627 entitled "Research Coordination Network: In situ Studies of Rock Deformation (ISRD)," also under the direction of PI Wenlu Zhu. The proposal was submitted on February 25, 2019, and was awarded on July 9, 2019 for $398,524.00, of which $338,142.00 remains.[7] The award began in July 2019 and is expected to end on June 30, 2024.[8]
    - Unreported Foreign Funding: The same foreign award referenced above in Zhu's earlier NSF award, EAR-1761912, was also active during this proposal and award.

- CBET-1805159 entitled "Mechanism for Lithium Dendrite Formation in Solid State Electrolytes," under the direction of PI Chunsheng Wang. The proposal was submitted on October 20, 2017, and was awarded on July 2, 2018 for $340,000.00, of which $46,709.00 remains.[9] The award began in July 2018 and is expected to end on June 30, 2023.[10]
    - Unreported Foreign Funding: Dr. Wang received a $641,024.00 'unrestricted, charitable gift' from Huawei Technologies Co., Ltd. on February 27, 2017. The gift's stated purpose was "to support the research on the high energy density FeF3 conversion cathode materials and Li metal anodes in the United States by Dr. Chunsheng Wang." The award was accepted by UMCPF on February 27, 2017, and the period of performance was from January 26, 2017 through January 26, 2019.[11]

- IIS-1910940 entitled "CHS: Small: Audio-Visual Reconstruction for Immersive Virtualized Reality," under the direction of PI Ming C. Lin. The proposal was submitted on November 15, 2018, and was awarded on September 4, 2019 for $499,999.00, of which $354,035.00 remains.[12] The award began in October 2019 and is expected to end on September 30, 2023.[13]
    - Unreported Foreign Funding: Dr. Lin received a $100,000.00 award titled, "Cyber-Manufacturing of Customized Apparel," from Alibaba/Taobao (China) Software Co, Ltd. The award was accepted by UMCP on January 29, 2018, and the period of performance was from January 1, 2018 through June 30, 2019.[14]

[6] Attachment 03 - Dr. Zhu's foreign award
[7] Attachment 04 - 1926627 - ACM$ w amend
[8] Attachment 05 - 1926627 - ACM$
[9] Attachment 06 - 1805159 - ACM$ w amend
[10] Attachment 07 - 1805159 - ACM$
[11] Attachment 08 - Dr. Wang's foreign gift
[12] Attachment 09 - 1910940 - ACM$ w amend
[13] Attachment 10 - 1910940 - ACM$
[14] Attachment 11 - Dr. Lin's foreign award

OIG Investigation

We interviewed Wendy Montgomery, Director for UMCP's Office of Research Administration (ORA), who told us her staff assists PIs with the basic development of scientific proposals, including providing training and updates on program requirements, new guidelines, etc. She noted that the PI is responsible for accurately responding to questions and certifications when submitting proposals. ORA reviews the proposals to ensure there are responses to questions where required but does not independently verify the information provided by PIs.

Montgomery said her office oversees the pre- and post-award "sponsored projects," including foreign-sponsored projects, and the compliance, billing, and financial reports of the projects, as well. However, she stated her office would not be aware of any domestic or foreign 'gift' funding. Of the awards noted above, only Dr. Wang received such a 'gift.' Drs. Zhu and Lin each received foreign 'sponsored project' funds through UMCP.

Our investigation into these matters, as well as other potential wrongdoings not described in this memorandum, is ongoing. We are working with the U.S. Attorney's Office for the District of Maryland on this matter.

OIG Recommendation

Based on the information set forth above, we recommend NSF suspend the above noted awards pending the outcome of our investigation. It would be helpful to be copied on any actions taken in response to this recommendation.

[redacted]

Attachments

Attachment 01 - 1761912 - ACM$ w amend
Attachment 02 - 1761912 - ACM$
Attachment 03 - Dr. Zhu's foreign award
Attachment 04 - 1926627 - ACM$ w amend
Attachment 05 - 1926627 - ACM$
Attachment 06 - 1805159 - ACM$ w amend
Attachment 07 - 1805159 - ACM$
Attachment 08 - Dr. Wang's foreign gift
Attachment 09 - 1910940 - ACM$ w amend
Attachment 10 - 1910940 - ACM$
Attachment 11 - Dr. Lin's foreign award

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

SETTLEMENT AGREEMENT

This Settlement Agreement (Agreement) is entered into among the United States of America, acting through the United States Department of Justice and on behalf of the National Science Foundation (NSF) and the Department of the Army (Army) and (collectively, the United States); and The University of Maryland, College Park (UMD), through their authorized representatives. Collectively, all of the above will be referred to as "the Parties."

RECITALS

A. UMD is a public university in College Park, Maryland that receives research grant funding from NSF and Army.

B. The United States contends that it has certain civil claims against UMD arising from false claims submitted by UMD to NSF and Army between January 2015 and May 2021 based on the following alleged conduct:

(1) The United States contends that UMD, despite requirements to do so, failed to disclose to NSF and Army current and pending support from foreign sources for three UMD faculty members who were principal investigators (PI) or co-PIs on the five federal research grant proposals listed in Exhibit A from which UMD received funding (collectively, the Subject Grants).

(2) Specifically, the United States contends that UMD failed to disclose to NSF gift funding agreed to by Huawei Technologies Co., Ltd. (Huawei) in January 2017 to a PI in support of research titled, "High energy density FeF3 conversion cathode materials and Li metal anodes." (UMD terminated the Huawei gift in June 2019, and returned the unexpended balance of the gift to Huawei.) In addition, the United States contends that UMD failed to disclose to NSF and Army grant funding agreed to by Taobao (China) Software Co., Ltd. (Alibaba) in

January 2018 to one PI in support of research titled, "Large-Scale Behavior Learning for Dense Crowds," and funding to another PI in support of research titled, "Cyber-Manufacturing of Customized Apparel." Despite NSF and Army requirements that research grant proposals disclose foreign support received by PIs and co-PIs, the United States contends that UMD did not disclose to NSF and Army in the grant proposals that the professors received or would receive these foreign funds during the period of the Subject Grants.

The conduct set forth in this Recital is referred to below as the Covered Conduct.

C. This Settlement Agreement is neither an admission of liability by UMD, nor a concession by the United States that its claims are not well-founded.

D. As a result of the United States' investigation into the Covered Conduct, UMD has implemented corrective actions to protect against incomplete reporting of required research support.

To avoid the delay, uncertainty, inconvenience, and expense of protracted litigation of the above claims, and in consideration of the mutual promises and obligations of this Settlement Agreement, the Parties agree and covenant as follows:

TERMS AND CONDITIONS

1. Subject to the condition set forth in Paragraph 2, UMD shall pay to the United States the amount of Five Hundred Thousand Dollars ($500,000.00) ("Settlement Amount") by electronic funds transfer pursuant to written instructions to be provided by the United States Attorney's Office for the District of Maryland no later than 45 days after approval of this Settlement Agreement by the Maryland Board of Public Works. Notwithstanding the foregoing 45-day deadline, the Parties acknowledge that the timing of payment is not within UMD's control but instead is controlled by the State of Maryland Office of the Comptroller. UMD will

request accelerated processing by the Office of the Comptroller but a delay in payment shall not be considered a breach by UMD of this Settlement Agreement.

2. The obligation of UMD under this Settlement Agreement to make payment of the Settlement Amount set forth in Paragraph 1 above is subject to: (a) approval by the Board of Public Works; and (b) the identification by the State of Maryland of funds to satisfy the Settlement Amount. If the Board of Public Works rejects the payment of the Settlement Amount by UMD under this Settlement Agreement, or if the State of Maryland provides notice to the United States that it has been unable to identify funds to satisfy the Settlement Amount, the United States shall have the right to prosecute its claims against UMD as though this Settlement Agreement had never been entered into. UMD shall promptly submit through the Maryland Office of the Attorney General a request for approval of this Settlement to the Maryland Board of Public Works under the policies of the Board of Public Works.

3. Subject to the exceptions in Paragraph 4 (concerning reserved claims) below, and conditioned upon the United States' receipt of the Settlement Amount, the United States releases UMD from any civil or administrative monetary claim the United States has for the Covered Conduct under the False Claims Act, 31 U.S.C. §§ 3729–3733; the Program Fraud Civil Remedies Act, 31 U.S.C. §§ 3801–3812; or the common law theories of payment by mistake, unjust enrichment, and fraud.

4. Notwithstanding the release given in Paragraph 3 of this Agreement, or any other term of this Agreement, the following claims and rights of the United States are specifically reserved and are not released:

a. Any liability arising under Title 26, U.S. Code (Internal Revenue Code);

b. Any criminal liability;

c. Except as explicitly released in this Agreement, any administrative liability or enforcement right, or any administrative remedy, including the suspension and debarment rights of any federal agency;

d. Any liability to the United States (or its agencies) for any conduct other than the Covered Conduct;

e. Any liability based upon obligations created by this Agreement;

f. Any liability of individuals; and

h. Any liability for failure to deliver goods or services due.

5. UMD waives and shall not assert any defenses UMD may have to any criminal prosecution or administrative action relating to the Covered Conduct that may be based in whole or in part on a contention that, under the Double Jeopardy Clause in the Fifth Amendment of the Constitution, or under the Excessive Fines Clause in the Eighth Amendment of the Constitution, this Agreement bars a remedy sought in such criminal prosecution or administrative action.

6. UMD fully and finally releases the United States, its agencies, officers, agents, employees, and servants, from any claims (including attorneys' fees, costs, and expenses of every kind and however denominated) that UMD has asserted, could have asserted, or may assert in the future against the United States, its agencies, officers, agents, employees, and servants, related to the Covered Conduct and the United States' investigation and prosecution thereof.

7. a. Unallowable Costs Defined: All costs (as defined in the Federal Acquisition Regulation, 48 C.F.R. § 31.205-47) incurred by or on behalf of UMD, and its present or former officers, directors, employees, shareholders, and agents in connection with:

(1) the matters covered by this Agreement;

(2) the United States' audit(s) and civil investigation(s) of the matters covered by this Agreement;

(3) UMD's investigation, defense, and corrective actions undertaken in response to the United States' audit(s) and civil investigation(s) in connection with the matters covered by this Agreement (including attorneys' fees);

(4) the negotiation and performance of this Agreement;

(5) the payment UMD makes to the United States pursuant to this Agreement,

are unallowable costs for government contracting purposes (hereinafter referred to as Unallowable Costs).

b. Future Treatment of Unallowable Costs: Unallowable Costs will be separately determined and accounted for by UMD, and UMD shall not charge such Unallowable Costs directly or indirectly to any contract with the United States.

c. Treatment of Unallowable Costs Previously Submitted for Payment: Within 90 days of the Effective Date of this Agreement, UMD shall identify and repay by adjustment to future claims for payment or otherwise any Unallowable Costs included in payments previously sought by UMD or any of its subsidiaries or affiliates from the United States. UMD agrees that the United States, at a minimum, shall be entitled to recoup from UMD any overpayment plus applicable interest and penalties as a result of the inclusion of such Unallowable Costs on previously submitted requests for payment. The United States, including the Department of Justice and/or the affected agencies, reserves its rights to audit, examine, or re-examine UMD's books and records and to disagree with any calculations submitted by UMD

or any of its subsidiaries or affiliates regarding any Unallowable Costs included in payments previously sought by UMD, or the effect of any such Unallowable Costs on the amount of such payments.

8. This Agreement is intended to be for the benefit of the Parties only.

9. Each Party shall bear its own legal and other costs incurred in connection with this matter, including the preparation and performance of this Agreement.

10. Each Party and signatory to this Agreement represents that it freely and voluntarily enters into this Agreement without any degree of duress or compulsion.

11. This Agreement is governed by the laws of the United States. The exclusive venue for any dispute relating to this Agreement is the United States District Court for the District of Maryland. For purposes of construing this Agreement, this Agreement shall be deemed to have been drafted by all Parties to this Agreement and shall not, therefore, be construed against any Party for that reason in any subsequent dispute.

12. This Agreement constitutes the complete agreement between the Parties. This Agreement may not be amended except by written consent of the Parties.

13. The undersigned counsel represent and warrant that they are fully authorized to execute this Agreement on behalf of the persons and entities indicated below.

14. This Agreement may be executed in counterparts, each of which constitutes an original and all of which constitute one and the same Agreement.

15. This Agreement is binding on UMD's successors, transferees, heirs, and assigns.

16. All Parties consent to the United States' disclosure of this Agreement, and information about this Agreement, to the public.

17. This Agreement is effective upon approval of the Board of Public Works as set forth in paragraph 2 (Effective Date of this Agreement). Facsimiles of signatures shall constitute acceptable, binding signatures for purposes of this Agreement.

THE UNITED STATES OF AMERICA

DATED: June 10, 2024 BY: [redacted]

UMD COLLEGE PARK

DATED: _____ BY: [redacted]

Reviewed for form and legal sufficiency
this ____ day of June, 2024:

[redacted]

THE UNITED STATES OF AMERICA

DATED: June 10, 2024 BY: [redacted]

UMD COLLEGE PARK

DATED: June 17, 2024 BY: [redacted]

Reviewed for form and legal sufficiency
this 19th day of June, 2024:

[redacted]

EXHIBIT A

The Subject Grants

Agency	Award No
Army	W911NF-18-1-0313
Army	W911NF-19-1-0069
NSF	1805159
NSF	1810076
NSF	1910940

United States – Israel
Binational Science Foundation

22-Jul-2015

[redacted]

Research Grant Agreement:

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Research Year: 1

Dear [redacted]

Enclosed please find the documents related to the research project(s) mentioned above. If Research Grant Agreement is included, please sign and return it to us at your earliest convenience so that we can activate the grant(s). If an Agreement was signed already for this grant (applicable only to the large Israeli institutions), please attach the present documents to the previously signed Agreement. Please note the following:

[1] A BSF Agreement covers the entire grant period.

[2] The Research Proposal constitutes an integral part of the Agreement as Annex I. As you have a copy, there is no reason for it to be sent. Please attach it.

[3] Annex II-A details the estimated total budget for the entire duration of the project and the approved budget for the first year. Following receipt of each annual scientific report, you will be sent the approved budget for the current year (Annex II-B). Each annual budget will constitute an integral part of the Agreement.

[4] Strict adherence to the terms of the Agreement (see our website for details) is vital for receipt of funds for the project.

[5] The BSF does not allow the grant to be used to pay any part of the salary of the PI, including summer salary.

[6] If a form for updated bank details is included please fill it out and send it to us by mail/email/fax so that we will be able to forward you the grant money.

[7] For information only, a copy of the budget allocated to the collaborating PI(s) is enclosed.

Yours Sincerely,

[redacted]

United States – Israel
Binational Science Foundation
8 Hamarpeh Street, P.O.B 49086
Har Hotzvim, Jerusalem 91450, Israel

www.bsf.org.il
Tel. 972-2-582-8239
Fax. 972-2-582-8306
Email: bsf@bsf.org.il

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Research Authority - Authorizing Official

Please update and fill in missing data

22-Jul-2015

BSF Grant Number 2014036

UOM2

PI Prof. Zhu Wenlu

[1] **AUTHORIZING OFFICIAL**

	Ms. [redacted]
Organization	University of Maryland
Division	Office of Research Administration
Address	[redacted]
	MD USA [redacted]
Fax	
Email	

[2] **BANK DETAILS FOR WIRE TRANSFERS:**

Name	[redacted]
Address	
Account Number	[redacted]
Aba Number (9 digits)	[redacted]

[3] **FINANCIAL OFFICIAL** **Official responsible for fiscal reports and payment notification**

Title and Name	[redacted]
Division	
Fax	

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RESEARCH GRANT AGREEMENT
BETWEEN
The UNITED STATES - ISRAEL BINATIONAL SCIENCE FOUNDATION

(Hereinafter - the FOUNDATION)

AND

[redacted]

(Hereinafter - the GRANTEE)

Pursuant to an Agreement between the Governments of the United States of America and Israel to promote and support cooperation in science and technology for peaceful purposes on subjects of mutual interest, the FOUNDATION is awarding to the GRANTEE, research grant(s) for the project(s) described in the research proposal(s) (Annex I) and total estimated budget for each RESEARCH PROJECT(S) and approved first-year budget(s) (Annex II) hereto appended as an integral part hereof. (Each project hereinafter – the RESEARCH PROJECT)

The RESEARCH PROJECT(S) ARE:

1. PRINCIPAL OBLIGATIONS OF THE GRANTEE

(a) To carry out the RESEARCH PROJECT.

(b) The Principal Investigator is responsible for the implementation of the RESEARCH PROJECT during the period of this Agreement. Written approval of the FOUNDATION is required for changes involving the participation in a RESEARCH PROJECT of Principal Investigators and other key personnel. In cases when such personnel are withdrawn from or will be absent for more than three months (e.g., sabbatical), the GRANTEE must notify the FOUNDATION. The FOUNDATION will approve the leave if satisfied with the arrangements made for the smooth continuation of the RESEARCH PROJECT. The FOUNDATION will not approve a leave of over one year.

(c) To supply all reasonable means of support and assistance necessary for the implementation of the RESEARCH PROJECT, including manpower, raw materials, equipment, technical and administrative services and other services.

(d) To be responsible for all monies granted by the FOUNDATION pursuant to this Agreement, to draw such monies for the RESEARCH PROJECT only and in accordance with BSF guidelines as published in the Foundation website www.bsf.org.il, to return any money remaining at the termination of the Agreement, to maintain complete records of expenses relating to the RESEARCH PROJECT in a special and separate account and to submit an annual fiscal report within 2 months of the completion of each 12 months during the period covered by this Agreement.

(e) To permit the FOUNDATION to examine all books, documents, records and accounts relating to the RESEARCH PROJECT during the period of this Agreement and for three years thereafter, and to make inspections at the places where the research is conducted and receive from the research operators full information with regard to their activities.

(f) To submit to the FOUNDATION annual scientific reports in accordance with BSF Guidelines, as published on the FOUNDATION website, www.bsf.org.il.

(g) To inform the FOUNDATION of any other financial support received for the RESEARCH PROJECT or related research and of any obligations of the GRANTEE which may in any way affect the rights of the FOUNDATION or of the GOVERNMENTS of the UNITED STATES or ISRAEL under this Agreement.

(h) To acknowledge the support of the FOUNDATION for the RESEARCH PROJECT in all publications and reports summarizing the results of the research, as follows:

"This research was supported by a grant from the United States-Israel Binational Science Foundation

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(BSF), Jerusalem, Israel".

(i) The FOUNDATION does not assume any liability for accidents, illnesses or claims arising out of any work supported by the grant or for any unauthorized use of patented, copyrighted or other protected material or intellectual property rights. The GRANTEE shall bear full responsibility for all personal injury, damage to property and breaches of intellectual property rights which may result from the GRANTEE'S implementation of the RESEARCH PROJECT.

2. NO EMPLOYER - EMPLOYEE RELATIONSHIP

The GRANTEE agrees that persons employed by it in connection with the RESEARCH PROJECT shall be deemed to be solely its own employees and that no relationship of master and servant shall be created between such employees and the FOUNDATION, for the purposes of tort liability, social benefits or for any other matter. The GRANTEE shall be responsible for any payments which it may be obligated to make under law or contract based on the employer-employee relationship.

3. PRINCIPAL OBLIGATIONS OF THE FOUNDATION

(a) To reimburse the GRANTEE for the costs and obligations incurred in implementing the RESEARCH PROJECT to a sum not exceeding the Budget. The reimbursements will be in U.S. Dollars. Payments to GRANTEES in Israel may be made in Israeli currency at the representative exchange rate for the US Dollar published by the Bank of Israel, effective for the first day of the month preceding the month of reimbursement. Regarding grants under which more than one GRANTEE is to receive funds, the grant will enter into force only after all GRANTEES have signed and returned their Agreements to the FOUNDATION. Payment shall be transferred to the GRANTEE in installments as provided hereunder:

(1) First year of the Agreement: Upon signing of the Agreement, 75% of the approved budget the first year.

(2) Subsequent years:
a. Upon submission of the annual scientific report of the previous year, the FOUNDATION will notify the GRANTEE of the approved budget for the current year and will forward 25% of the said amount.
b. Upon submission of the previous year's annual fiscal report, 50% of the approved budget for the current year and the balance of the budget approved for the previous year.
c. Each approved annual budget will be appended to the Agreement as Annex II-B and as an integral part thereof.

(3)(a) Final payment: Upon submission of the final fiscal and scientific reports, the remaining 25% of the budget, subject to the expenditure of previous payments.

(b) Continuation of the grant beyond the first year is subject to satisfactory progress in the RESEARCH PROJECT; the annual budget will be in accordance with the research requirements and available funds as determined by the Board of Governors of the BSF.

(c) The FOUNDATION will not transfer to the GRANTEE any amount which the latter may expend in excess of that specified in paragraph (a) above, unless the Budget has been amended by the parties in writing. Payment in accordance with paragraph (a) above shall be made only after most of the amount from the previous payment has been expended. Unexpended balances in the possession of the GRANTEE at the termination of the Agreement shall be refunded to the FOUNDATION without delay.

4. TERMINATION

The FOUNDATION shall be entitled, after consultation with the GRANTEE, to terminate this Agreement and cease making payments under paragraph 3 above, subject to fulfilling its undertakings as to expenditures and obligations incurred prior to the notice of termination, and which cannot be cancelled at the time of notification. The GRANTEE shall not be entitled to cancel this Agreement or to abandon the RESEARCH PROJECT, without prior written consent of the FOUNDATION.

5. EQUIPMENT AND MATERIALS

All permanent equipment purchased with grant funds shall be the property of the FOUNDATION. At the termination of the Agreement, title to equipment purchased under this Agreement shall transfer to the GRANTEE.

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6. RIGHTS CONCERNING RESEARCH FINDINGS

(a) Subject to paragraphs 6(c), 7 and 8 below, results of research sponsored by the FOUNDATION shall be made available by the FOUNDATION and the GRANTEE, to the world scientific community through customary channels, in accordance with the applicable procedures and policies of the institutions involved.

(b) There shall be no restrictions on the publication of information, subject to paragraph 6 (c) below and the provisions governing copyrights set forth in paragraph 8 below.

(c) Subject to paragraph 7(d) (2) below, the FOUNDATION shall ensure that proprietary information provided by and so marked by the GRANTEE shall be respected and shall not be disclosed without the consent of the GRANTEE. Information may be identified as 'proprietary' if a person having the information may derive an economic benefit from it or may obtain a competitive advantage over those who do not have it, the information is not generally known or publicly available from other sources, or the GRANTEE has not previously made the information available without imposing in a timely manner an obligation to keep it confidential.

7. PATENT RIGHTS

(a) The GRANTEE shall communicate to the FOUNDATION full information on any invention or discovery resulting from FOUNDATION sponsored or supported research within two months of becoming aware of the invention or discovery.

(b) Within two years of the communication to the FOUNDATION pursuant to paragraph (a) above, the GRANTEE shall inform the FOUNDATION whether it intends to file for patent protection and the countries in which it intends to file.

(c) Subject to paragraph 7 (d) (2) below, the FOUNDATION shall not disclose information acquired pursuant to paragraph 7 (a).

(d)(1) The GRANTEE shall be entitled to all rights, title and interest to the invention in all countries provided that the GRANTEE files: (i) its initial patent application within one year of informing the FOUNDATION of its intent in accordance with paragraph 7(b) above, and with respect to applications in additional countries, within ten months of initial filing; (ii) prior to any statutory bar date under the applicable laws of the countries in which patent protection is sought, whichever is earlier.

(2) Once the time period specified in paragraph 7(d)(1) above has elapsed, the FOUNDATION shall be entitled to all rights, title and interest to the invention in all remaining countries, to the extent that the Grantee is legally able to do so, and the non-disclosure provision of paragraph 6 (c) shall no longer apply.

(3) Patent rights of the GRANTEE and the FOUNDATION are subject to the applicable laws of the countries in which patent protection is sought.

(e) The FOUNDATION shall be entitled to 5% of the royalties (computed after payment of costs related to the patent application and its maintenance) from the manufacture, use or sale of the invention in that country. Royalties received by the FOUNDATION shall be used to further the purposes of the FOUNDATION.

(f) The Governments of the United States and Israel shall be entitled to irrevocable, non-exclusive, royalty-free licenses to use for non-commercial and government purposes any invention referred to in paragraph 7(d)(1) above within their respective countries or within any third countries.

(g) The FOUNDATION shall have the right to require the GRANTEE, its assignee or exclusive licensee to grant a non-exclusive, partially exclusive or exclusive license to a responsible applicant(s) within the United States or Israel and upon terms that are reasonable, if the GRANTEE, its assignee or exclusive licensee has not taken or is not expected to take effective steps to achieve practical application of the invention in the United States or Israel. The term "practical application" shall mean: the manufacture in the case of a product, the practice in the case of a method, the operation in the case of a machine or system, under such conditions as to establish that the invention is being utilized and that its benefits are available to the public on reasonable terms.

(h) Any licensing agreement entered into by the GRANTEE or its assignee shall describe the FOUNDATION support for the research leading to the invention.

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(i) GRANTEES shall execute or have executed and promptly deliver to the FOUNDATION all instruments necessary to: (1) enable the Governments of the United States and Israel to establish or confirm rights conferred under this Agreement; and (2) convey title to the FOUNDATION and enable the FOUNDATION to obtain patent protection pursuant to paragraph 7(d)(2) above.

8. COPYRIGHTS

(a) Copyrights of FOUNDATION GRANTEES and other persons shall be in accordance and consistent with applicable international agreements and internationally recognized standards of protection.

(b) Except as otherwise specified in this Agreement, the GRANTEE may own or permit others to own copyright in all writings produced in the performance of work under this grant. The GRANTEE agrees that if it or anyone else owns copyright in a writing, the FOUNDATION and the Governments of the United States and Israel shall have non-exclusive, non transferable, irrevocable, royalty-free licenses to exercise or have exercised for or on their behalf throughout the world all exclusive rights provided by any copyright. Such licenses will not include the right to sell copies of the copyrighted work to the public.

9. The research shall be conducted in accordance with the highest ethical standards and all laws and regulations applicable and in such a manner as to minimize detrimental effects on humans, animals, plants and the environment.

10. The rights and obligations of the GRANTEE under this Agreement may not be transferred or assigned to a third party without the written consent of the FOUNDATION.

11. Notices sent by one party to the other by courier shall be deemed to have reached their destination at the end of 96 hours from the posting thereof.

IN WITNESS WHEREOF THE PARTIES HAVE SET THEIR HANDS AND SIGNATURES

[redacted]

THE FOUNDATION

THE GRANTEE

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United States – Israel
Binational Science Foundation

ANNEX II-A
Payment Schedule

22-Jul-2015

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Duration of Grant: 4 years **Start Date:** 01-Sep-2015

Total Grant Budget Estimate $180,000

Annual Budget (in US Dollars)

Institution	Year 1	Year 2	Year 3	Year 4	Total
Geological Survey of Israel	17,000	18,700	17,000	18,700	71,400
University of Maryland	28,000	26,300	28,000	26,300	108,600
Grand Total	**$ 45,000**	**$ 45,000**	**$ 45,000**	**$ 45,000**	**$ 180,000**

[redacted]

United States – Israel
Binational Science Foundation
8 Hamarpeh Street, P.O.B 45085
Har Hotzvim, Jerusalem 91450, Israel

www.bsf.org.il
Tel. 972-2-582-8233
Fax. 972-2-582-5306
Email: bsf@bsf.org.il

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United States - Israel
Binational Science Foundation

Budget Year: 1
Start: 01-Sep-2015
End: 31-Aug-2016

ANNEX II-B
Approved Budget

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Budget Details For Investigator : Prof. Zhu Wenlu
University of Maryland , College Park, USA

Category	Details	Amount In Dollars
1 - Salaries		
	Research assistant	$12,000
2 - Equipment		
		$8,000
3 - Supplies		
		$2,000
4 - Travel		
	Funds restricted to travel from: US to Israel, US PI or group members	$2,348
9 - 2 Overhead		
	Overhead on ALL expenses is 15%	$3,652
	Total:	**$28,000**

[redacted]

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United States – Israel
Binational Science Foundation

9-Nov-2016

[redacted]

Research Grant Agreement:

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Research Year: 2

Dear [redacted]

Enclosed please find the approved budget for the year shown above, for this Research Grant.

Payment of your share of the grant is according to the schedule detailed in Article 3 of the Research Grant Agreement and is subject to the satisfactory fulfillment of the conditions listed in the Agreement.

Yours Sincerely

[redacted]

United States – Israel
Binational Science Foundation
8 Hamarpeh Street, P.O.B 45086
Har Hotzvim, Jerusalem 91450, Israel

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הקרן הדו-לאומית למדע
ארצות הברית – ישראל
רחוב המרפא 8, ת.ד. 45086
הר חוצבים, ירושלים, 91450

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United States – Israel
Binational Science Foundation

Budget Year: 2
Start: 01-Sep-2016
End: 31-Aug-2017

ANNEX II-B
Approved Budget

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Budget Details For Investigator : **Prof. Zhu Wenlu**
University of Maryland , College Park, USA

Category	Details	Amount In Dollars
1 - Salaries		
	Research assistant	$12,869
3 - Supplies		
		$10,000
9 - 2 Overhead		
	Overhead on ALL expenses is 15%	$3,431
	Total:	**$26,300**

[redacted]

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United States – Israel
Binational Science Foundation

13-Aug-2017

[redacted]

Research Grant Agreement:

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Research Year: 3

Dear [redacted]

Enclosed please find the approved budget for the year shown above, for this Research Grant.

Payment of your share of the grant is according to the schedule detailed in Article 3 of the Research Grant Agreement and is subject to the satisfactory fulfillment of the conditions listed in the Agreement.

Yours Sincerely,

[redacted]

United States – Israel
Binational Science Foundation
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הקרן הדו-לאומית למדע
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רחוב המרפא 8, ת.ד. 45086
הר חוצבים, ירושלים, 91450

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United States – Israel
Binational Science Foundation

Budget Year: 3
Start: 01-Sep-2017
End: 31-Aug-2018

ANNEX II-B
Approved Budget

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Budget Details For Investigator : **Prof. Zhu Wenlu**

University of Maryland , College Park, USA

Category	Details	Amount $US
1 - Salaries		
	Research assistant	$12,500
3 - Supplies		$8,848
4 - Travel		
	Funds restricted to travel from: US to Israel, US PI or group members	$3,000
9 - 2 Overhead		
	Overhead on ALL expenses is 15%	$3,652
	Total:	**$28,000**

[redacted]

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United States – Israel
Binational Science Foundation

26-Aug-2018

[redacted]

Research Grant Agreement:

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Research Year: 4

Dear [redacted]

Enclosed please find the approved budget for the year shown above, for this Research Grant.

Payment of your share of the grant is according to the schedule detailed in Article 3 of the Research Grant Agreement and is subject to the satisfactory fulfillment of the conditions listed in the Agreement.

Yours Sincerely

[redacted]

United States – Israel
Binational Science Foundation
8 Hamarpeh Street, P.O.B 45086
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קרן בינלאומית למדע
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הר חוצבים, ירושלים, 91450

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United States – Israel
Binational Science Foundation

Budget Year: 4
Start: 01-Sep-2018
End: 31-Aug-2019

ANNEX II-B
Approved Budget

Grant Number: 2014036

Title: Hydro-Chemo-Thermo-Mechanical behavior of Carbonate Rocks

Principle Investigators:

[redacted]

Prof. Zhu Wenlu, University of Maryland, College Park, GA USA

Budget Details For Investigator : **Prof. Zhu Wenlu**
University of Maryland , College Park, USA

Category	Details	Amount $US
1 - Salaries		
	Research assistant	$15,000
2 - Equipment		$7,870
9 - 2 Overhead		
	Overhead on ALL expenses is 15%	$3,430
	Total:	**$26,300**

[redacted]

Confidential and Exempt from Disclosure Under FOIA

Document No: YBN2017010021

HUAWEI

Current Date: Jan 26, 2017

[redacted]

Dear [redacted]

Huawei Technologies Co., Ltd. is pleased to make an unrestricted, charitable gift of $641,024 to the University of Maryland College Park Foundation *Dr. Chunsheng Wang Research Fund account* to support the research on the high energy density FeF3 conversion cathode materials and Li metal anodes in the United States led by Dr. Chunsheng Wang.

The gift will be available in Three (3) installments for expenses related to the research. The first installment of $205,838 will be paid with the issuance of this Gift Letter, within 15 days after receiving the invoice. The other two installments will be paid subject to Huawei's further written approval. The second installment of $213,572 will be paid Twelve (12) months after the date of this letter within 15 days after receiving the invoice. The third installment of $221,614 will be paid Twenty-four (24) months after the date of this letter within 15 days after receiving the invoice.

All Taxes levied on Huawei or University of Maryland College Park Foundation shall be borne by either Party respectively in accordance with the applicable tax laws and/or regulations in the Territory. The University of Maryland College Park Foundation is exempt from federal income tax in the United States under section 501(a) of the Internal Revenue Code as an organization described in 501(c)(3).

If required by the laws of People's Republic of China, Huawei shall have the right to deduct any taxes imposed in the People's Republic of China on any payment to be made by Huawei to University of Maryland College Park Foundation from Consideration on behalf of University of Maryland College Park Foundation. In that case, University of Maryland College Park Foundation shall only be paid by Huawei the balance after such deduction from the Consideration to Partner's performance of the obligations under this Agreement. Upon University of Maryland College Park Foundation's request, Huawei shall submit to Partner official taxes receipts as such.

Huawei makes no claims on the basis of this gift to any ownership or other beneficial interest in any work product resulting from this gift. Nonetheless, we would appreciate being kept abreast of the progress of the research and request that you provide us with annual progress reports or as is otherwise appropriate. It is our hope that any researcher(s) who benefit from this gift will consider releasing any code or data from their project under an open source permissive license such as the Apache license.

We look forward to seeing the progress of your research.

Sincerely, [redacted]

Huawei Technologies Co., Ltd

Signature: [redacted] Date: 2017.2.21

Name: [redacted] Title: [redacted]

Accepted and Agreed:

University of Maryland College Park Foundation, Inc.

Signature [redacted] Date: 2/27/2017

Name [redacted] Title: [redacted]

YBTC20161289NDA

NONDISCLOSURE AGREEMENT

This Agreement is entered into by and between **HUAWEI TECHNOLOGIES CO., LTD.** ("Company"), a corporation organized and existing under the laws of China and having a primary location of Administration Building Huawei Technologies Co., Ltd. Bantian, Longgang District, Shenzhen, 518129, P. R. CHINA,

And the University of Maryland, a public agency and instrumentality of the State of Maryland located in College Park, Maryland 20742 ("University"), effective on the date of last signature ("Effective Date").

A. **Purpose:** The parties recognize that it may be necessary to disclose information to the other that the disclosing party considers its proprietary and confidential information ("Confidential Information") to fulfill the following purpose (the "Purpose"):

Huawei and UMD wish to disclose certain information to each other on the high energy density FeF3 conversion cathode materials and Li metal anodes.

B. **Definition of Confidential Information:**

1. Confidential Information means information that one party discloses (the "Disclosing Party") in written, oral, graphic, electronic or physical form to the other party (the "Recipient") that (a) is not generally known to the public and concerns scientific knowledge, know-how, processes, inventions, techniques, formulae, products, data, plans, software and similar information; (b) is clearly marked, if disclosed in a tangible form, by the Disclosing Party as Confidential Information at the time of initial disclosure to the Recipient and/or, if disclosed verbally, is identified as being Confidential Information at the time of disclosure, then summarized and identified as Confidential Information in a writing marked "Confidential" furnished by the Disclosing Party to the Recipient within ten (10) business days of initial disclosure.
2. Confidential Information does not include information that (a) the Recipient develops independently and without the benefit of Confidential Information of the Disclosing Party; (b) the Recipient lawfully obtains from a third party under no obligation of confidentiality; (c) is or becomes publicly available through no wrongful act of the Recipient; (d) is known to the Recipient prior to receiving the information from the Disclosing Party, and/or (e) Recipient is obligated to produce to comply with applicable laws or regulations, including but not limited to the Maryland Public Information Act, or pursuant to an order of a court of competent jurisdiction or a valid administrative or congressional subpoena provided the Recipient notifies the Disclosing Party prior to making such a disclosure so it may take appropriate action.

C. **Describe the Confidential Information to be released and that meets the definition above:**
Synthesis of FeF3 based conversion cathode materials, preparation of Li metal anodes and their electrochemical performance.

D. **Disclosure of Confidential Information:** The Disclosing Party will furnish Confidential Information only to the Recipient's Technical contact identified in Section M.

E. **Disclosure of Export Controlled Information:** The parties do not anticipate the need to disclose to each other technical data that are subject to control under the Commerce Control

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List of the Export Administration Regulations (excluding "EAR99"), the US Munitions List of the International Traffic in Arms Regulations, or "Sensitive Nuclear Technology" subject to the Atomic Energy Act (collectively, "Export Controlled Information"). University faculty and/or students involved in fulfilling the Purpose may qualify as foreign persons under those Export Control regulations and. University email systems are NOT certified for transmitting and receiving Export Controlled Information. **Disclosure of Export Controlled Information is NOT permitted under this agreement unless the Disclosing Party has received written approval from the University's Export Compliance Office and the Disclosing Party agrees to follow any protocol provided by the Export Compliance Office for transmitting Export Controlled Information to the University.** If it becomes necessary to disclose Export Controlled Information to the University, the Disclosing Party must first contact the University's Export Compliance Office (export@umd.edu) and provide a description of information to be sent. The University will incur no liability if it elects not to accept Export Controlled Information.

F. **Restrictions on Use:** The Recipient of Confidential Information and/or Export Controlled Data will:

1. Hold Confidential Information in confidence using at least the same degree of care it uses to prevent the disclosure of its own proprietary or confidential information, but in any event using no less than a reasonable standard of care; and
2. Use Confidential Information solely in support of the Purpose; and
3. Limit disclosure of Confidential Information to those of Recipient's employees, students and agents who have a need to know in order to fulfill the Purpose and obtain the agreement of such persons to maintain and safeguard the confidentiality of Confidential Information and, in the case of Export Controlled Information disclosed to the University, to individuals who have received approval from the University Export Compliance Officer; and
4. Reproduce Confidential Information only as needed to fulfil the Purpose and ensure that all copies clearly identify the information as Confidential Information; and
5. Not disclose Confidential Information to any third party without the prior written consent of the Disclosing Party and then only pursuant to a separate written nondisclosure agreement that is at least as restrictive as this Agreement.

G. **Duration of Obligations:** The obligations of confidentiality imposed under Section F shall continue for a period of one (1) year from the date of disclosure or until Confidential Information becomes publicly available through no fault of the Recipient, whichever occurs first. Obligations with respect to Export Controlled Information and/or trade secrets shall last for so long as the data continue to be subject to export controls or trade secret restrictions, respectively.

H. **No License:** This Agreement shall not be construed to grant any right or license, express or implied, to the Recipient under any patent, copyright or application therefore except to the extent specified in this Agreement. Title in Confidential Information and/or Export Controlled technical data shall remain with the Disclosing Party.

I. **Limited Warranties:** The parties acknowledge that Confidential Information is or may be experimental in nature. THE DISCLOSING PARTY MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, IN FACT OR ARISING BY OPERATION OF LAW, ORAL OR WRITTEN, WITH RESPECT TO THE ACCURACY, UTILITY, SAFETY OR APPROPRIATENESS FOR A PARTICULAR USE OF CONFIDENTIAL INFORMATION OR ITS FREEDOM FROM INFRINGEMENT OF ANY INTELLECTUAL PROPERTY OR PROPRIETARY RIGHTS OF ANY THIRD PARTY.

J. **Liability:** In no event will either party or their officers, agents, or employees be liable for any claims, demands, or damages arising out of this Agreement, including but not limited to

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UMD_DOJ_00012411

incidental, special, indirect, exemplary or consequential damages of any kind, even if the party has been advised of the possibility of such damages.

K. **Authority:** The Disclosing Party represents that it has the right to disclose Confidential Information and/or Export Controlled technical data to the Recipient.

L. **Term and Termination:** This Agreement will commence on the Effective Date and expire _3_ year(s) from the Effective Date. Within sixty (60) days of the expiration of this Agreement, the Recipient will destroy or return, as directed by the Disclosing Party, the originals and any copies of Confidential Information and/or Export Controlled technical data in its possession or control.

M. **Contact:** Until otherwise notified in writing, each party designates the following person as its sole contact on all matters related to the delivery, receipt, use and protection of Confidential Information and/or Export Controlled technical data:

1. For University of Maryland:

[redacted]

Technical Contact: (DO NOT SEND EXPORT CONTROLLED INFORMATION)

Name: Prof. Chunsheng Wang

Address: _Department of Chemical & Biomolecular Engineering_____

University of Maryland, College Park, MD 20742

[redacted]

2. For Company:

Administrative/Contractual Contact:

Name: [redacted]

Address: [redacted]

Telephone: [redacted]

E-mail: [redacted]

Technical Contact:

Name: [redacted]

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UMD_DOJ_00012412

[redacted]
Address: [redacted]

Telephone [redacted] Facsimile: [redacted]
E-mail: [redacted]

N **General:**

1. The failure of either party to enforce any term hereof shall not be deemed a waiver of any rights contained herein.
2. This Agreement may not be modified in any way without the prior written consent of the authorized representatives of each party. Any attempt to modify this Agreement in any way without the prior written consent of those persons shall render the proposed modification null and void.
3. This Agreement shall be governed and interpreted in accordance with the laws of the State of Maryland excluding its conflict of laws rules.
4. The terms and conditions herein constitute the entire agreement and understanding of the parties and shall supersede all other communications, negotiations, arrangements and agreements, either oral or written, with respect to the subject matter herein.
5. This Agreement may be executed in several counterparts and all counterparts so executed by all the parties and affixed to this Agreement shall constitute a valid and binding agreement, even though all the parties have not signed the same counterpart.

IN WITNESS WHEREOF, each of the parties to this Agreement has caused this Agreement to be signed.

AGREED TO:

HUAWEI TECHNOLOGIES CO., LTD. UNIVERSITY OF MARYLAND

[redacted]

University of Maryland Principal Investigator: I understand and will abide by the terms and conditions of this Agreement. I have had the opportunity to request the University of Maryland signatory or a similar representative explain the terms and conditions of the Agreement to me.

Acknowledged: [redacted]

1st December 2016

FOIA/MPIA TRADE SECRET CONFIDENTIAL UMD_DOJ_00012413

YBTC20161289NDA

[redacted]

Date Dec. 1, 2016

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UMD_DOJ_00012414

UNIVERSITY OF MARYLAND
OFFICE OF GIFT ACCEPTANCE

4603 Calvert Road
College Park, Maryland 20740
301.955.1280 TEL
www.foundation.umd.edu

MEMO

To: [redacted]

From: [redacted]

Date: October 3, 2019

Re: Huawei Technologies, Co, LTD Gift Timeline

1. **Huawei wire - $213,562.00**
   Wire arrived to Gift Acceptance – April 17, 2018
   Confirmation from Engineering – April 26, 2018
   Processed in Advance – April 27, 2018

2. [redacted]

3. [redacted]

4. **Huawei wire - $205,838.00**
   Gift Agreement signed – December 27, 2017
   Documentation received from Engineering – March 7, 2017
   Wire received – March 23, 2017
   Processed in Advance – March 28, 2017

5. [redacted]

6. [redacted]

UNIVERSITY OF MARYLAND

COLLGE PARK FOUNDATION

INVOICE

TO: Huawei Technologies Company, Inc. #35227099
Attn: Dr. Wenshuo Wang
518129
Bantian, Longgang District, Shenzhen 518129
P.R. China

Date	Description	Total Due
3/29/2018	Gift to Dr. Chunsheng Wang Research Fund [redacted] to support	$213,572.00
	general research in the United States led by Dr. Chunsheng Wang	
	Project Number: **YBN2017010021**	
	Total Due Upon Receipt	$213,572.00

Payable to: **University of Maryland College Park Foundation (UMCPF)**
4603 Calvert Road
College Park, MD 20740
USA
Tax ID Number: [redacted]

Contact: [redacted]
[redacted]
USA
Phone: 301.405.2150/ Email: [redacted]@umd.edu

RECEIVED
APR 26 2018
By 250042

THANK YOU FOR YOUR SUPPORT

UNIVERSITY OF MARYLAND

[redacted]<[redacted]@umd.edu>

Re: HUAWEI Payment Notice (华为付款通知)

1 message

[redacted]2@umd.edu> Thu, Apr 12, 2018 at 2:01 PM
To: [redacted]steina@ece.umd.edu>
Cc: [redacted]@umd.edu, [redacted]@umd.edu

H[redacted],
This one looks like the right denomination to be for Dr Wang's research.
Best,
[redacted]

[redacted] *University of Maryland*
[redacted]

On Apr 12, 2018, at 1:35 PM, <[redacted]v@huawei.com> <[redacted]@huawei.com> wrote:

HUAWEI Payment Notice

This email was sent by system automatically, please don't reply directly.

Dear University Of Maryland College Park Foundation, Inc.

The payment details we have paid to your bank account [redacted] are as below:

Note:
1.The payment reference date listed in the table is Huawei system processing date, normally the fund will reach your account in 1 to 3 days, the exact date depends on the local bank processing cycle.
2.If SCS has implemented in your company, for further information, please check in SCS system.
3.Please notify your HUAWEI contact to update it in SRM system if have any changes of your company's financial contacts, otherwise you shall bear the resulting losses.

Invoice no.	payment reference date	currency	Payment Amount
35227099-1	2018-04-12	USD	213,572
			Total amount : 213,572

Huawei Technologies Co., Ltd.
HW payment Reference No.: [redacted]

华为付款通知

此邮件由系统自动发出，请勿直接回复

尊敬的：**University Of Maryland College Park Foundation, Inc.**

我公司本次支付贵公司 ***9694账户 的付款详细信息如下：

Confidential and Exempt from Disclosure Under FOIA

注意:

1.表中所列的付款参考日期是华为系统处理日期，一般于1到3工作日到账，具体根据当地银行处理周期而定，请您耐心等待，谢谢您！

2.若贵司已使用华为SCS系统，更多付款信息请在SCS系统中查询；

3.若贵司财务联系人有变更，请通知您的华为联系人在SRM系统中进行变更，如未及时通知我司变更带来的损失请自行承担。

发票号	参考付款日期	币种	付款金额
[redacted]	2018-04-12	USD	213,572

总金额：213,572

华为技术有限公司

华为付款参考号:5020025968(0021)

GIFT TRANSMITTAL FORM

UNIVERSITY OF MARYLAND

Destination: UMCPF **Gift GTF ID:** Z3036 **Date:** 2017-03-02

Contact Information:

Department/School: Engineering **Contact Name:** [redacted]
Contact Phone: +1 301 405 5776 **Contact Email:** [redacted]

Donor Information:

Name: Huawei Technologies Company Inc. **BSR ID:** [redacted]
Address: Idling Section B, Huawei Base Bant,Ian Cn/Longang Distrtict Shenzen Non-USA 51 China
Phone: N/A **Email:** N/A

Gift Information:

Amount: $205,838.00 **Allocation Name:** Dr. Chunsheng Wang Research Fund in ChBE
Appeal Code: N/A **Account No:** [redacted]
Gift Type: Gift **Payment:** Not Available
Annoymous Gift? No **Joint Gift?** No
Proposal Number: 18238

Notes: Gift of $205,838 to support the Dr. Chunsheng Wang Research Fund (Acct. # [redacted] in ChBE. This is the first gift of three possible gifts. The other 2 will be given subject to Huawei's further written approval.

Send Tribute Card To:

Name: N/A **Title:** N/A **Company:** N/A
Address: N/A

Send Thank You Note To:

Name: [redacted] **Title** [redacted] **Company:** Huawei Technologies Company Inc.
Address: Idling Section B, Huawei Base Bant,Ian Cn/Longang Distrtict Shenzen 51 Non-USA China

RECEIVED
MAR 07 2017
By QDS173

Confidential and Exempt from Disclosure Under FOIA UMD_ED_00009073

[redacted]

Dear Dr. Ming C. Lin,

As part of Alibaba's growing efforts to support excellent research in academia, Taobao (China) Software Co., Ltd, with offices at No. 969 Wenyi West Road, Hangzhou, China, shall pay, and only pay to University of Maryland ("University") the following sums in about 60 days upon receipt of your invoice(s):

Amount: USD 100,000

in order to support the project proposed by Dr. Ming C. Lin in the title of "Cyber-Manufacturing of Customized Apparel" as set out in the proposal attached.

We would appreciate receiving news about how the grant is used:

(i) it shall be used solely to support the project in the area described in the attached proposal; and

(ii) it will not be used to cover any overhead costs but dedicated solely to direct project expenditure. Direct project expenditure includes without limitation the expenses and costs for travel and accommodation for purposes of attending workshop, conference and/or other project related activities organized/sponsored by Alibaba; and

(iii) all results derived from the project must, as soon as they are generated, be readily put in the public domain, freely and without restrictions, and accordingly the University shall waive all proprietary right, title and interest in and to such results. If the University does wish to assert any intellectual property rights over any such results it may only do so if:

(a) it provides Alibaba with a prior written notice thereof; and

(b) it grants Alibaba, its parents and affiliates in each case a non-exclusive, perpetual, royalty-free, assignable and sub- licensable license to use such results for any purpose whatsoever and agrees to execute any instruments required to give effect to that license grant, and if the term of the contract or license itself is in any way limited by statute, the term of this license shall be for the statutory term, with automatic renewals thereafter on each license expiration date at no additional cost to Alibaba; and

(iv) this grant will be acknowledged in all publications, press releases and other publicity connected with the research program detailed above.

The grant shall be transferred upon signing of this agreement in two installments in 2018. The first installment of USD 60,000 shall be paid within thirty (30) days after signing, the second of USD 40,000 in Q3 2018 with a prior written notice to Alibaba. Both parties shall be responsible for respective taxes, pursuant to the applicable tax code(s). To the extent necessary, China VAT and surcharge is excluded on the prescribed amount.

Please arrange for both copies of the letter to be signed and returned two sets of copy to us. One duly executed copy will be returned to you for your records.

Yours sincerely

ACCEPTED AND AGREED

University of Maryland

By: [redacted]

Nar

Titl

Date: 1/29/18

Alibaba entity:

By: _____

Name (Printed): _____

Title: _____

Date: [redacted]

Dr. Luiqing Yang
University of Minnesota, Twin Cities

CUI//PRVCY

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

September 28, 2023

To: [redacted]

From: [redacted]

Subject: Recommendation for Governmentwide Debarment (OIG Case I-21-0060-O)

Attached is our investigation report concerning allegations that Dr. Liuqing Yang failed to disclose paid affiliations with multiple foreign universities. Additionally, through her attorney, Yang refused to accept service of an IG subpoena which precluded us from continuing our investigation.

In order to protect the government, we recommend that NSF debar Yang for three years and prohibit her from serving as a peer reviewer, advisor, or consultant at NSF for three years. The basis for our recommendation is described in detail in the report.

We have on file the following contact information for Yang and her counsel:

Dr. Liuqing Yang
[redacted]

[redacted]

[redacted]

[redacted]

CUI//PRVCY

Recommendation for Governmentwide Debarment

OIG Case I-21-0060-O

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

September 21, 2023

[redacted]

REPORT RELEASE RESTRICTION

This report contains protected personal information, the unauthorized disclosure of which may result in personal criminal liability under the Privacy Act, 5 U.S.C. § 552a. This report will only be disclosed outside NSF if such disclosure is required or consistent with standards allowing disclosure under the Freedom of Information and Privacy Acts, 5 U.S.C. §§ 552 & 552a. This report may be further disclosed within NSF only to individuals who must have knowledge of its contents to facilitate NSF's assessment and resolution of this matter. Please take appropriate precautions in handling this report.

CUI//PRVCY

AT A GLANCE

Recommendation for Governmentwide Debarment

OIG Case I-21-0060-O
September 21, 2023

WHAT WE FOUND

Dr. Liuqing Yang served as a professor in the Department of Electrical and Computer Engineering at Colorado State University (CSU) from August 16, 2010, to August 20, 2020. She was the Principal Investigator (PI) on two NSF awards funded in 2019. On August 31, 2020, she accepted a position as a professor at the University of Minnesota, Twin Cities (UMTC), and both of her active CSU NSF awards were transferred to UMTC. While at UMTC, Yang served as the PI for one additional NSF grant awarded in August 2021.

Through a joint investigation with the Federal Bureau of Investigation (FBI), we learned that Yang was a member of the One Hundred Talents Program through the Chinese Academy of Sciences from 2011 until at least 2016. Yang was appointed as a Chutian Scholar seasonal lecturer in 2016 at China Three Gorges University (CTGU) to teach a course called Control Theory and Control Engineering. Per a 2018 CTGU spreadsheet, CTGU awarded Yang 200,000 RMB (approximately $30,000 USD) in Chutian Scholar talent funding for the time frame December 2018 through November 2021. Yang also held an ongoing paid position with Shenzhen Research Institute of Big Data (SRIBD) beginning in 2017. As of 2019, when she applied for her NSF awards, Yang was also listed on Tongji University's School of Software Engineering's website as an Adjunct Professor.

In March 2021, UMTC interviewed Yang about her involvement with foreign entities. When UMTC asked for a follow-up interview in June 2021, Yang refused. She went to China in July 2021 and resigned from UMTC in October 2021. To date, Yang has not returned to the United States.

Our investigation confirmed that Yang failed to disclose all the above foreign support and affiliations in her NSF grant proposals. Additionally, through her attorney, Yang refused to accept service of an IG subpoena which precluded us from obtaining information crucial to the investigation, including details necessary to better understand the full scope of her involvement with other institutions and funding entities.

WHAT WE RECOMMEND

Based on Yang's conduct, pursuant to 2 C.F.R. § 180 & et. seq. and based upon the facts described herein, we recommend that NSF debar Yang for three years and prohibit her from serving as a peer reviewer, advisor, or consultant at NSF for three years.

CUI//PRVCY

[redacted]

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Factual Background

Dr. Liuqing Yang (Yang) was a Professor within the Department of Electrical and Computer Engineering at the University of Minnesota, Twin Cities (UMTC)[1] from August 16, 2020[2] to August 20, 2021[3]. Prior to UMTC, she was a Professor at Colorado State University (CSU) from July 2014 to August of 2020.[4] While at CSU, Yang served as the Principal Investigator (PI) on two NSF awards: CNS-1932413, entitled *CPS: Medium: Collaborative Research: Collective Intelligence for Proactive Autonomous Driving*; and ECCS-1935915, entitled *Hybrid mmWave mMIMO Transceiver Design for Doubly-Selective Channel.* When Yang transferred from CSU to UMTC, these awards were transferred to UMTC under new award numbers CNS-2103256 and ECCS-2102312. While at UMTC, Yang served as the PI on another NSF award, ECCS-2128593, entitled *Collaborative Research: SWIFT: Cognitive-IoV with Simultaneous Sensing and Communications via Dynamic RF Front End*, (collectively, the Awards).

The Awards

Proposal/ Award Number[5]	Proposal Title	Institution	Date Received by NSF	Award Date	End Date	Total Awarded Amount
CNS-1932413	CPS: Medium: Collaborative Research: Collective Intelligence for Proactive Autonomous Driving (CI-PAD)	Colorado State University	4/12/2019	10/1/2019	Transferred to UMTC	$958,337
ECCS-1935915	Hybrid mmWave mMIMO Transceiver Design for Doubly-Selective Channels	Colorado State University	5/20/2019	9/01/2019	Transferred to UMTC	$344,483
ECCS-2102312	Hybrid mmWave mMIMO Transceiver Design for Doubly-Selective Channels	University of Minnesota-Twin Cities	10/14/2020	10/1/2020	10/31/2023	$311,000
CNS-2103256	CPS: Medium: Collaborative Research: Collective Intelligence for Proactive Autonomous Driving (CI-PAD)	University of Minnesota-Twin Cities	10/21/2020	10/1/2020	9/30/2023	$913,956
ECCS-2128593	Collaborative Research: SWIFT: Cognitive-IoV with Simultaneous Sensing and Communications via Dynamic RF Front End	University of Minnesota-Twin Cities	3/19/2021	8/15/2021	7/31/2024	$420,000

[1] Attachment 1, Yang UMN Bio;
[2] Attachment 23, Yang UMN Offer Letter
[3] Attachment 22, Email Correspondence Update related to Prof. Liuqing Yang's awards
[4] Attachment 2, Yang - Biosketch ECCS-2128593
[5] ECCS-2102312, CNS- 2103256, and ECCS- 2128593 are currently under the direction of a new PI, Georgios B. Giannakis.

As set forth below, we discovered that Yang had paid affiliations with China's Three Gorges University (CTGU) beginning in 2016[6] and Shenzhen Research Institute of Big Data (SRIBD) beginning in 2017[7] and that she failed to disclose those outside affiliations when applying for the Awards.

In March 2021, UMTC officials and agents from the Federal Bureau of Investigation (FBI) interviewed Yang about her foreign affiliations. She declined a second interview with UMTC and left the United States for China in July 2021, right before the start date of ECCS-2128593. Yang resigned from UMTC in October 2021. Finally, in June 2022, Yang failed to cooperate with our investigation when she refused to accept service of an IG subpoena through her attorney.[8] To date, Yang has not returned to the United States.

In at least one version of her curriculum vitae, Yang indicated that she served as an NSF panelist 24 times from January 2006 to July 2021.

OIG Investigation

Undisclosed Affiliations

On November 1, 2021, we received information from the FBI that Yang had undisclosed paid, foreign affiliations at SRIBD and CTGU[9] dating as far back as 2011 and continuing through at least 2021, which overlapped with the proposal submissions for the Awards. According to the FBI, Yang was accepted into the One Hundred Talents Program through the Chinese Academy of Sciences in 2011. It is unconfirmed when her affiliation ended.[10] The FBI's information also indicated that Yang was appointed as a Chutian Scholar seasonal lecturer in 2016 at CTGU to teach a course called Control Theory and Control Engineering.[11] She was awarded 200,000 RMB (approximately $30,000 USD) in Chutian Scholar talent funding from CTGU for the time frame of December 2018 through November 2021.[12] The Chutian Scholar Program, one of China's Talent Recruitment Programs, is run by the Hubei Provincial Government and is a sub-program of the Thousand Talents Program.

Information obtained from the FBI also identified a July 21, 2017, article entitled, *Research Projects of Shenzhen Research Institute of Big Data received grants from Shenzhen Municipal Commission of Science and Technology Innovation*, which indicated that Yang applied to and received funding from the Shenzhen Municipal Commission of Science and Technology Innovation and received funding to support the Shenzhen Knowledge Innovation Program Basic Research Project. She was awarded

[6] Attachment 3, FBI LHM, p. 2 #3
[7] *Id.*
[8] Attachment 4, Yang Attorney Response Email
[9] Attachment 5, LHM correspondence; Attachment 3, LHM
[10] Attachment 3, LHM p. 3
[11] Attachment 7, Chutian Scholar Program 2016
[12] Attachment 3, LHM p. 3; Attachment 8, Three Gorges University

3,000,000 yuan (approximately $456,000 USD) over three years.[13] In addition, an article titled "New members join SRIBD" was posted to SRIBD's website indicating that Yang joined their faculty team in January 2017.[14] The article included Yang's biography and a photograph.

We also identified a 2018 *Outstanding Scholars List* identifying a list of teachers that were "introduced" to the Chinese University of Hong Kong (CUHK). Yang's name was listed as an Institute of Electrical and Electronics Engineers (IEEE) fellow. The document also states, "The CUHK inherits the academic tradition of the Chinese University of Hong Kong… integrates China and the West, and applies bilingual teaching, a school system and general education."[15] A document from CUHK dated 2021 stated, "By the end of August 2020, more than 360 world-renowned teachers had been introduced … and were selected for various high-level talent projects in provincial and municipal areas in China."[16] Yang's name was included among the list of teachers, but there was no information about the projects she would be working on.

A review of the proposal and grant documents for the Awards confirmed that Yang did not disclose any of the foreign affiliations or funding discussed above, in violation of the corresponding Proposal and Award Policies & Procedures Guide (PAPPG) and award terms and conditions.[17]

IG Subpoena to CSU and UMTC

In December 2021, we subpoenaed CSU and UMTC requesting award documents as well as any information pertaining to Yang's foreign affiliations or her association with foreign-funded research projects. Among the responsive material CSU provided us were emails sent to Yang from multiple students requesting to study under her in China, further corroborating the existence of the undisclosed foreign affiliations discussed above.

On June 29, 2017, a student emailed her stating, "I am already in China, Shenzhen, and have applied for MPhil-Phd program in CIE. I would be honored if you would be my supervisor. I'm confident that I will excel under your tutorage."[18] On October 20, 2017, another student wrote, "I have completed my degree in Electrical Engineering….and now I want to do my master's degree in China under your supervision."[19] On November 16, 2017, a student wrote, "I came to China from Pakistan and I studied in Shenzhen since last three years I really like to stay here and get advantages of advanced studies in China….I would like to study my Ph.D. degree… I shall be very thankful if you review it and take a responsibility as my supervisor."[20] Finally, in an email dated March 7, 2019, a student wrote, "I am planning to attend post-graduate school in Chinese University of Hongkong-Shenzhen with a focus on,

[13] Attachment 3, LHM p. 2; We were unable to obtain evidence of the specific start and end dates of the foreign funding or whether Yang served as the PI for those awards.
[14] Attachment 6, New Members Join SRIBD
[15] Attachment 9, Teacher Strength Hires
[16] Attachment 10, Chinese University HK
[17] NSF PAPPG 19-1.
[18] Attachment 11, Request for Supervision email
[19] Attachment 12, Request for Acceptance email
[20] Attachment 13, Admission procedure email

"Smart-grid." …I have explored your department's school website in detail, and it seems like an excellent fit for me because of its emphasis on Smart Grid."[21]

During our review of documentation provided by CSU and UMTC, we also found evidence that Yang was aware or should have been aware of her responsibility to disclose her relationships with foreign entities on ECCS-2128593. On February 11, 2020, CSU emailed its faculty, including Yang, reminding them of the correct definitions of "Other Support" and "Current and Pending Support," and the need to adequately disclose their relationships with foreign entities, including any participation in a foreign government talent recruitment program in their NSF grant applications. [22] Despite this reminder from CSU, Yang did not disclose any foreign affiliations or foreign research funding in the ECCS-2128593 proposal received by NSF on March 19, 2021. At the very least, the funding she received as a Chutian Scholar at CTGU, lasting from December 2018 through November 2021, should have been disclosed.[23]

Yang Publication Review

We conducted a review of publications listing Yang as an author or co-author between December 2018 and July 2020. We identified three publications that specifically listed Yang's dual affiliation with CSU and SRIBD. Yang did not disclose her affiliation with SRIBD in any of the NSF proposals submitted with her as the PI in 2019 and 2020. Below is a chart showing the title of those publications and the associated affiliations for Yang.

Publication Date	Article Title	Yang's Listed Affiliations
December 2018	*Mobile Big Data Based Network Intelligence*	Department of Electrical and Computer Engineering, CSU and SRIBD, Shenzhen 518172, China[24]
January 2019	*Flexible Energy Management Protocol for Cooperative EV-to-EV Charging*	Department of Electrical and Computer Engineering, CSU and SRIBD, Shenzhen 518172, China[25]
July 2020	*One-Class Classifier Based Fault Detection in Distribution Systems With Varying Penetration Levels of Distributed Energy Resources*	Department of Electrical and Computer Engineering, CSU and SRIBD, Shenzhen 518172, China[26]

[21] Attachment 14, Email Mphil-Phd program
[22] Attachment 15, Email [AcadFac] Foreign Influence
[23] Attachment 8, Three Gorges University
[24] Attachment 16, *Mobile Big Data Based Network Intelligence article*
[25] Attachment 17, *Flexible Energy Management Protocol for Cooperative EV-to-EV Charging*
[26] Attachment 18, *One-Class Classifier Based Fault Detection in Distribution Systems With Varying Penetration Levels of Distributed Energy Resources*

On October 15, 2020, Yang submitted an annual report for award ECCS-1935915 that listed numerous 2019 and 2020 publications. The papers, which were reviewed during our investigation, all include co-authors that are affiliated with international organizations. All of the listed publications also acknowledge support from multiple foreign sources including the National Natural Science Foundation of China, SRIBD, and the Beijing Municipal Science and Technology Commission. (See Appendix A) None of this information was included in the annual report; instead, both individuals listed as working on the award, Yang and Shijian Gao, indicated that the research had not involved any international collaboration. Additionally, in response to the question asking what other organizations were involved as partners, Yang wrote "nothing to report." Finally, Yang listed only the University of Wyoming and Google as collaborators or contacts involved with the project.[27]

As previously stated, Yang failed to disclose her affiliation with SRIBD, or any other foreign institutions, in the applications for the Awards. The revised Current and Pending Support form Yang submitted on May 1, 2020, for ECCS-2128593 also did not list any foreign support or in-kind contributions.[28]

Yang Interview and IG Subpoena

In March 2021, FBI and UMTC officials interviewed Yang to discuss her research activities with China. When UMTC asked about her SRIBD research funding, she claimed her name was a common name in China, and there must have been a different Liuqing Yang at SRIBD. However, the Institute of Electrical and Electronics Engineers (IEEE) website had a biography for a "Liuqing Yang" affiliated with SRIBD that included a photograph that matched the photographs of Yang on CSU's website.[29] Yang acknowledged collaborating with CTGU in the past, stating that her affiliation was limited to co-authoring a few papers with faculty and a few summer visits. Yang claimed that she never received any salary, only reimbursement for travel expenses and a couple hundred dollars in honorarium. Yang also denied any knowledge of the term "Chutian Scholar."[30] In August 2021, Yang's attorney informed UMTC that she would not accommodate UMTC's request for a second interview.[31] On October 8, 2021, UMTC informed NSF that Yang resigned, and that it would be requesting a PI change for the Awards.[32] UMTC provided us with an undated copy of Yang's curriculum vitae (CV) in which Yang indicated she was a regular panelist for NSF as well as the Hong Kong Research Grants Council and Qatar's National Priorities Research Program. According to her CV, Yang was an NSF proposal panelist 24 times from January 2006 to July 2021. In addition, she listed herself as Vice Chair, Technical Committee on Intelligent Distributed Energy, Chinese Association of Automation, and a Fellow of the Asia-Pacific Artificial Intelligence Association.[33]

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[27] Attachment 19, 1935915 Annual Report
[28] Attachment 20, 2128593 Current and Pending Support
[29] Attachment 3, LHM, p. 4
[30] *Id.*
[31] Attachment 3, LHM, pp. 4 -5
[32] Attachment 22, Email Correspondence Update related to Prof. Liuqing Yang's awards
[33] Attachment 24, Yang CV

On May 26, 2022, in order to fully understand Yang's relationship with foreign institutions and research funding, we served Yang, via her attorney, with an IG subpoena for additional documentation. Through email correspondence, her attorney confirmed that he still represented Yang, that he received the subpoena, and that he would confer with his client. He later responded that "he was not authorized to accept service on her behalf." When pressed, her attorney would not elaborate on his comment, stating that doing so would violate attorney/client privilege.[34] As a result, we have not been able to obtain documents to understand the full scope of Yang's involvement with the aforementioned foreign organizations.

Department of Justice (DOJ) Coordination

We coordinated with DOJ who declined this matter for criminal prosecution. Once Yang left the country, she was beyond the jurisdiction of the court which potentially would have enforced the subpoena.

OIG Assessment

Grounds for Debarment

NSF has authority to debar an individual for any "Violation of the terms of a public agreement or transaction so serious as to affect the integrity of an agency program"[35] or "Any other cause of so serious or compelling a nature that it affects (the Subject's) present responsibility."[36]

In this case, Yang's dishonest behavior lies not just in her failure to disclose, but her refusal to take part in the investigation regarding her foreign affiliations, and ultimately not only refusing service of an IG subpoena but fleeing the country to avoid responsibility. Yang's conduct falls within the above-referenced sections of 2 C.F.R. § 180.800(b)&(d).

Burden of Proof

In debarment actions, the burden of proof rests with NSF to demonstrate by a preponderance of the evidence that a cause for debarment exists.[37] Under the totality of the circumstances, Yang has failed to show that she is presently responsible, and the factors below illustrate sufficient information to warrant debarment.

Relevant Factors

The debarment regulation lists 19 mitigating and aggravating factors that the debarring official may consider when determining whether to impose debarment and the length of the debarment period.

[34] Attachment 4, Yang Attorney Response Email
[35] 2 C.F.R. § 180.800(b)
[36] 2 C.F.R. § 180.800(d)
[37] C.F.R. § 180.850(a)

The following factors are pertinent to this case.

1. **Actual or Potential Harm or Impact**[38]

NSF relies on universities and PIs to honestly disclose time commitments and affiliations by providing accurate and complete information to NSF. NSF requires submission of a Current and Pending Support document on new proposals and ongoing disclosure of other support on continuing awards. Yang did not comply with these rules when she failed to disclose any of her foreign affiliations, which dated as far back as 2011 and continued through at least 2021. Yang initially denied any involvement in research activities with China during a March 2021 interview, despite there being evidence that she received funding from SRIBD and communicated with students who wanted to study under her at Chinese universities. She further denied having any paid foreign affiliations despite open-source evidence to the contrary.

By failing to honestly disclose her time commitments and affiliations Yang inhibited NSF's ability to assess her proposals accurately and determine whether she had sufficient time to devote to the awarded proposals. While Yang is no longer employed by UMTC, she retains the ability to return to the United States for employment with another academic institution, to resume teaching students, and to apply for additional funding from NSF.

2. **Frequency of Incidents and/or Duration of the Wrongdoing**[39]

For almost 10 years (2011-2021), Yang was affiliated with foreign talent plan programs and foreign institutions while serving as PI on NSF awards for overlapping periods. Yang was accepted into the 100 Talents Program through the Chinese Academy of Sciences as early as 2011. Around 2017, Yang received around $456,000 from SRIBD to conduct research over a three-year period. She also received funds from CTGU as a Chutian Scholar for the period December 2018 through November 2021.

Yang had numerous publications in 2019 and 2020 which list collaborations with and funding from various Chinese institutions, as well as a dual affiliation with SRIBD. Yang submitted three proposals to NSF between 2019-2021 where her foreign collaborations, institutional affiliations and research funding were not disclosed.

3. **Role in Wrongdoing**[40]

Yang was the PI on three NSF proposals submitted between 2019-2021. She failed to disclose her foreign affiliations and research funding on all three. Additionally, on May 26, 2022, an IG subpoena was served to Yang via her legal counsel. Her attorney confirmed he still represented Yang and that he was in receipt of the subpoena, but stated he was not authorized by Yang to accept it on her behalf. Although we were not able to speak directly with Yang, it appears that she instructed her attorney to

[38] 2 C.F.R. § 180.860(a)
[39] 2 C.F.R. § 180.860(b)
[40] 2 C.F.R. § 180.860(f)

refuse to accept a lawfully issued subpoena and, therefore, declined to fully explain the extent of her affiliations outside of the United States and whether she had other commitments while serving as a PI on NSF awards.

As a former PI on three NSF awards, Yang should reasonably be expected to cooperate with the funding agency and the funding agency's OIG. Presently, Yang has fled the country in an apparent attempt to evade interviews with UMTC and the FBI. We do not know when or if Yang will return to the United States, but her conduct in response to the service of an IG subpoena is contrary to the expectations placed upon individuals who accept taxpayer-funded research dollars from the U.S. Government.

4. Acceptance of Responsibility for Wrongdoing and Recognition of Seriousness of the Misconduct[41]

Yang has not accepted responsibility for her actions. When interviewed by UMTC about her SRIBD research funding, she claimed her name was a common name in China, and there must have been a different Liuqing Yang at SRIBD. However, IEEE's website had a biography for a "Liuqing Yang" affiliated with SRIBD that included a photograph that matched the photographs of Yang on CSU's website. She also declined a second interview with UMTC to answer additional questions regarding her foreign affiliations. Rather, Yang chose to leave the United States and resign from her position with UMTC. In addition, Yang would not allow her attorney to accept an IG subpoena on her behalf, therefore not cooperating with the OIG.

5. Cooperation of the Subject[42]

Yang has not cooperated with the UMTC investigation or with our investigation. Yang has not been forthright in explaining her affiliations and time commitments while serving as a PI on NSF awards. As stated above, rather than cooperate with UMTC and answer questions regarding her foreign affiliations, she chose to leave the United States and resign from her position with UMTC. In addition, Yang would not allow her attorney to accept an IG subpoena on her behalf.

6. **Position Held by Subject[43]**

At the time our investigation began, Yang was a PI on two NSF awards, with a third award pending. She was also a teacher and advisor to Ph.D. students. While Yang is no longer employed by UMTC, she retains the ability to return to the United States for employment with another academic institution. If she chooses to, Yang can also return to teaching students and apply for new funding from NSF.

Additionally, Yang's CV indicates that she served as an NSF panelist 24 times from January 2006 to July 2021. Should Yang return to the United States, it is likely she will attempt to serve as a panelist again.

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[41] 2 C.F.R. § I 80.860(g)
[42] 2 C.F.R. § 180.860(i)
[43] 2 C.F.R. § 180.860(k)

OIG Recommendation

Based on Yang's conduct, pursuant to 2 C.F.R. § 1 &q et. seq. and based upon the facts described herein, we recommend that NSF debar Yang for three years and prohibit her from serving as a peer reviewer, advisor, or consultant at NSF for three years.

Attachments

Attachment 1-	Yang UMN Bio
Attachment 2-	Yang - Biosketch ECCS-2128593
Attachment 3-	LHM to NSF
Attachment 4-	Yang Attorney Response
Attachment 5-	LHM correspondence
Attachment 6-	New Members Join SRIBD
Attachment 7-	Chutian Scholar Program 2016
Attachment 8-	Three Gorges University
Attachment 9-	Teacher Strength Hires
Attachment 10-	Chinese University HK
Attachment 11-	Request for Supervision
Attachment 12-	Request for acceptance letter
Attachment 13-	Admission Procedure for PhD
Attachment 14-	MPhil-PhD program in Computer & Information Engineering
Attachment 15-	[AcadFac] Foreign Influence on Faculty Activity
Attachment 16-	Article: Mobile_Big_Data_Based_Network_Intelligence Publication
Attachment 17-	Article: Flexible_Energy_Management_Protocol_
Attachment 18-	Article: One-class_Classifier_Based_Fault_Detection_in_Distribution
Attachment 19-	1935915 Annual Report
Attachment 20-	2128593_Current_and_Pending_Support
Attachment 21-	MOI UMTC GC Feb 2022 Meeting
Attachment 22-	2102312- Correspondence Update related to Prof. Liuqing Yang's awards
Attachment 23-	Yang UMN Offer Letter
Attachment 24-	Yang Curriculum Vitae

Appendix A

On October 15, 2020, while at CSU, Yang submitted an annual report for award ECCS-1935915, now ECCS-2102312. It listed the following 2019 and 2020 publications. While not disclosed in the annual report, the publications themselves listed the following funding support:

- *Graph-Based File Dispatching Protocol with D2D-Enhanced UAV-NOMA Communications in Large-Scale Networks.* "This work was supported in part by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, in part by the National Science Foundation under Grant CNS-1932413 and Grant ECCS-1935915, in part by the National Natural Science Foundation of China under Grant 61901302, in part by the Open Research Fund of National Mobile Communications Research Laboratory, Southeast University under Grant 2020D01, and in part by the Open Research Fund from Shenzhen Research Institute of Big Data under Grant 2019ORF01006."
- *Graph-Based File Dispatching Protocol with D2D-Aided UAV-NOMA Communications in Large-Scale Networks.* "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, the National Natural Science Foundation of China under Grant 61901302, Guangdong Key R&D Project under Grant 2018B030338001, the open research fund of Key Laboratory of Wireless Sensor Network & Communication under Grant 2017003, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, the open research fund of National Mobile Communications Research Laboratory, Southeast University (No. 2020D01), and the National Science Foundation under Grant CPS-1932413 and ECCS-1935915."
- *Mobility Prediction-Based Joint Task Assignment and Resource Allocation in Vehicular Fog Computing.* "This work was also supported in part by the open research fund of National Mobile Communications Research Laboratory, Southeast University (No. 2020D01), in part by the Scientific Research Project of Shanghai Science and Technology Committee under Grant 19511103302, and in part by the National Science Foundation under Grant CPS-1932413 and ECCS-1935915."
- *UAV-assisted Data Dissemination with Proactive Caching and File Sharing in V2X Networks.* "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, the National Science and Technology Major Project under Grant 2018ZX03001031, the Major Project from Beijing Municipal Science and Technology Commission under Grant Z181100003218007, Shenzhen Fundamental Research Fund under Grant No. JCYJ20170411102217994 and Guangdong province under grant No. 2017ZT07X152, the National Natural Science Foundation of China under Grants 61622101 and 61571020, and the National Science Foundation under Grant CPS-1932413 and ECCS-1935915."
- *UAV-Assisted Data Collection with Non-Orthogonal Multiple Access.* "This work was supported in part by the National Key Research and Development Project under Grant

2019YFB2102300 and Grant 2019YFB2102301; in part by the National Natural Science Foundation of China under Grant 61936014 and Grant 61901302; in part by the Scientific Research Project of Shanghai Science and Technology Committee under Grant 19511103302; in part by the Fundamental Research Funds for the Central Universities; in part by the Open Research Fund from Shandong Provincial Key Laboratory of Wireless Communication Technologies under Grant SDKLWCT-2019-02; in part by the Open Research Fund from Shenzhen Research Institute of Big Data under Grant 2019ORF01014; and in part by the National Science Foundation under Grant CPS-1932413 and Grant ECCS-1935915."

- *Hybrid Precoded Spatial Modulation (hPSM) for mmWave Massive MIMO Systems Over Frequency-Selective Channels*. "This work was supported in part by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, in part by the Open Research fund of Key Laboratory of Wireless Sensor Network and Communication under Grant 2017003, in part by the Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, and in part by the National Science Foundation under Grant CPS-1932413 and Grant ECCS-1935915."
- *Estimating Doubly-Selective Channels for Hybrid mmWave Massive MIMO Systems: A Doubly-Sparse Approach. IEEE Transactions on Wireless Communications*. "This work was supported in part by the Key-Area Research and Development Program of Guangdong Province under Project 2019B010153003, and in part by the National Science Foundation under Grant CPS-1932413 and Grant ECCS-1935915."
- *LSTM-Based Channel Prediction for Secure Massive MIMO Communications Under Imperfect CSI*. "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, the National Science and Technology Major Project under Grant 2018ZX03001031, the Major Project from Beijing Municipal Science and Technology Commission under Grant Z181100003218007, the open research fund of Key Laboratory of Wireless Sensor Network & Communication under Grant 2017003, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, the National Natural Science Foundation of China under Grants 61622101 and 61571020, and the National Science Foundation under Grant CPS-1932413."
- *Joint Transmit Power and Trajectory Optimization for Two-Way Multi-Hop UAV Relaying Networks*. "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, the National Science and Technology Major Project under Grant 2018ZX03001031, the Major Project from Beijing Municipal Science and Technology Commission under Grant Z181100003218007, the open research fund of Key Laboratory of Wireless Sensor Network & Communication under Grant 2017003, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, the National Natural Science Foundation of China under Grants 61622101 and 61571020, and the National Science Foundation under Grant CPS-1932413."
- *Spatial Multiplexing With Limited RF Chains: Generalized Beamspace Modulation (GBM) for mmWave Massive MIMO*. "This work was supported in part by the National Key Research and Development Project under Grant 2017YFE0121400, in part by the

Major Project from Beijing Municipal Science and Technology Commission under Grant Z181100003218007, in part by the National Science and Technology Major Project under Grant 2018ZX03001031, in part by the National Natural Science Foundation of China under Grant 61622101 and Grant 61571020, and in part by NSF ECCS-1935915."

- *Relay Selection Strategy (RSS) Design for In-Vehicle Storage (IVS) System.* "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, the National Science and Technology Major Project under Grant 2018ZX03001031, the Major Project from Beijing Municipal Science and Technology Commission under Grant Z181100003218007, the open research fund of Key Laboratory of Wireless Sensor Network & Communication under Grant 2017003, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, the National Natural Science Foundation of China under Grants 61622101 and 61571020, and the National Science Foundation under Grant CPS-1932413."
- *Hybrid Multi-User Precoding for mmWave Massive MIMO in Frequency-Selective Channels.* "This work was in part supported by the Ministry National Key Research and Development Project under Grant 2017YFE0121400, Guandong Key R&D Project under Grant 2018B030338001 and 2019B010153003, and the National Science Foundation under Grant CPS-1932413 and ECCS1935915."

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

US Department of Justice

Federal Bureau of Investigation

August 21, 2019

iTo: [redacted]

From: [redacted]

Subject: Dr. Liuqing Yang

Introduction

FBI provides the below information for consideration of NSF regarding suspending two awards:

- 2103256 entitled "CPS: Medium: Collaborative Research Collective Intelligence for Proactive Autonomous Driving (CI-PAD)" with an award period of October 1, 2019 through September 30, 2019, amount $958,337. The award was initially made to Colorado State University (award 1932413) and listed Dr. Liuqing Yang as Principal Investigator (PI). The award is now assigned to University of Minnesota – Twin Cities with Dr. Yang as PI.
- 2102312 entitled "Hybrid mmWave mMMO Transceiver Design for Doubly-Selective Channels" with an award period of September 1, 2019 through August 21, 2022, amount $344,483. The award was initially made to Colorado State University (award 1935915) and listed Dr. Liuqing Yang as PI. The award is now assigned to University of Minnesota – Twin Cities with Dr. Yang as PI.

As set forth below, FBI obtained evidence that Dr. Yang received awards from China's Shenzhen Municipal Commission of Science and Technology Innovation and China's Chutian Scholar Program. Additionally, there is evidence that Dr. Yang held and/or holds numerous positions at Chinese universities/research entities and in China Talent Plans.

FBI Investigation

The investigation of Dr. Yang was predicated on open source information regarding her significant PRC affiliations. Dr. Yang was a Professor in the Department of Electrical and Computer

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Engineering at Colorado State University (CSU) and moved to University of Minnesota in the fall of 2020. Dr. Yang has received research funding from NSF and other U.S. Government agencies. Her research focus includes: signals processing with applications to communications, networking and power systems; underwater acoustic sensors; and 5G networks.
A review of Dr. Yang's publications revealed a large number of publications acknowledging NSF as well as Chinese funding sources. Additionally, one of Dr. Yang's biographies on the web site of the Institute of Electrical and Electronics Engineers (IEEE) lists her affiliation as Shenzhen Research Institute of Big Data (SRIBD), Shenzhen, China (https://ieeexplore.ieee.org/author/37086624831). A review of Dr. Yang's NSF proposals revealed no disclosure of her positions in China or the funding she received from China.

Identified Affiliations in China of Liuqing Yang:

1. Shenzhen Research Institute of Big Data (SRIBD):

- 03/12/2017 news article titled "New members join SRIBD," on the web site of Shenzhen Research Institute of Big Data (SRIBD), Shenzhen, China, Yang joined the faculty of SRIBD in January of 2017. The article provides a short biography of each researcher. (https://sribd.cn/index.php/en/news/87-new-members-join-sribd.html)
- 07/21/2017 article titled "Research Projects of Shenzhen Research Institute of Big Data received grants from Shenzhen Municipal Commission of Science and Technology Innovation," Yang applied to the Shenzhen Municipal Commission of Science and Technology Innovation for funding from the Shenzhen Knowledge Innovation Program Basic Research Project. She was awarded 3,000,000 Yuan (approximately $456,000 USD) over three years. Yang's affiliation is listed as SRIBD: Key Technologies in Smart Grid with Distributed Energy Resources. Project description: "This project firstly aims to model at different degree combining traditional physical modeling and basing on data analysis modeling, aimed at equipment with different degree of complexity. And secondly aim to model the relationship between weather and the output of the distributed energy, finding out the main and secondary factors and their dynamic relationship. In addition, this project wish to put forward a scheme for smart power dispatch and profit maximization."
- 08/29/2018 article titled "Shenzhen Topow E-Commerce Co., Ltd. And Shenzhen Research Institute of Big Data Jointly Established 'Puhul Data Research Center'" lists Yang as a Senior Research Scientist of SRIBD.
- Institute of Electrical and Electronics Engineers (IEEE) – Liuqing Yang biography on the IEEE web site includes her photo and lists Yang's affiliation as Shenzhen Research Institute of Big Data (SRIBD), Shenzhen, China.
- Yang's affiliation with SRIBD appears to be ongoing.

2. Tongji University: Per open sources, Yang is or was an Adjunct Professor in the School of Software Engineering. Per the Tongji University homepage, Yang is regarded as an expert in artificial intelligence and signal processing.

3. China Three Gorges University (CTGU): Per open sources, Yang was appointed as Chutian Scholar in 2016 as a seasonal lecturer at China Three Gorges University to teach a course called Control Theory and Control Engineering. The Chutian Scholar Program, one of China's Talent Recruitment Programs, is run by Hubei Provincial Government as a sub-program of the Thousand

Talents Program. Such programs are typically contracted for three to five years. Per a 2018 spreadsheet, Yang was awarded 200,000 RMB (approximately $30,000 USD) in Chutian Scholar talent funding from CTGU for time frame December 2018 through November 2021. Therefore, it appears Yang's affiliation with CTGU is ongoing.

4. Huazhong University of Science and Technology (HUST): Per open sources, Yang was an Adjunct Professor in the School of Electronic Information and Communications as of Dec. 2014. Ongoing affiliation with HUST is possible though unconfirmed.

5. Zhengzhou University: Per open sources, Yang was an Advisor to Ph.D. student(s) as of March 2018. Ongoing affiliation with Zhengzhou is likely though unconfirmed.

6. Chinese Academy of Sciences (CAS): Per open sources, Yang was a Research Fellow of Institute of Automation as of Nov. 2014. Also, Yang was accepted into the One Hundred Talents Program at CAS in 2011. Yang advised UMN that her affiliation with CAS ended in 2016, however that is unconfirmed.

7. State Key Lab for Management and Control of Complex Systems (SKL – MCCS): Per open sources, Yang was a Research Fellow as of March 2017. Ongoing affiliation with SKL-MCCS is possible though unconfirmed.

8. Chinese University of Hong Kong – Shenzhen (CUHK-S): On 08/27/2019, Yang submitted a required Conflict of Interest form to Colorado State University. Yang listed teaching a summer course at the Chinese University of Hong Kong – Shenzhen. Yang stated she was under contract to teach one summer course per year for five years. She stated the position was unpaid. Per previously referenced 08/29/2018 article titled "Shenzhen Topow E-Commerce Co., Ltd. And Shenzhen Research Institute of Big Data Jointly Established 'Puhul Data Research Center,'" the Puhul Data Research Center was opened at the Chinese University of Hong Kong Shenzhen on 06/26/2018. Yang is listed as a Senior Research Scientist of SRIBD.

Colorado State University (CSU):

Per liaison contacts at CSU, Dr. Yang submitted a Conflict of Interest form on 08/27/2019 required by CSU. She disclosed an "ongoing contractual" engagement with the Chinese University of Hong Kong – Shenzhen in Shenzhen, China. Relationship states "Paid Activities" and Relationship Type states "Outside Teaching." Estimated time commitment and expected duration is described as "one summer course for 5 years". Amount of compensation in the past 12 months (including travel expenses, intellectual property rights and any other funds received or expected) states "$0/Unpaid." Dr. Yang's previous submissions listed no conflicts.
In writer's experience, it is extremely unusual for a prestigious researcher and IEEE Fellow to make a five year contractual commitment for no compensation, not even travel expenses, per diem or honorarium.

University of Minnesota:

In Fall of 2020 and Spring of 2021, Dr. Yang submitted Reports of External Professional Activities (REPA) required by UMN. She answered all questions negatively and disclosed no external professional activities. Based on information provided by the FBI and others, UMN was aware of significant external research activity by Dr. Yang. On 03/23/2021, UMN administrators held a virtual

meeting with her to discuss her activities in China. UMN advised the FBI that Dr. Yang's statements regarding activities in China contradicted other information UMN possessed.

Dr. Yang acknowledged collaboration with the Chinese Academy of Sciences (CAS) and said her involvement with CAS ended five years ago. She denied participating in a Talent Plan. Dr. Yang acknowledged only past collaboration with China Three Gorges University (CTGU). She said her affiliation with CTGU was limited to co-authoring a few papers with CTGU faculty and making a few summer visits to CTGU. She claimed she received no salary - only travel expenses and a couple hundred dollars honorarium. Dr. Yang denied any knowledge of the term "Chutian Scholar". In writer's experience working investigations related to China Talent Plans, it is highly likely Dr. Yang would be familiar with the Chutian Scholar program, whether or not she was a participant.

Dr. Yang denied any knowledge of the Shenzhen Research Institute of Big Data (SRIBD). When UMN read information about research funding awarded to her, she claimed Liuqing Yang is a common name in China, and there must be a different Liuqing Yang at SRIBD. [Writer notes the IEEE biography for Liuqing Yang at SRIBD includes a photograph which matches photographs of Yang on CSU's web site and other locations.]

Dr. Yang acknowledged only past collaboration with the University of Hong Kong-Shenzhen in 2016 while she was on sabbatical. She also taught a 2-4 week communications class in the summers of 2017-2019. She was paid as a Lecturer and held that title only during the time she taught. Dr. Yang denied any current research collaboration in Shenzhen. She denied receiving any funds beyond her short term lecturer salary.

UMN asked Dr. Yang about a research grant from the National Science Foundation of China to Liuqing Yang for GPS research and about a research grant from the Chinese Ministry of Transportation to Liuqing Yang for urban traffic research. Although part of Dr. Yang's research is focused on GPS and intelligent traffic systems, she again said it was not her. UMN requested Dr. Yang look for any documents or emails related to any affiliations in China and that UMN would likely request a follow-up interview.

In early March, UMN notified the U.S. National Science Foundation of Dr. Yang's apparent undisclosed foreign affiliations.

In late June 2021, UMN re-contacted Dr. Yang. After multiple attempts, Dr. Yang advised she was seeking legal counsel and would participate in an interview with her legal counsel present. UMN made contact with Dr. Yang's attorney on 07/06/2021 to discuss Dr. Yang. The following day, Dr. Yang departed the U.S. for China. A second interview with UMN was repeatedly rescheduled by her attorney and ultimately canceled altogether.

On 08/31/2021, Dr. Yang's attorney advised UMN that he spoke with Dr. Yang about the "China Initiative," her circumstances, paths forward, possible consequences, and that it will likely be a long process. She declined to pursue that process and her preference is to "wind down" her federal research work and her work at UMN. She has been thinking about a timeline, how to "disentangle" herself, transfer her research grant to other UMN faculty, while continue advising and teaching for a short period. Dr. Yang desires to get her research funding transferred to another UMN researcher, in the spirit of trying to help UMN retain that funding. Dr. Yang requested that UMN withdraw any of her pending research proposals. She wants to retain her UMN affiliation through this academic

year. Yang was scheduled to teach an in-person course fall semester beginning 09/07/2021. She requested to teach via an online platform. She wants to be on leave from UMN Spring semester of 2022, except for advising her Ph.D. students. Dr. Yang's attorney will not reschedule UMN's interview request.

Travel:

Dr. Yang departed to China on 07/07/2021. As of 09/10/2021, she has not re-entered the U.S. Travel to China in the recent past is as follows:

- 07/06/19 (LAX to Peking) - 08/26/19 (Peking to LAX) – approximately 50 days
- 01/24/19 (LAX to Peking) - 01/28/19 (Peking to LAX) – approximately 4 days
- 06/11/18 (SFO to Peking) - 08/20/18 (Peking to LAX) – approximately 70 days

[redacted]

Regards,

[redacted]

This is Google's response to http://xtbg.ctgu.edu.cn/oa/info/infoShowAction.do?Method=getInformation&id=52aa33f66f2f7130167c01e4cd000B1 cache. This is a snapshot of the web page in December 17, 2020 10:32:03 GMT. The current page may have changed during this time. Learn more.

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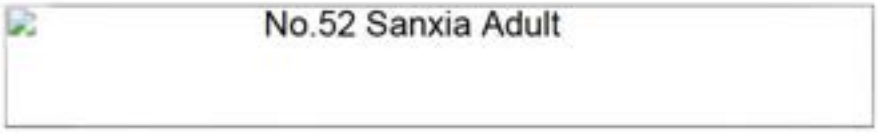
Tip: To quickly find your search words on this page, press Ctrl+F or ⌘-F (Mac), and then use the find bar to search.

About announcing the special funding for talent at three Gorges University for 2018 (Third installment)



School units:

According to "three Gorges University Talent specialized

The "Rules for the implementation of the work of introducing Overseas High-level Talent from three Gorges University" (No. 34 from three Gorges University), "Rules for the implementation of the Chutian scholars' Program from three Gorges University" (No. 27 from 2015), and "Rules for the implementation of the Chutian scholars' Program from three Gorges University" (provisional) [2013] 29), The Notice on the implementation of the Teaching and cultivation Plan for famous teachers of three Gorges (2010) 32, the Management measures of the three Gorges University Project for young People to develop top Talent (temporary) (2013) 20, In the spirit of documents such as the "Management measures for the three Gorges University's cadre leadership Talent Training Program" (No.1 of the three Gorges Adult [2015]), the school decided to approve 38 people, including Li Xin, as the target of funding the special talent (third batch) of the three Gorges University for 2018. They are now published (see annex for details).

The recipients of the subsidy are invited to formulate a plan for the use of the funds and performance targets according to the individual criteria for the subsidy before December 11 , and to complete the "three-copy plan for the use of special funds for talent at the three Gorges University", which was approved by the joint meeting of the University's party and government, and signed by the head of the academy, and reported to the personnel

Annex: A list of recipients of and the amount of subsidy for talent from three Gorges University in 2018 (the third batch)

Three Gorges University

November 28, 2018

Office of the President of three Gorges University

A total of 5 copies were issued by November 28, 2018

Accessories:

The list of recipients of and the amount of subsidy for talent from three Gorges University in 2018 (the third batch) is listed

Serial number	Who is being funded	The unit in which you are located	Type of funding	Amount of subsidy (million) Dollars)	Execution period
1	[redacted]	Institute of Electric and New Energy	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
2	[redacted]	Institute of Machinery and Power	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
3	[redacted]	Foreign Language Institute	Start-up fund for high-level talent research (Doctor)	1	December 2018 — November 2021
4	[redacted]	Faculty of Literature and Media	Start-up fund for high-level talent research (Doctor)	1	December 2018 — November 2021
5	[redacted]	Faculty of materials and Chemical Sciences	Start-up fund for high-level talent research (Doctor)	30	December 2018 — November 2021
6	Yang Liuqing	Institute of Electric and New Energy	Supporting the construction of a high-level talent platform Funding (Chutian Scholar)	20	December 2018 — November 2021
7	[redacted]	Institute of Electric and New Energy	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
8	[redacted]	Institute of Electric and New Energy	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
9	[redacted]	Faculty of materials and Chemical Sciences	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
10	[redacted]	Faculty of Economics and Management	Start-up fund for high-level talent research (Doctor)	1	December 2018 — November 2021
11	[redacted]	Faculty of materials and Chemical Sciences	Start-up fund for high-level talent research (Doctor)	3	December 2018 — November 2021
12	[redacted]	Faculty of materials and	Start-up fund for high-level talent research	3	December 2018 — November 2021

Translated [redacted] Show original Options

Sebastian Y. Bednarek Visiting Professor Appointment Ceremony at Zhejiang Normal University

2012 Nian 9 Yue 21 morning 10：00, Zhejiang Normal University **Sebastian Y. Bednarek** visiting professor appointment ceremony held at the Institute of Biochemistry Hall. Personnel Director Cai Zhiliang attended and presided over the ceremony.

Vice-President Yang Ling attended the ceremony and presented a letter of appointment to Professor **Sebastian Y. Bednarek**. On behalf of the school, Yang Ling welcomed Professor Sebastian Y. Bednarek . Yang Ling said that the joining of Sebastian Y. Bednarek has created more opportunities for us to learn from him. On the other hand, it will certainly provide a lot of help for the development of schools and disciplines.

Professor Sebastian Y. Bednarek expressed his gratitude for the trust of Zhejiang Normal University. He said that he will do his best to make his own contribution to the development of the National Taiwan Normal University. The leadership team of the School of Biochemistry, the head of the discipline, and some teachers and students attended the appointment ceremony.

After the ceremony, Professor Sebastian Y. Bednarek also gave a report entitled " Seeing Stars: Clathrin-dependent membrane trafficking during plant cytokinesis and cell expansion " to the teachers and students of the School of Biochemistry . The leaders of the School of Biochemistry, relevant teachers and students listened to this report and had a lively discussion and exchange with Professor Sebastian Y. Bednarek .

Links/links

Ministry of Science and Technology | National Natural Science Foundation of China | Zhejiang Natural Science Foundation Committee |

浙江师范大学举行Sebastian Y. Bednarek客座教授聘任仪式

发布时间：2012-09-21 浏览次数：2次

2012年9月21日上午10：00，浙江师范大学Sebastian Y. Bednarek客座教授聘任仪式在生化学院报告厅举行，人事处处长蔡志良出席并主持仪式。

副校长杨玲出席仪式并为Sebastian Y. Bednarek教授颁发聘书。杨玲代表学校对Sebastian Y. Bednarek教授的加盟表示欢迎。杨玲说，Sebastian Y. Bednar一方面给我们创造了更多向他学习的机会，另一方面也将会给学校、学科的发展提供很多帮助。

Sebastian Y. Bednarek教授对浙师大的信任表示感谢，他说以后将尽自己的能力，为师大的发展做出自己的贡献。生化学院领导班子、学科负责人以及部分了聘任仪式。

仪式后，Sebastian Y. Bednarek教授还为生化学院的师生作了题为"Seeing Stars: Clathrin-dependent membrane trafficking during plant cytokine cell expansion"的报告。生化学院领导、相关老师和学生聆听了本次报告，并与Sebastian Y. Bednarek教授开展了热烈的讨论和交流。

友情链接/links

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Dr. Enrique Lavernia

University of California-Irvine

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

July 15, 2020

To: [redacted]

From: [redacted]

Subject: Recommendation for Governmentwide Suspension (OIG Case I-18-0032-O)

Attached is our investigation report concerning allegations that Dr. Enrique Lavernia, Distinguished Professor and now-former Provost and Executive Vice Chancellor at the University of California-Irvine, engaged in a pattern and practice of deception in repeatedly failing to disclose material information regarding his foreign affiliations and/or employment. The wrongdoing is serious and material and has put federal funds at immediate risk. We have referred this matter the U.S. Attorney's Office for the District of Maryland, where it has been accepted for further investigation and possible criminal prosecution.

To protect the Federal government, we recommend that NSF suspend Dr. Enrique Lavernia governmentwide while our investigation is ongoing. The basis for our recommendation is described in detail in the report.

Pursuant to 2 C.F.R. § 180.735, the Assistant U.S. Attorney handling this case has advised: "Because the investigation is ongoing, I request that this memo not be disclosed outside of your agency, unless necessary for the suspension process." Accordingly, we request that neither this report nor its attachments be provided to Lavernia, his counsel, or any other third party.

We have on file the following contact information for the subject and his attorney:

Dr. Enrique Lavernia
[redacted]
lavernia@uci.edu
[redacted]

[redacted]

[redacted]

Attachment

cc: [redacted]

Recommendation for Governmentwide Suspension

OIG Case Number I-18-0032-O

June 30, 2020

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AT A GLANCE

Recommendation for Governmentwide Suspension

OIG Case Number I-18-0032-O
June 30, 2020

WHAT WE FOUND

We received an allegation that Dr. Enrique Lavernia, then-Provost and Executive Vice Chancellor of the University of California-Irvine, held outside positions at various universities located in the People's Republic of China and was a member of China's Thousand Talents Program. We substantiated the claims and determined that Lavernia did not disclose these positions or other foreign funding in his NSF proposals going back as far as October 2011, as required by the Proposal & Award Policies and Procedures Guide. We also learned during our multiagency investigation that Lavernia failed to disclose his foreign affiliations and funding with the National Aeronautics and Space Administration, as required by law, and omitted relevant information when applying for a security clearance for the Department of Energy.

Based upon the information developed during our investigation, the case was referred to the U.S. Attorney's Office for the District of Maryland, which accepted the matter for further investigation.

WHAT WE RECOMMEND

We recommend that NSF suspend Dr. Enrique Lavernia governmentwide pending conclusion of the ongoing investigation and proceedings to protect the U.S. Government from further fraud.

For further information, contact Special Agent in Charge Jen Springmann at x8757 or jspringm@nsf.gov.

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Factual Background

Dr. Enrique Lavernia was the University of California-Irvine (UCI) Provost and Executive Vice Chancellor from July 2015 to March 2020, when he resigned his duties;[1] he remains at UCI as a Distinguished Professor with the Department of Materials Science. Previously, Lavernia was acting Provost and Executive Vice Chancellor at the University of California-Davis (UCD) for 2 years from January 2009 – December 2010, as well as a Distinguished Professor of Chemical Engineering and Materials Science and dean of the College of Engineering. He has submitted nearly 100 proposals to NSF, including supplemental proposals, throughout his career, with 23[2] proposals being submitted since the start of Fiscal Year (FY) 2012.[3] Six[4] grants were awarded since the start of FY 2012, including two award supplements, valued at approximately $2.9 million.[5] He has served as an NSF reviewer and panelist since 1992, reviewing at least 100 different proposals.[6]

Lavernia is also a past recipient of funding from various Federal agencies, including the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE). He was previously granted a Top Secret clearance as requested by DOE,[7] and since the start of FY 2012, his NASA and DOE awards have totaled at least $2.3 million.

On March 11, 2020, UCI placed Lavernia on administrative leave "pending an external investigation into his academic and research activities."[8]

OIG Investigation

In early 2018, we received information alleging that Dr. Enrique Lavernia, then-Provost and Executive Vice Chancellor of UCI, held outside positions at various universities located in the People's Republic of China (PRC) and was a member of China's Thousand Talents Program.[9] We substantiated the claims

[1] https://chancellor.uci.edu/engagement/campus-communications/2020/200324-provost-update.php
[2] Two proposals did not require current and pending support forms (HRD-1543823 and HRD-1644801) as they are Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). Another two proposals are amendments to previously awarded proposals (both awarded since FY 2012). Finally, two other proposal numbers are the result of an award transfer when Lavernia moved from UCD to UCI.
[3] TAB 1
[4] Two awards were assigned new award numbers when Lavernia moved from UCD to UCI; these changes are not separately counted in this award total figure.
[5] TABS 1, 2
[6] TAB 3
[7] Upon current knowledge and belief, Lavernia has worked on DOE classified projects and was involved in "project consulting."
[8] https://www.latimes.com/california/story/2020-03-11/uc-irvine-provost-placed-on-leave-pending-investigation
[9] The Chinese Talent Plans are programs established by the Chinese government to recruit individuals with access to or knowledge of foreign technology, intellectual property, or individuals in a position to influence others. Through these plans, the Chinese government has created a significant financial incentive for foreign, talented individuals to transfer international technology and intellectual property to China, licitly or otherwise; to conduct influence operations on behalf of the Communist Party of China; and to recruit others to do the same. The goal is to further China's national ambitions and

through open source internet searches and IG subpoena responses. We also determined that Lavernia did not disclose these positions or other foreign funding sources in his NSF proposals going back as far as the beginning of FY 2012, as required by the Proposal & Award Policies and Procedures Guide (PAPPG). We learned during our multiagency investigation that Lavernia also did not disclose his foreign affiliations and funding with NASA, as required by law, and omitted such relevant information during his Top Secret security clearance process at DOE.

Undisclosed Foreign Positions & Funding

During our investigation, we reviewed multiple documents that referenced Lavernia's roles as a Wuhan University of Technology (WUT) visiting professor and later as a strategic scientist; Thousand Talents member; dean of the International Model College of Materials Science and Engineering (ISMSE); and honorary professor of the South China University of Technology (SCUT). In 2006, Lavernia was named a WUT visiting professor.[10] In 2013, he was then employed by WUT as a strategic scientist.[11] In 2014, Lavernia became a Thousand Talents member,[12] and 1 year later, he was named dean of ISMSE.[13] Also in 2015, an inauguration ceremony was held for Lavernia, naming him "the Honorary Professor of SCUT."[14] These positions were not disclosed in his NSF proposals since the start of FY 2012. He did, however, disclose his 1997 position as a visiting professor at the Max-Planck Institute in Germany in his NSF biographical sketches.

We also learned that from October 2012 to February 2019, Lavernia was co-author on at least 14[15] publications that only received foreign funding support. These funding sources were not previously reported in Lavernia's NSF current and pending support forms since the start of FY 2013. The publication dates ranged from May 2013 to February 2019 and included support from such funding sources as the 111 Project (discussed below).

security. Specifically, the Thousand Talents Program may also be referred as the Recruitment Program of Global Experts (Thousand Talents Plan, foreign section); 1000 Foreign Experts Introduction Plan; One-Thousand Talent High Level Foreign Expert; National Thousand Talents Program (for Overseas Experts); etc.

[10] TABS 4, 5 (p. 11), 6. There is also reference to Lavernia's visiting scholar work on TAB 5 (pp. 8-9) without reference to the year 2006.

[11] TABS 4, 5 (pp. 11, 101-105), 6, 7, 8 (p. 10), 9

[12] TABS 4, 7, 10. There is also reference to Lavernia's Thousand Talent Program membership on TAB 8 (p. 11) without reference to the year 2014. See also, TAB 6 (writing received from Lavernia with his subpoena production materials, expressing willingness to apply for the "1000 Foreign Experts Plan").

[13] TABS 4, 8 (p. 11). ISMSE was also translated as the "International Demonstration School of Materials Science and Engineering" by WUT; see TAB 7. See also, TABS 11, 12 (discussing Lavernia's ISMSE payments).

[14] TAB 10

[15] TAB 13. We used Web of Science to search Lavernia's publications from 1 year after the start of FY 2012 and 1 year after the date of his last NSF proposal submission in February 2018. We excluded any federal, UC-based, or verifiable U.S.-based sources of funding from our analysis. Additionally, the total number herein cited only includes those records showing a "Funding Agency" chart in the Web of Science results as attached.

Thousand Talents Program

Through our investigation, we received a copy of Lavernia's "Foreign Experts Thousand Talents Program Application."[16] On his application, Lavernia listed his personal information and entered WUT as his "Applicant unit" and SKLWUT [State Key Lab of Advanced Technology for Materials Synthesis and Processing] as his "Working Platform", respectively.[17] According to WUT's English website, SKLWUT is "under the supervision of the administration of the Ministry of Science and Technology of the People's Republic of China."[18] Its lab objectives are to "develop advanced technology for material synthesis and processing with independent intellectual property rights, and to explore new important materials in the field of some key technology research to continuously give technical support for the national economy and national defense construction."[19] The application states Lavernia will have "supportive conditions" to include 5 million RMB[20] [approximately $702,000 USD] for establishing his WUT laboratory.[21]

We also received a copy of Lavernia's Thousand Talents contract.[22] It listed responsibilities of both WUT and Lavernia under the contract. These included providing Lavernia 8 million RMB [approximately $1.13 million USD] for infrastructure construction and equipment; $50,000 USD[23] per month according to his "working time in Wuhan"; and, 1 million RMB [approximately $141,500 USD] as a "living allowance." Lavernia was to work up to 9 months a year for WUT; apply for various projects and conferences; cultivate young teachers and students; and, apply for patents and publish papers in the name of WUT.

While both the application and contract copies we received were unsigned, there is evidence demonstrating Lavernia's acceptance. The evidence includes both publicly sourced[24] and IG subpoena response materials[25] that reference his Talent plan membership, as well as emails that reference Lavernia's "1000" professor payments.[26]

111 Project

According to an open source article, the 111 Project is a program in the PRC "jointly organized by Ministry of Education and State Administration of Foreign Experts Affairs."[27] It aims to "upgrade the

[16] TAB 5. See also, TAB 6 (writing received from Lavernia with his subpoena production materials, expressing willingness to apply for the "1000 Foreign Experts Plan").
[17] TAB 5 (pp. 1-2)
[18] TAB 14
[19] *Id.*
[20] RMB is an abbreviation for Ren Min Bi, which loosely translates to "People's Money/Notes." It is the official currency of the PRC.
[21] TAB 5 (p. 11)
[22] TAB 15
[23] The contract only lists the payment in U.S. dollars; there is no cited RMB amount.
[24] TABS 4, 7, 10
[25] TAB 8 (p. 11)
[26] TABS 16, 17
[27] TAB 18

scientific renewal and peers competition of Chinese universities by establishing innovation centers and gathering groups of first-class minds from around the world."[28] Participating scholars "should work at least a month within China," and "[t]ravel fees, allowance, housing, [and] medical services for the overseas talents will be also included in this plan."[29]

When he was invited to join the 111 Project, it was explained to Lavernia that the program was "[i]nitiated in 2005 by the Ministry of Education, together with Chinese Foreign Experts Bureau, the 'Program of Introducing Talents of Discipline to Universities.'"[30] Additionally, "[t]he '111 Project' will give financial support (1 million Chinese Yuan, equal to $157,000 [USD]) for academic activities and research work related to the cooperation."[31] He accepted the offer in July 2012,[32] and his contributions would later be described as having "a crucial role in the construction and implementation of the approved project of our university in 2013."[33]

There was no mention of the 111 Project, Lavernia's role, or any corresponding potential or received funding in his NSF proposals.

Through open source sites, we found that Lavernia appears as a co-author on at least 12 publications from October 2012 to February 2019 that list 111 Project funding and cite no other domestic funding sources.[34] Also in that same timeframe, at least three additional publications acknowledge funding from both the 111 Project and NSF, causing potential duplication in research funding by a U.S. Government agency.

NASA and the China Restriction Policy

In its Grant and Cooperative Agreement for award no. NNX15AD81G, NASA included a section entitled, "Restrictions on Funding Activities with China."[35] As stated, "NASA is restricted from using funds appropriated in the Acts to enter into or fund any grant or cooperation agreement of any kind to participate, collaborate, or coordinate bilaterally with China …."[36] China is defined as "the People's Republic of China, any company owned by the People's Republic of China, or any company incorporated under the laws of the People's Republic of China."[37]

Lavernia was a Co-Investigator (Co-I) on NASA award no. NNX15AD81G (proposal no. 14-14ESI-0072). In the proposal's Biographical Sketches section, Lavernia again listed his 1997 foreign visiting professorship with Germany's Max-Planck Institute.[38] He did not include, however, any of his

[28] Id.
[29] Id.
[30] TAB 19
[31] TAB 19
[32] TAB 19. See also, TAB 7 (referring Lavernia's 111 Program involvement).
[33] TAB 8 (p. 10)
[34] TAB 13
[35] TAB 20 (p. 168)
[36] Id. at p. 170
[37] Id. at pp. 170-171
[38] TAB 20 (p. 294)

appointments or positions with PRC organizations, as required. He also did not mention any PRC-based funding in his submitted Current and Pending Support form.[39] As such, Lavernia caused the UCD Authorized Organizational Representative (AOR) to falsely certify the Certification of Compliance with Applicable Executive Orders and U.S. Code, which included:

- "the statements made in this proposal are true and complete to the best of his/her knowledge"[40];
- "agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal"[41]; and,
- "confirms compliance with all provisions, rules, and stipulations set forth in this solicitation."[42]

In an interview with NASA OIG, the NASA award's technical officer said if a PI or Co-I were working with a Chinese entity, they would not be permitted to work on the award. He would have taken immediate action upon discovery and contacted the grants officer. NASA OIG also interviewed the presiding grants officer, who stated the UCD AOR confirmed the Certification of Compliance with Applicable Executive Orders and U.S. Code, which included NASA's China funding restriction. The grants officer would have given UCD an opportunity to remove the involved PI or Co-I, but that if no action were taken, UCD would be in violation of NASA terms and conditions.

Omissions in Top Secret Clearance

In August 2016, Lavernia electronically submitted and certified the accuracy of his "Questionnaire for National Security Positions" as part of his reinvestigation for a U.S. Government Top Secret security clearance as related to aspects of his DOE work. He certified his statements were "true, complete, and correct to the best of my knowledge and belief and are made in good faith." Based on our investigation, we know there are inaccuracies.

Regarding his employment, Lavernia only listed the University of California and unpaid consultant work as related to Sandia National Laboratories. There was no mention of his employment connections, associated positions, or salaries from WUT as a strategic scientist; as dean of ISMSE; with SCUT as an honorary professor; or, originating from his membership with the Thousand Talents Program.

Regarding foreign businesses or organizations in which he provided advice or support, Lavernia disclosed his "advice to [the] International Materials School on curriculum, lectures, student organization and joint basic research for joint publications" for WUT. He listed his related compensation as only "Honoraria for advice and invited lectures." There was no mention of his PRC-associated affiliations or its corresponding income or in-kind support, including his positions as a WUT strategic scientist; dean of ISMSE; honorary professorship at SCUT; membership with the Thousand Talents Program; or, his support of the 111 Project.

[39] TAB 20 (pp. 298-300)
[40] Id. at p. 260
[41] Id.
[42] Id.

Regarding advice or serving as a consultant, even informally, to any foreign government official or agency, Lavernia checked, "No." There was no mention of his participation in the 111 Project or his work at or through SKLWUT as purported in his Thousand Talent Program applications.

Finally, regarding if he was asked by any foreign national to work as consultant or consider employment with them, Lavernia checked, "No."

During his January 2018 interview with background investigators, Lavernia disclosed a PRC bank account in which he receives money, noting "approximately $100-200, for travel expenses when he needs to travel to Wu Han University in China." He also said that he received $2,000 for his listed employment with China and Germany, which then go into his foreign bank accounts. Yet 9 days earlier, Lavernia received an email saying his fourth quarter ISMSE payment of 63100 RMB [approximately $9,650 USD] would be wired into his account.[43]

Investigators followed up within 2 weeks after their interview, asking for additional information regarding his foreign contacts, foreign bank accounts, and wire transfers. On or around that same day, Lavernia responded to the background investigator, deciding to terminate his application for a Top Secret clearance.

Induction into the Chinese Academy of Engineering

In May 2018, Lavernia received an email explaining that his nomination to the Chinese Academy of Engineering (CAE) was being processed. As explained, current CAE members can only vote once for a foreign CAE member, "[s]o the competition to get their vote is fierce."[44]

Lavernia's application discussed his major contributions to the PRC's engineering and technology undertakings. As listed, Lavernia "has profound academic attainment and significant international influence in nanomaterials, structural materials, and thermal spray technology."[45] His work "break[s] from the traditional concept of nanomaterials design and preparation technology and open[s] the way for the application of this new nanomaterial in both military and civilian fields.[46]

Also as stated, "[i]n areas such as cutting-edge national defense materials and manufacturing techniques, … there exist [sic.] a large technological gap between China and developed countries, such as the United States.[47] […] China still has obvious weaknesses in the development of new material technology as the material basis for defense-oriented weapons and equipment. […] Accelerating the development of

[43] TAB 11. See also, TAB 16 (referring to Lavernia's dean payment).
[44] TAB 8 (p. 1)
[45] Id.
[46] Id. at p. 6
[47] The U.S. impact was later therein described: "Additive manufacturing (or 3D printing) originated in the United States, the world's top technology leader. At present, with the world's most advanced additive manufacturing technology, the United States is at the forefront of the world in military, aerospace, medical, industrial, and civilian applications." TAB 8 (p. 8)

additive manufacturing technology and building an industrial scale as soon as possible is of great significance for promoting the transformation and upgrading of China's manufacturing industry."[48]

These foreign consultations and contributions were not disclosed in Lavernia's Top Secret clearance investigation. He was selected as a foreign member of the CAE, with his induction scheduled in June 2020 at the academy's annual General Assembly.[49]

Prosecution or Other Action(s) (Criminal, Civil, Administrative)

Based upon information uncovered during our multiagency investigation, the participating agencies referred the case to the U.S. Attorney's Office for the District of Maryland, which accepted the matter for further criminal investigation.

OIG Assessment

Grounds for Governmentwide Suspension

Pursuant to 2 C.F.R. § 180.605, suspension is the "temporary status of ineligibility for procurement and non-procurement transactions, pending completion of an investigation or legal proceedings." The procedures for suspension action are set forth in 2 C.F.R. § 180.700, which recognizes the serious nature of suspension actions, and sets for the procedures under which suspension may be effectuated. Pursuant to this section, the suspending official may issue a suspension if it determines that:

(1) "[t]here exists an indictment for, or other adequate evidence to suspect an offense listed under § 180.800(a)"; *or*
(2) "[t]here exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d)"; *and*
(3) "[i]mmediate action is necessary to protect the public interest."

Unlike debarment actions, suspensions are effective upon signature of the suspending official, and are generally imposed prior to notification to the suspended party.[50]

The analysis in suspension actions is similar to that undertaken in debarment actions, except that suspensions have a lower burden of proof of "adequate evidence," and an added requirement that there be a showing of "immediate need."[51] Specifically, NSF may suspend a person or entity for the same reasons listed in 2 C.F.R. § 180.800(a), -(b), -(c), or -(d), if there is adequate evidence to suspect that the individual or entity being considered for suspension is engaged in:

[48] TAB 8 (pp. 7-8)
[49] https://news.uci.edu/2020/01/27/enrique-lavernia-elected-to-chinese-academy-of-engineering/
[50] 2 C.F.R. § 180.710
[51] 2 C.F.R. § 180.605

- "[c]ommission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public or private agreement or transaction"[52];
- "[c]ommission of ... theft, ... making false statements, ... [or] making false claims"[53];
- "[c]ommission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects ... present responsibility"[54]; or
- "violation of the terms of a public agreement or transaction so serious as to affect the integrity of an agency program ... such as ... a willful violation of a statutory or regulatory provision or requirement applicable to a public agreement or transaction ...."[55]

NSF may also suspend such person or entity if NSF determines there is "[a]ny other cause of so serious or compelling a nature that it affects ... present responsibility."[56]

Adequate Evidence that Cause for Suspension Exists

In suspension actions, the burden of proof lies with the Federal agency to demonstrate that adequate evidence exists to support a debarment action. The debarment regulation lists 19 factors that the debarring official may consider, if applicable,[57] when determining whether there is adequate evidence that a cause for debarment exists. The following factors are pertinent to this case:

1. Actual or Potential Harm or Impact[58]

Lavernia's actions have caused significant potential and actual harm to NSF, NASA, and the U.S. Government at large. Lavernia repeatedly did not disclose material information regarding his foreign affiliations, funding, and positions as required by NSF and NASA. Lavernia violated NASA's China funding restriction and prevented NSF from making comprehensive assessments on his award proposals due to his omission of material information. In doing so, Lavernia compromised a system that relies upon honesty to function properly.

Lavernia's pattern of concealment extends beyond his proposals for federal awards, as identified in his application for a Top Secret security clearance and in a subsequent interview with a U.S. Government background investigator. Lavernia's false statements and omissions of information relevant to his security application could have provided Lavernia continued access to material that would cause grave damage to national security if made publicly available.

[52] 2 C.F.R. § 180.800(a)(1)
[53] 2 C.F.R. § 180.800(a)(3)
[54] 2 C.F.R. § 180.800(a)(4)
[55] 2 C.F.R. § 180.800(b)(3)
[56] 2 C.F.R. § 180.800(d)
[57] 2 C.F.R. § 180.860
[58] 2 C.F.R. § 180.860(a)

2. Frequency of Incidents and/or Duration of the Wrongdoing[59]

Lavernia demonstrated a pattern of deception, beginning with his appointment as a WUT visiting professor in 2006. From at least October 2011, Lavernia made and/or caused to be made multiple false statements and certifications to NSF and NASA. In addition, he did not disclose his foreign affiliations, funding sources, and salaries as also required for his Top Secret clearance as related to DOE.

3. Pattern of Wrongdoing[60]

Lavernia's actions demonstrate a pattern of disregard for various federal laws, policies, and procedures. From at least October 2011, none of Lavernia's biographical sketches or current and pending support sections list his PRC affiliations or funding sources. Moreover, he similarly omitted that information, as well as his foreign compensation, in his Top Secret clearance reinvestigation documents and interview.

4. Role in Wrongdoing[61]

Lavernia is solely responsible for not disclosing the entirety of his foreign affiliations, funding sources, and salary payments.

5. Acceptance of Responsibility[62]

To date, Lavernia has not accepted responsibility for his actions.

6. Repayment[63]

No funds have been returned to NSF, NASA, or DOE at this time. In response to a recommendation from NSF OIG, NSF suspended award CMMI-1729829 on which Lavernia was Co-PI.[64]

7. Cooperation of the Subject[65]

Lavernia, through his legal counsel, has cooperated with our subpoena demands to date.

8. Position Held by Subject[66]

Lavernia held a high-level position with UCI until March 23, 2020, when he resigned from his position as UCI Provost and Executive Vice Chancellor. He continues as a Distinguished Professor with the UCI

[59] 2 C.F.R. § 180.860(b)
[60] 2 C.F.R. § 180.860(c)
[61] 2 C.F.R. § 180.860(f)
[62] 2 C.F.R. § 180.860(g)
[63] 2 C.F.R. § 180.860(h)
[64] TAB 21
[65] 2 C.F.R. § 180.860(i)
[66] 2 C.F.R. § 180.860(k)

Department of Materials Science. Prior to his UCI move but after the start of FY 2012, Lavernia was a Distinguished Professor of Chemical Engineering and Materials Science and dean of the College of Engineering at UCD. He also participated as an NSF panelist and reviewer on three occasions since FY 2012.

9. Organizational Action[67]

In response to a recommendation from NSF OIG, NSF suspended Lavernia's award CMMI-1729829 entitled, "DMREF/Collaborative Research: Multiscale Alloy Design of HCP Alloys via Twin Mesh Engineering," made to UCI and listing Lavernia as Co-PI.[68]

Immediate Need

"In deciding whether immediate action is needed to protect the public interest, the suspending official has wide discretion."[69] As an example, the suspending official "may infer the necessity for immediate action to protect the public interest ... from potential business relationships or involvement with a program of the Federal Government."[70]

Lavernia has a significant history of receiving federal grants. Throughout his career, he was the PI or Co-PI on 33[71] NSF grants, including supplemental proposals, totaling approximately $8.1 million.[72] Since the start of FY 2012, Lavernia has been PI or Co-PI on six[73] NSF grants, totaling approximately $2.9 million.[74] When considering this amount alongside his NASA and DOE funding since the start of FY 2012, Lavernia has had access to and responsibility over approximately $5.2 million[75] in federal funds.

His continuous conduct spanning over 8 years sufficiently establishes that Lavernia is not presently responsible to receive federal funds. There is an immediate need for suspension because he has submitted, and likely will continue to submit, additional proposals for funding to federal agencies.

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[67] 2 C.F.R. § 180.860(l)
[68] TAB 21
[69] 2 C.F.R. § 180.705(c)
[70] 2 C.F.R. § 180.705(c)
[71] TAB 1. This figure includes supplemental proposals but excludes two proposals as they are the result of award transfers when Lavernia moved from UCD to UCI.
[72] TAB 1
[73] Two awards were assigned new award numbers when Lavernia moved from UCD to UCI; these changes are not separately counted in this award total figure.
[74] TABS 1, 2
[75] This figure combines Lavernia's $2.9 million in NSF funds (start date: FY 2012) with his NASA and DOE funds awarded since the start of FY 2012, or $2.3 million.

In sum, given the nature of the misconduct, the fact that he is currently an active award recipient[76] with an extensive federal award history, and likelihood that he will continue to apply for federal awards, there is an immediate need to issue the suspension to prevent additional federal funding from being granted and released to Lavernia during this ongoing investigation.

OIG Recommendation

It is imperative that the ability of Lavernia to obtain and spend Federal funds be suspended for the duration of this active investigation being conducted in conjunction and coordination with the U.S. Attorney's Office for the District of Maryland. Therefore, we recommend that NSF suspend Lavernia governmentwide pending conclusion of this ongoing investigation.

[76] Lavernia's current NSF award, CMMI-1729829, is suspended. See TAB 21. One DOE award is also suspended, while his NASA award currently remains active. Upon information and belief, Lavernia also has at least one active award with the Department of Defense.

Attachments

TAB 1 – Lavernia PI history detail
TAB 2 – Lavernia E-Jacket (10.01.11-06.05.20)
TAB 3 – Lavernia Reviewer list (sorted)
TAB 4 – WUT article
TAB 5 – Thousand Talents application (unsigned)
TAB 6 – Lavernia statement
TAB 7 – Bell award announcement
TAB 8 – CAE nomination form
TAB 9 – Strategic scientist contract
TAB 10 – SCUT announcement
TAB 11 – ISMSE payment (01.02.18)
TAB 12 – ISMSE payment (03.19.18)
TAB 13 – Web of Science publications list (10.12-02.19)
TAB 14 – SKLWUT about us
TAB 15 – Thousand Talents contract (unsigned)
TAB 16 – TTP professor bonus & dean salary
TAB 17 – TTP professor payment
TAB 18 – 111 Program background
TAB 19 – 111 Program invite and response
TAB 20 – NASA award (NNX15AD81G)
TAB 21 – Notice of Suspension of Award (CMMI-1729829)

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

National Science Foundation
Division of Grants and Agreements

2415 Eisenhower Avenue
Alexandria, Virginia 22314
(703) 292-4814
(703) 292-9142 FAX

April 24, 2020

[redacted]

Re: Notice of Suspension for NSF Award CMMI-1729829

Dear [redacted]

This letter serves to notify you that NSF is suspending award CMMI-1729829, effective immediately. Suspension is an action that temporarily withholds Federal support of a project pending corrective action by the grantee or a decision by NSF to terminate the grant. Based on a recommendation from the agency's Office of Inspector General, NSF has determined that suspension of the referenced award is reasonable to protect the interests of the government.

No costs incurred during a suspension period will be allowable except those costs which, in the opinion of NSF, the grantee could not reasonably avoid or eliminate, or which were otherwise authorized by the suspension notice, provided such costs would otherwise be allowable under the terms and conditions of the award and the appropriate Federal costs principles.

The suspension will remain in effect until otherwise notified by NSF and is in accordance with NSF's Research Terms & Conditions (March 14, 2017), Article 30.

[redacted]

Sincerely,

[redacted]

cc: [redacted]

From: Fei Chen
Sent: Thursday, April 6, 2017 5:26 PM
To: Enrique Lavernia
Subject: Re: Hi

Have a safe travel! Waiting for your arrival to Wuhan.

Fei

On Thu, Apr 6, 2017 at 7:28 PM, Enrique Lavernia <[redacted]> wrote:
Thank you Fei! I am in Boston now...

On Wed, Apr 5, 2017 at 8:55 PM, Fei Chen <chenfei027@gmail.com> wrote:
Dear Prof. Lavernia,

Do you want to know the time of the year for: B) The highest balance held was RMB 409,573.02, when the 1000 Professor 1/3 bonus and your dean salary was deposited together?

It is around November 6, 2016.

See you soon.

Fei

On Tue, Apr 4, 2017 at 11:55 PM, Enrique Lavernia <[redacted]> wrote:
Thank you perfect! It's that time of the year.

Enrique J. Lavernia, Ph.D
Provost and Executive Vice Chancellor Distinguished Professor of Chemical Engineering and Materials Science
509 Aldrich Hall
University of California, Irvine
Irvine, CA 92697-1000

Phone: (949) 824-6296
Fax; (949) 824-2438

provost@uci.edu

On Apr 4, 2017, at 6:59 AM, Fei Chen <chenfei027@gmail.com> wrote:

> Dear Prof. Lavernia,
>
> It is great to know and we look forward to your arrival together with Prof. Apelian.
>
> To your question, I have checked it.

A) At the year end 2016, your ICBC account balance was RMB 6,290.70. All your income in year 2016 was ~RMB 980,000.
B) The highest balance held was RMB 409,573.02, when the 1000 Professor 1/3 bonus and your dean salary was deposited together.

I hope this could help you.

Fei

On Tue, Apr 4, 2017 at 9:40 PM, Enrique Lavernia [redacted]> wrote:
Dear Fei, ready for my trip, atlhough I am off to a meeting in Boston, I return Friday and then I leave Saturday.

Fei, for my US taxes, I need some information that is required, please: a) what was the balance at year end (2016) and what was the highest balance held at any time during the 2016 year in my chinese account? Approximate numbers are ok.

Thank you so much

Been working hard on Chuandong's paper but its looking a lot better!

e

--
Enrique J. Lavernia, Ph.D.
Distinguished Professor of Chemical Engineering and Materials Science
Editor-in-Chief, Materials Science and Engineering A
509 Aldrich Hall
University of California, Irvine
Irvine, CA 92697-1000

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Fax: +86-27-87879468
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Fax: +86-27-87879468

http://www.journals.elsevier.com/materials-science-and-engineering-a/
E-mail: chenfei027@gmail.com
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From: 陈斐
Sent: Sunday, July 2, 2017 9:37 PM
To: Prof. Lavernia
Subject: 1000 Plan professor payment
Attachments: 无标题.jpg

Dear Prof. Lavernia,

I noticed that your last payment for 1000 Plan foreign professor has been deposited into your WUT account. It is RMB 333,333.

Today, I wired to you USD 49,100 (RMB 333,973) and please see the details. Please let me know when you receive it.

best wishes,

Fei

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========== D========== D==========
Fei Chen, Ph.D.
Professor
State Key Lab of Advanced Technology for Materials Synthesis and Processing
Wuhan University of Technology, Wuhan 430070, P. R. China
Tel: +86-13808629168
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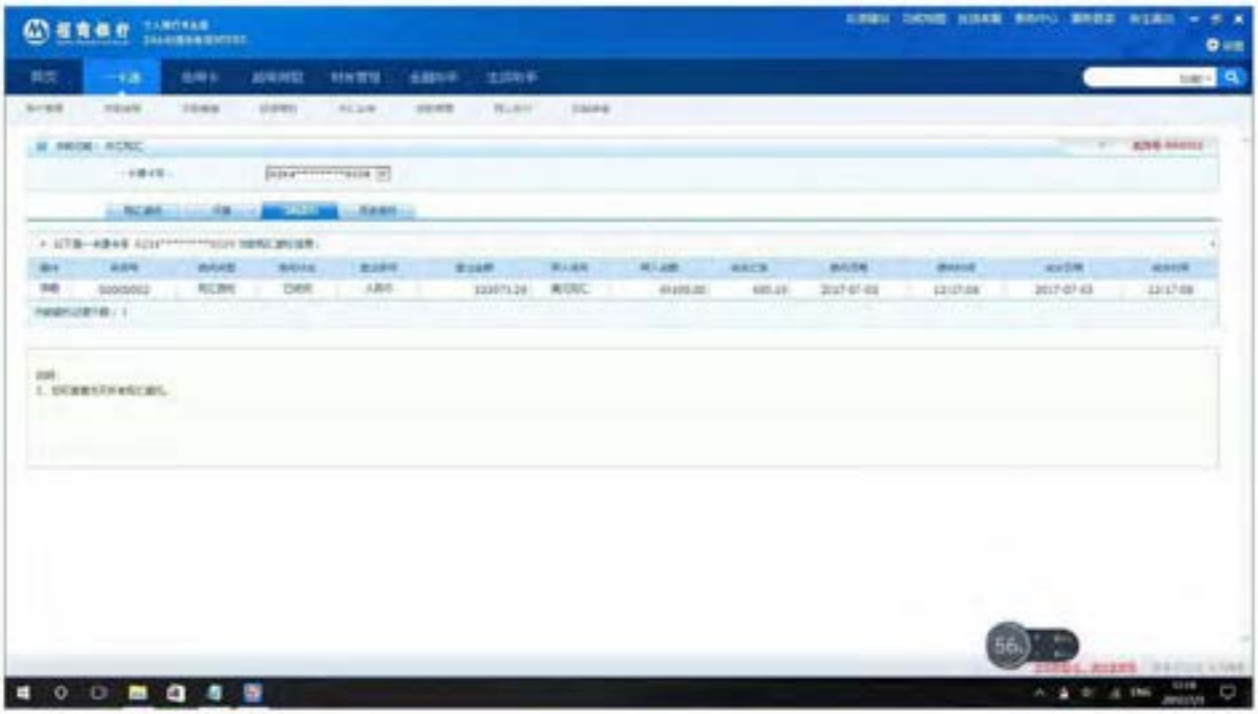

China to Undergo Brain Gain Through Plan 111

Adjust font size:

The Ministry of Education issued a regulation on September 11 to help tackle course innovation in colleges and universities, marking the implementation of "Plan 111."

The plan has been jointly organized by Ministry of Education and State Administration of Foreign Experts Affairs. It aims to upgrade the scientific renewal and peers competition of Chinese universities by establishing innovation centers and gathering groups of first-class minds from around the world. It will bring in about 1,000 overseas talents from the top 100 universities and research institutes worldwide. These experts will team up with domestic research infrastructures alongside the creation of 100 subject innovation centers to be set up in universities.

Only universities from "985 Project", which aimed at developing a number of world-class universities, and "211 Project", which aimed at strengthening about 100 institutions of higher learning and key disciplinary areas in the 21st century, can be chosen for the "Plan 111". At least 10 overseas talents should be employed in each innovation center. In each of these teams, at least one should be an overseas academic master while the foreign representatives can only emanate from the top 100 universities and research institutes. Generally, the academic masters should not be older than 70, with the exception of Nobel Prize winners, with other representatives under 50. Subjects should include basic sciences, technology and project management among others.

The overseas academic masters must be worldwide renowned professors or well-recognized famous scholars with an academic level and record beyond contestation. Each academic master should work at least a month within China with other members of the visiting teams working here for three months.

Travel fees, allowance, housing, medical services for the overseas talents will be also included in this plan.

(China.org.cn by Li Xiaohua, September 14, 2006)

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From: Enrique J. Lavernia
Sent: Sunday, July 8, 2012 4:29 PM
To: Fei Chen
CC: Haiming Wen; Julie M. Schoenung; Yizhang Zhou
Subject: Re: Haiming's visit and invitation for a 111 Project
Attachments: Passport.pdf; WHUT-2012.pdf

Dear Fei, I am pleased to attach both documents as requested; delighted that Haiming's visit was so productive!

Best regards,

EJL

Enrique J. Lavernia
Distinguished Professor
Dean, College of Engineering
University of California, Davis
One Shields Avenue Davis, CA 95616-8558
Phone: (530) 752-0554
Fax: (530)752-2400
lavernia@ucdavis.edu

50th Anniversary Schedule of Events

On Jul 7, 2012, at 12:54 AM, Fei Chen wrote:

> Dear Prof. Lavernia,
>
>
> On behalf of Prof. Zhang and Prof. Shen, I am pleased to tell you that Dr. Haiming Wen has been in our group for 3 days during Jul.3 to Jul.5 and he gave us an excellent presentation about his fantastic research work under your guidance. Attached please find some photos related to his presentation and his visit to Wuhan University of Technology. Prof. Zhang, Prof. Shen, Ms. Ling Li, and I have communicated with Dr. Haiming Wen a lot during and after the presentation. We enjoyed a Chinese style evening dinner together. From the presentation, Prof. Zhang and Prof. Shen suggested we could further our collaborations in the nanocrystalline metal matix composites and multi-modal composites.
>
>
> By the way, currently there is a great opportunity for us to strengthen the collaborations that we are going to apply a "111 Project". Initiated in 2005 by the Ministry of Education, together with Chinese Foreign Experts Bureau, the “Program of Introducing Talents of Discipline to Universities,” also known as the “111 Project” in China, is a national program that aims to draw “about 1000 leading overseas scholars and researchers” from the “top 100 world leading universities and research institutes” to build “100 innovative bases for disciplinary development and research” in China (1000-100-100, thus the nickname “111 Project”). The “111 Project” will give financial support (1 million Chinese Yuan, equals to $157,000) for academic activities and research work related to the cooperation. So this program will surely be of great significance in strengthening the collaboration and exchanges between our two groups. Because of our several successful collaborations, you and Prof. Schoenung are invited to the “111 Project”. Prof. Zhang has issued an invitation letter (in the attachment) for you and Prof. Schoenung. Now, we need your confirmation letter signed by you for participation in this project. Could you please use the formal UC Davis letter sheet and make a reply (I have written the reply form for you and Prof. Schoenung, please see the attached Reply form. doc). The scanning copy of the reply form is needed. Please notice that the due date for the application is in Jul. 16. So, could you please send me the reply if possible soon?
>
>

> On the other hand, for your "Strategic Scientist" issue, a scanning copy of your passport is needed.
>
>
> The documents list needed from you is as follows:
>
> 1. Scanning Copy of Reply form signed by you to confirm your participation in 111 Program
>
> 2. Scanning Copy of your passport for Strategic Scientist in WHUT.
>
>
> I am looking forward to your reply.
>
>
> Best regards.
>
>
> Fei Chen
>
>
> --
> ==========
> Fei Chen, Ph.D.
> Associate Professor
> Key Lab of Advanced Technology for Specially Functional Materials, Ministry of Education
> State Key Lab of Advanced Technology for Materials Synthesis and Processing
> Wuhan University of Technology, Wuhan 430070, P. R. China
> Tel: +86-13808629168
> Fax: +86-27-87879468
> E-mail: chenfei027@gmail.com
> ==========
>
> <IMG_7783.JPG><IMG_7788.JPG><IMG_7806.JPG><Invitation letter for Prof. Lavernia.jpg><Reply form for Prof. Lavernia.doc>

The Secretary of State of the United States of America
hereby requests all whom it may concern to permit the citizen/national
of the United States named herein to pass without delay or hindrance
and in case of need to give all lawful aid and protection.

Le Secrétaire d'Etat des Etats-Unis d'Amérique
prie par les présentes toutes autorités compétentes de laisser passer le citoyen
ou ressortissant des Etats-Unis titulaire du présent passeport, sans délai ni
difficulté et, en cas de besoin, de lui accorder toute aide et protection légitimes.

El Secretario de Estado de los Estados Unidos de América por el presente solicita a las
autoridades competentes permitir el paso del ciudadano o nacional de los Estados Unidos
aquí nombrado, sin demora ni dificultades y en caso de necesidad, prestarle toda la
ayuda y protección lícitas.

SIGNATURE OF BEARER/SIGNATURE DU TITULAIRE/FIRMA DEL TITULAR

NOT VALID UNTIL SIGNED

PASSPORT
PASSEPORT
PASAPORTE

USA

UNITED STATES OF AMERICA

Type / Type / Tipo: P
Code / Code / Código: USA
Passport No. / No. de Passeport / No. de Pasaporte: [redacted]

Surname / Nom / Apellidos
LAVERNIA

Given names / Prénoms / Nombres
ENRIQUE JOSE

Nationality / Nationalité / Nacionalidad
UNITED STATES OF AMERICA

Date of Birth / Date de naissance / Fecha de nacimiento
30 Jul 1960

Sex / Sexe / Sexo: M
Place of Birth / Lieu de naissance / Lugar de nacimiento
CUBA

Date of Issue / Date de délivrance / Fecha de expedición
25 Feb 2005

Authority / Autorité / Autoridad
San Francisco
Passport Agency

Date of Expiration / Date d'expiration / Fecha de caducidad
24 Feb 2015

Amendments / Modifications / Enmiendas
See Page 24

P<USALAVERNIA<<ENRIQUE<JOSE<<<<<<<<<<<<<<<<

[redacted]<<<<<<<<<<<<<<<00

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ENRIQUE J. LAVERNIA, DEAN
PHONE: (530) 752-0554
FAX: (530) 752-8058
E-mail: lavernia@ucdavis.edu

COLLEGE OF ENGINEERING
OFFICE OF THE DEAN
ONE SHIELDS AVENUE
DAVIS, CA 95616-5294

July 7, 2012

Prof. Lianmeng Zhang
Vice President of Wuhan University of Technology

Thank you very much for the invitation extended by you and Dr. Fei Chen for the participation of the 5-year academic innovation program (2013-2017) for universities in China carried out by the Ministry of Education in China and Chinese Foreign Experts Bureau (abbreviated as the Program of 111). This Program will surely be of great significance in strengthening the collaboration and exchanges between University of California at Davis, United States and Wuhan University of Technology, China.

I will be pleased to participate in this Program and be willing to make further contributions for scientific collaboration and exchange between United States and China.

Please do not hesitate to contact me if you need additional information.

Yours sincerely,

Enrique J. Lavernia, Ph.D.
Distinguished Professor
Dean, College of Engineering
Fellow, ASM International, ASME, and AAAS

National Science Foundation
Office of the Director

July 24, 2020

BY ELECTRONIC MAIL

[redacted]

Re: Notice of Government-wide Suspension of Enrique Lavernia, Ph.D.

[redacted]

This letter se1ves as fo1mal notice that, based on a recommendation by the National Science Foundation's Office of Inspector General (NSF OIG), NSF is suspending your client, Emique Lavernia, Ph.D., from directly or indirectly obtaining the benefits of Federal grants and contracts, effective immediately. During the government-wide suspension, Dr. Lavernia is precluded from receiving Federal financial and non-financial assistance and benefits under nonprocurement Federal programs and activities. Dr. Lavernia also is prohibited from paiiicipating in Federal agency transactions that are covered transactions and from paiiicipating in ce1iain non-procurement transactions, which includes se1ving as an NSF reviewer, advisor, or consultant. Finally, Dr. Lavernia is prohibited from receiving any Federal contracts or approved subcontracts under the Federal Acquisition Regulations (FAR).

Background

Dr. Lavernia se1ved as the University of California-hvine (UCI) Provost and Executive Vice Chancellor from July 2015 to Mai·ch 2020, when he resigned his duties. He remains at UCI as a Distinguished Professor with the Department of Materials Science. Previously, Dr. Lavernia also se1ved as acting Provost and Executive Vice Chancellor at the University of California-Davis (UCD) for 2 years from Januaiy 2009 through December 2010, as well as a Distinguished Professor of Cheinical Engineering and Materials Science and Dean of the College of Engineering. Throughout his cai·eer, Dr. Lavernia submitted neai·ly 100 proposals to NSF, including supplemental proposals. Out of those subinissions, at least 23 proposals were submitted since approximately 2012. Since approximately 2012, Dr. Lavernia se1ved as Principal Investigator (PI) on six awai·ded grants, including two award supplements, valued at approximately $2.9 million. Since 1992, he se1ved as an NSF reviewer and panelist, reviewing

at least 100 different proposals.[1] On March 11, 2020, UCI placed Dr. Lavernia on administrative leave pending external investigations related directly to his research activities.

Reason for Suspension

Based on a recommendation from the NSF OIG and an ongoing criminal investigation, there is adequate evidence that Dr. Lavernia failed to disclose required information concerning his affiliations, income, positions, and current and pending support in proposal documents and other documents submitted to NSF as required by the Proposal & Award Policies and Procedures Guide (PAPPG)[2] and service as a reviewer. During a multiagency investigation, NSF learned that Dr. Lavernia did not disclose required information concerning his affiliations, income, positions, and current and pending support to NASA and DOE, most notably on his DOE Top Secret Security clearance documents.

Specifically, there is adequate evidence to establish that Dr. Lavernia failed to disclose to NSF, NASA, and DOE affiliations with Wuhan University of Technology (WUT), the International Model College of Materials Science and Engineering (ISMSE), South China University of Technology (SCUT), the Chinese Academy of Engineering (CAE), and the Chinese government through the Thousand Talents Program and 111 Project. These affiliations included positions held, income, and financial and other support for research. There is adequate evidence to establish that Dr. Lavernia failed to disclose this information to NSF in proposal submission documents, as required by the PAPPG, as far back as 2013.

Based on the information uncovered during a multiagency investigation, the U.S. Attorney's Office for the District of Maryland is conducting a further criminal investigation of Dr. Lavernia.

Regulatory Basis for Suspension

Pursuant to 2 C.F.R. § 180.700, suspension may be imposed when the suspending official determines that:

(a) There exists an indictment for, or other adequate evidence to suspect, an offense listed under § 180.800(a); or
(b) There exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d); and
(c) Immediate action is necessary to protect the public interest.

---

[1] Dr. Lavernia is a past recipient of funding from the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE). He previously applied for and held a Top Secret clearance as requested by DOE, and since 2012, his NASA and DOE awards have totaled at least $2.3 million.

[2] *See generally* PAPPG, Chapter II.C.2.f. (Biographical Sketch(es)) and Chapter II.C.2.h. (Current and Pending Support).

In this case, we have determined that bases for the suspension exist under 2 C.F.R. § 180.700(a), (b) and (c).

With respect to 2 C.F.R. § 180.700(a), there is adequate evidence to suspect that Dr. Lavernia committed an offense listed under 2 C.F.R. § 180.800(a) in view of Dr. Lavernia's suspected false statements to NSF, NASA, and DOE. More specifically, Dr. Lavernia's failures to disclose multiple affiliations, income, positions, and current and pending support are bases to suspect that he committed the offense of making false statements. Additionally, Dr. Lavernia failed to disclose this information while applying for and receiving grants from NSF and other Federal agencies, bearing directly on his present responsibility. Finally, the ongoing criminal investigation into the undisclosed affiliations, income, and current and pending support further supports there is adequate evidence to suspect an offense listed under § 180.800(a).

With respect to 2 C.F.R. § 180.700(b), there is adequate evidence to suspect a violation of the terms of a public agreement or transaction, as set out in 2 C.F.R. § 180.800(b), and a cause of so serious or compelling a nature that it affects Dr. Lavernia's present responsibility, as set out in 2 C.F.R. § 180.800(d). More specifically, there is adequate evidence that Dr. Lavernia failed to make required disclosures in documents submitted to NSF as required by the PAPPG. In addition, adequate evidence established a failure to disclose this information to NASA and DOE, including documents submitted to DOE for a Top Secret clearance. These suspected omissions are breaches of the terms of various public agreements and transactions, as well as various rules, regulations, and policies, such that they affect his present responsibility.

Under 2 C.F.R. § 180.700(c), immediate action against Dr. Lavernia is necessary to protect the public interest in view of both the seriousness and nature of the circumstances that gave rise to the present criminal investigation. Dr. Lavernia is an established professor who has submitted numerous proposals to NSF, served as a PI/co-PI on Federal awards exceeding $5.2 million, and served as an NSF panelist which gave him access to confidential information in over a hundred proposals to NSF. Given his background and experience, he has the ability to exploit confidential information acquired from NSF to secure Federal funding. In addition, sufficient evidence exists to suspect he has omitted relevant information on the proposals he has submitted in the past. Therefore, immediate action is necessary to safeguard Federal funds, preserve the integrity of NSF's merit review process, and protect the public interest.

Length of Suspension

Dr. Lavernia's suspension is for a temporary period not to exceed 12 months except, if legal or debarment proceedings are initiated at the time of or during the suspension, then the suspension may continue until the conclusion of those proceedings. Further, NSF may extend the suspension for an additional six months at the request of a prosecuting official. *See* 2 C.F.R. § 180.760. During the period of suspension, Dr. Lavernia also is prohibited from serving as an NSF reviewer, advisor, or consultant.

Procedures Governing Suspension

The provisions of2 C.F.R. §§ 180.700 through 180.760 govern suspension procedures and decision-making. Under our regulations, Dr. Lavernia has 30 days after receipt of this notice to submit, in person, or in writing, or through a representative, infonnation and argument in opposition to the suspensions. 2 C.F.R. §§ 180.720, 180.725. Comments submitted within the 30-day period will receive full consideration and may lead to a tennination or modification of the suspensions. IfNSF does not receive a response to this notice within the 30-day period, the suspensions will remain in effect.

[redacted]

[redacted]

Enclosures:
Nonprocurement Debarment and Suspension Regulations
FAR Regulations

National Science Foundation
Office of the Director

July 24, 2020

BY ELECTRONIC MAIL

[redacted]

Re: Notice of Government-wide Suspension of Enrique Lavernia, Ph.D.

[redacted]

This letter serves as formal notice that, based on a recommendation by the National Science Foundation's Office of Inspector General (NSF OIG), NSF is suspending your client, Enrique Lavernia, Ph.D., from directly or indirectly obtaining the benefits of Federal grants and contracts, effective immediately. During the government-wide suspension, Dr. Lavernia is precluded from receiving Federal financial and non-financial assistance and benefits under nonprocurement Federal programs and activities. Dr. Lavernia also is prohibited from participating in Federal agency transactions that are covered transactions and from participating in certain non-procurement transactions, which includes serving as an NSF reviewer, advisor, or consultant. Finally, Dr. Lavernia is prohibited from receiving any Federal contracts or approved subcontracts under the Federal Acquisition Regulations (FAR).

Background

Dr. Lavernia served as the University of California-Irvine (UCI) Provost and Executive Vice Chancellor from July 2015 to March 2020, when he resigned his duties. He remains at UCI as a Distinguished Professor with the Department of Materials Science. Previously, Dr. Lavernia also served as acting Provost and Executive Vice Chancellor at the University of California-Davis (UCD) for 2 years from January 2009 through December 2010, as well as a Distinguished Professor of Chemical Engineering and Materials Science and Dean of the College of Engineering. Throughout his career, Dr. Lavernia submitted nearly 100 proposals to NSF, including supplemental proposals. Out of those submissions, at least 23 proposals were submitted since approximately 2012. Since approximately 2012, Dr. Lavernia served as Principal Investigator (PI) on six awarded grants, including two award supplements, valued at approximately $2.9 million. Since 1992, he served as an NSF reviewer and panelist, reviewing

at least 100 different proposals.[1] On March 11, 2020, UCI placed Dr. Lavernia on administrative leave pending external investigations related directly to his research activities.

Reason for Suspension

Based on a recommendation from the NSF OIG and an ongoing criminal investigation, there is adequate evidence that Dr. Lavernia failed to disclose required information concerning his affiliations, income, positions, and current and pending support in proposal documents and other documents submitted to NSF as required by the Proposal & Award Policies and Procedures Guide (PAPPG)[2] and service as a reviewer. During a multiagency investigation, NSF learned that Dr. Lavernia did not disclose required information concerning his affiliations, income, positions, and current and pending support to NASA and DOE, most notably on his DOE Top Secret Security clearance documents.

Specifically, there is adequate evidence to establish that Dr. Lavernia failed to disclose to NSF, NASA, and DOE affiliations with Wuhan University of Technology (WUT), the International Model College of Materials Science and Engineering (ISMSE), South China University of Technology (SCUT), the Chinese Academy of Engineering (CAE), and the Chinese government through the Thousand Talents Program and 111 Project. These affiliations included positions held, income, and financial and other support for research. There is adequate evidence to establish that Dr. Lavernia failed to disclose this information to NSF in proposal submission documents, as required by the PAPPG, as far back as 2013.

Based on the information uncovered during a multiagency investigation, the U.S. Attorney's Office for the District of Maryland is conducting a further criminal investigation of Dr. Lavernia.

Regulatory Basis for Suspension

Pursuant to 2 C.F.R. § 180.700, suspension may be imposed when the suspending official determines that:

(a) There exists an indictment for, or other adequate evidence to suspect, an offense listed under § 180.800(a); or
(b) There exists adequate evidence to suspect any other cause for debarment listed under § 180.800(b) through (d); and
(c) Immediate action is necessary to protect the public interest.

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[1] Dr. Lavernia is a past recipient of funding from the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE). He previously applied for and held a Top Secret clearance as requested by DOE, and since 2012, his NASA and DOE awards have totaled at least $2.3 million.

[2] *See generally* PAPPG, Chapter II.C.2.f. (Biographical Sketch(es)) and Chapter II.C.2.h. (Current and Pending Support).

In this case, we have determined that bases for the suspension exist under 2 C.F.R. § 180.700(a), (b) and (c).

With respect to 2 C.F.R. § 180.700(a), there is adequate evidence to suspect that Dr. Lavernia committed an offense listed under 2 C.F.R. § 180.800(a) in view of Dr. Lavernia's suspected false statements to NSF, NASA, and DOE. More specifically, Dr. Lavernia's failures to disclose multiple affiliations, income, positions, and current and pending support are bases to suspect that he committed the offense of making false statements. Additionally, Dr. Lavernia failed to disclose this information while applying for and receiving grants from NSF and other Federal agencies, bearing directly on his present responsibility. Finally, the ongoing criminal investigation into the undisclosed affiliations, income, and current and pending support further supports there is adequate evidence to suspect an offense listed under § 180.800(a).

With respect to 2 C.F.R. § 180.700(b), there is adequate evidence to suspect a violation of the terms of a public agreement or transaction, as set out in 2 C.F.R. § 180.800(b), and a cause of so serious or compelling a nature that it affects Dr. Lavernia's present responsibility, as set out in 2 C.F.R. § 180.800(d). More specifically, there is adequate evidence that Dr. Lavernia failed to make required disclosures in documents submitted to NSF as required by the PAPPG. In addition, adequate evidence established a failure to disclose this information to NASA and DOE, including documents submitted to DOE for a Top Secret clearance. These suspected omissions are breaches of the terms of various public agreements and transactions, as well as various rules, regulations, and policies, such that they affect his present responsibility.

Under 2 C.F.R. § 180.700(c), immediate action against Dr. Lavernia is necessary to protect the public interest in view of both the seriousness and nature of the circumstances that gave rise to the present criminal investigation. Dr. Lavernia is an established professor who has submitted numerous proposals to NSF, served as a PI/co-PI on Federal awards exceeding $5.2 million, and served as an NSF panelist which gave him access to confidential information in over a hundred proposals to NSF. Given his background and experience, he has the ability to exploit confidential information acquired from NSF to secure Federal funding. In addition, sufficient evidence exists to suspect he has omitted relevant information on the proposals he has submitted in the past. Therefore, immediate action is necessary to safeguard Federal funds, preserve the integrity of NSF's merit review process, and protect the public interest.

Length of Suspension

Dr. Lavernia's suspension is for a temporary period not to exceed 12 months except, if legal or debarment proceedings are initiated at the time of or during the suspension, then the suspension may continue until the conclusion of those proceedings. Further, NSF may extend the suspension for an additional six months at the request of a prosecuting official. *See* 2 C.F.R. § 180.760. During the period of suspension, Dr. Lavernia also is prohibited from serving as an NSF reviewer, advisor, or consultant.

Procedures Governing Suspension

The provisions of 2 C.F.R. §§ 180.700 through 180.760 govern suspension procedures and decision-making. Under our regulations, Dr. Lavernia has 30 days after receipt of this notice to submit, in person, or in writing, or through a representative, information and argument in opposition to the suspensions. 2 C.F.R. §§ 180.720, 180.725. Comments submitted within the 30-day period will receive full consideration and may lead to a termination or modification of the suspensions. If NSF does not receive a response to this notice within the 30-day period, the suspensions will remain in effect.

[redacted]

[redacted]

Enclosures:
Nonprocurement Debarment and Suspension Regulations
FAR Regulations

WUT NEWS

Professor Enrique J. Lavernia, the strategic scientist in WUT, won 2017 Chinese Government Friendship Award

On September 29, 2017, the award ceremony of the Chinese government *Friendship Award* was held in the Great Hall of the People.As theStrategic Scientist in WUT, the expert of the *Recruitment Program of Global Experts*(known as *Thousand Talents Plan* , foreign experts section), dean of International Model College of Materials Science and Engineering, Professor Enrique J.Lavernia won the award and was invited to attend the ceremony.

Vice premier of the State Council, Ma Kai awarded 2017 Chinese Government *Friendship Award* for Professor Enrique J. Lavernia

At the ceremony, Ma Kai, member of the Political Bureau of the CPC Central Committee and vice premier of the State Council, presented the prize to Professor Enrique J. Lavernia. On September 30th,the foreign experts who won the prizes were invited to meet Premier Li Keqiang, Vice Premier Zhang Gaoli and Vice Premier Ma Kai for a conversation. During the stay in Beijing, Prof. Enrique J. Lavernia also participated in a panel discussion with foreign experts on the suggestions to Chinese government.

The Chinese government's *Friendship Award* is the highest award established to honor foreign experts who made outstanding contributions to China's modernization cause. This year, 50 foreign experts from 21 countries won this award.

Premier Li Keqiang took a group photo with the foreign expertsof the 2017 Chinese Government *Friendship Award*

Enrique J. Lavernia is a professor at the National Academy of Engineeringof United States and a member of the National Academy of Inventors of United States, the first executive vice president and dean of the University of California, Irvine(UCI), and the chief editor of *Materials Science and Engineering* A, an international key journal. Professor Enrique J. Lavernia was employed as the visiting professor in 2006 and a strategic scientist in 2013 in WUT. He was selected as a member of national *Thousand Talents Program* (foreign experts section) in 2014, and was employed as the dean of International Model College of Materials Science and Engineering in 2015, thus he has conducted long-term and fruitful cooperation with WUT. In 2016, he was awarded the *Chime Award* by Hubei Provincial Government.

122 Luoshi Road,Wuhan,Hubei, P.R.China Postcode:430070 Telephone:86-27-87858005 Copyright © Wuhan University of Technology
Contact: waishi@whut.edu.cn Created by webmaster@whut.edu.cn

Attachment 1

Please read the *Instructions* carefully before completing the form

"Foreign Experts Thousand Talents Program" Application

Applicant:	Enrique J. Lavernia
Applicant unit:	Wuhan University of Technology
Working platform:	State Key Laboratory of Advanced Technology for Materials Synthesis and Processing
Area of specialty:	Engineering and Materials Science
Professional field:	Advanced composite materials and the techniques for their manufacture
Contact person:	CHEN Fei
Contact telephone:	027-87217492 (Office) 13808629168 (Mobile)

Date of completion April 10, 2013

Produced by the State Administration of Foreign Experts Affairs

English	Enrique Jose Lavernia		Date of birth	July 30, 1960	[Photo portrait]
Place of birth	Havana, Cuba		Nationality	United States of America	
			Gender	Male	

Institutions and universities attended and specialties, degrees	Chinese	Ph.D. Materials Engineering, Massachusetts Institute of Technology
	English	Ph.D. Materials Engineering, Massachusetts Institute of Technology
Overseas work units and positions	Chinese	Dean, College of Engineering, University of California, Davis
	English	Dean, College of Engineering, University of California, Davis

Name of current or expected employer unit	State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology	Position	Professor
Address of current or expected employer unit	122 Luoshi Road, Wuhan University of Technology, Wuhan City	Postal code	430070

Education background

Degree	Time	Country	University	Major
Baccalaureate	September, 1978 - June, 1982	USA	Brown University	Solid mechanics
Master's	September, 1982 - February, 1984	USA	Massachusetts Institute of Technology	Metallurgy
Doctorate	April, 1984 - February, 1986	USA	Massachusetts Institute of Technology	Material Materials science and engineering

Employment background (please note part time positions)	Position	Time	Country	Employer unit
	Professor Irvine	July, 1995 – June, 2002	USA	University of California,
	Visiting Professor	March, 1997 – July, 1997	USA	University of California, Irvine
	Visiting Professor	March, 1997 – July, 1997	Germany	Max Planck Institute
	Dean of Dept. of Chemical Engineering and Materials Science	January, 1998 – September, 2002	USA	University of California, Irvine
	Professor	June, 2002 -	USA	University of California, Davis
	Dean of the School of Engineering	September, 2002 - December, 2008	USA	University of California, Davis
	First standing Deputy President	January, 2009 - January, 2011	USA	University of California, Davis
	Dean of the School of Engineering	January, 2011 -	USA	University of California, Davis

Field of Specialty and Representative Achievements

1. Personal field of specialty

Professor Lavernia is a fellow of the United States National Academy of Engineering. The dean of University of California, Davis, and has engaged in basic research of nanostructures and multi-scale materials synthesis and physical behavior. In nano materials, metal materials, and hot spray coating technology, [Professor Lavernia] has a deep understanding and international influence. Professor Lavernia has made outstanding contributions to the spray coating techniques for advanced materials and the synthesis of nano materials, achieving a series of world renowned research results. Through research and development of production techniques for multi-scale, multi-phase composite materials, was the first to synthesize (reinforced) nano crystals and (plasticized) coarse-grain multi-scale nano composite materials with enhanced mechanical strength and ductility performance (for example, tri-phase composite materials), broke through the traditional conceptions of nano material design and production technologies, breaking new ground in the application of such new nano materials in military materials and civilian materials. Professor Lavernia has brought spray deposit technologies into metal material production techniques, and wrote the first and the most authoritative book on spray deposit technology – *Spray Atomization and Deposition*, and successfully produced a new type of Al-Si alloy and related materials. He used virtual simulations and advanced sensor technology to uncover latent heat, flow, and solidification mechanisms in the spray deposition process, defined the formation and control mechanisms for major Si phases with unique forms, and dramatically increased the wear resistance and strength of Al-Si alloy, successfully achieving commercial rollout of this type of Al-Si alloy around the world. To date, he has published more than 700 high level research papers, published 18 books, and has been invited to more than 140 international academic forums. He is the editor in chief of *Materials Science and Engineering, A* magazine.

2. Major projects led (participated in)

Beginning and ending times	Nature and source of the project	Total budget	Number of participants	Specific position and duties of applicant
2011 – 2014	US Navy special research project	$1,475,079	8	Project director
2011 – 2014	US Navy special research project	$990,201	5	Project director
2011 – 2013	Boeing Corporation	$170,000	2	Project director
2010 – 2013	US Army special research project	$329,881	2	Project director
2012 - 2015	US National Natural Science Fund	$360,000	4	Project director
2009 – 2012	US Navy special research project	$594,715	4	Project director
2008 – 2013	National Defense Research Laboratory	$2,599,998	10	Project director
2008 – 2013	Sandia National Laboratories	$694,426	4	Project director
2008 – 2011	US Navy special research project	$863,979	5	Project director
2007 – 2008	US Navy special research project	$431,728	6	Project director
2006 – 2014	Los Alamos Laboratory	$5,270,994	15	Project director
2005 – 2009	US Navy special research project	$452,954	2	Project director
2004 – 2007	US Navy special research project	$846,169	3	Project director
2003 – 2007	US Navy special research project	$2,216,047	4	Project director
2002 – 2006	Sandia National Laboratories	$664,074	4	Project director
2000 – 2005	US Department of Energy	$1,860,000	7	Project director
1999 – 2003	US Navy special research project	$941,605	5	Project director
1998 – 2001	National Defense Research Laboratory	$360,000	2	Project director
1996 – 1997	US National Natural Science Fund	$330,000	2	Project director
1995 – 1999	US Navy special research project	$1,235,319	6	Project director
1994 – 1997	NASA	$515,764	3	Project director
1994 – 1997	US Air Force special research project	$835,260	3	Project director
1988 – 1993	US National Natural Science Fund	$350,000	2	Project director

3. Major achievements

(1) Representative publications (papers)

Date of publication	Work (Paper)	Publication media	Author of publication (thesis)
2013	Precipitation phenomena in an ultrafine-grained Al alloy	Acta Materialia	Tao Hu, Kaka Ma, Troy Topping, Julie Schoenung and Enrique Lavernia*
2011	Hybrid Al+Al3Ni Metallic Foams Synthesized In-Situ via Laser Engineered Net Shaping	Philosophical Magazine	B.L.Zheng, Y.Li, J.E.Smugeresky, Y.Z.Zhou, D.Baker, E.J.Lavernia*
2011	Boundaries and interfaces in ultrafine grain composites	Acta Materialia	Y.Li, Z.H.Zhang, R.G.Vogt, J.M.Schoenung, E.J.Lavernia*
2011	High Strength, Nano-Structured Mg–Al–Zn Alloy	Materials Science and Engineering A	Baolong Zheng, Osman Ertorer, Ying Li, Yizhang Zhou, Suveen N. Mathaudhu, Chi Y.A. Tsao, Enrique J. Lavernia*
2010	Structure Modulation Driven by Cyclic Deformation in Nanocrystalline NiFe	Physical Review Letters	S.Cheng, Y.H. Zhao, Y.M. Wang, Y. Li, X.L. Wang, P.K. Liaw, E.J. Lavernia
2010	Nanostructural Hierarchy Increases the Strength of Aluminum Alloys	Nature Communications	P.V.Liddicoat, X.Z.Liao, Y.H.Zhao, Y.T.Zhu, M.Y.Murashkin, E.J.Lavernia, R.Z.Valiev, S.P.Ringer
2010	The Rapid Solidification Processing of Materials: Science, Principles, Technology, Advances and Applications	Journal of Materials Science	E.J.Lavernia, T.S.Srivatsan
2010	Deformation Twinning in Boron Carbide Particles within Nanostructured Al 5083/B4C Metal Matrix Composites	Philosophical Magazine	Y. Li, Y.H. Zhao, W. Liu, Z.H. Zhang, R.G. Vogt, E.J. Lavernia, J.M. Schoenung
2009	Enhanced TensileStrength and High Ductility in a Cryomilled, Commercially Pure Titanium	Scripta Materialia	O. Ertorer, T. Topping, Y. Li, W. Moss, E.J. Lavernia
2009	High Plasticity and Substantial Deformation in Nanocrystalline NiFe Alloys under Dynamic Loading	Advanced Materials	Sheng Cheng, Yonghao Zhao, Yazhou Guo, Ying Li, Qiuming Wei, Xun-Li Wang, Yang Ren, Peter K. Liaw, Hahn Choo and Enrique J. Lavernia

2008	New deformation twinning mechanism generates zero macroscopic strain in nanocrystalline metals	Physical Review Letters	X.L.Wu, X.Z.Liao, S.G.Srinivasan, F.Zhou, E.J.Lavernia, R.Z.Valiev, Y.T.Zhu
2008	High tensile ductility and strength in bulk nanostructured nickel	Advanced Materials	Y.H.Zhao, T.Topping, J.F.Bingert, A.M.Dangelewicz, Y.Li, W.Liu, Y.T.Zhu, Y.Z.Zhou, E.J.Lavernia*
2006	Plastic Deformation and Fracture of Ultrafine-grained Al-Mg Alloys with a Bimodal Size Distribution	Acta Materialia	G.J. Fan, H. Choo, P.K. Liaw and E.J. Lavernia
2006	Synthesis and mechanical behavior of nanostructured materials via cryomilling	Progress in Materials Science	D.B.Witkin, E.J.Lavernia
2005	Creep Behaviour and Thermal Stability of Cryomilled Al Alloy	Philosophical Magazine Letters	B.Q. Han, Z. Zhang and E.J. Lavernia
2004	Deformation and Activation Volumes of Cryomilled Ultrafine-Grained Aluminum	Acta Materialia	R.W. Hayes, David Witkin, Fei Zhou and E.J. Lavernia
2003	Al-Mg Alloy Engineered with Bimodal Grain Size for High Strength and Increased Ductility	Scripta Materialia	David Witkin, Z. Lee, R. Rodriguez, S. Nutt and E. Lavernia*
2002	Thermo-fluid Mechanisms Controlling Droplet-based Materials Processes	International Materials Reviews	S.Q. Armster, J.-P. Delplanque, M. Rein and E.J. Lavernia
2001	Mechanical Behavior and Microstructure of a Thermally Stable Bulk Nanostructured Al Alloy	Metallurgical and Materials Transactions A	V.L. Tellkamp, A. Melmed and E.J. Lavernia
1996	Spray atomization and deposition	**Monograph**	E.J.Lavernia, Y.Wu

(2) Patents

Patent protection period	Patent title	Granting country	Patent owner
1991.4-2011.4	Bulk Rapidly SolidifiedMagnetic Materials	USA	R.C. Handley, N.J. Grant, E.J. Lavernia, T. Harada, T. Ando
997.12-2017.1	Method for Thermal Spraying of Nanocrystalline Coatings and Materials for the Same	USA	E.J. Lavernia
1996.7-2016.7	Spray Formed Multi-Functional Materials	USA	E.J. Lavernia
1995.2-2015.2	Aluminum-Lithium Alloy	USA	E. Chin, E.J. Lavernia
2003.7-2023.7	Functional Coatings for the Reduction of Oxygen Permeation and Stress and Method of Forming the Same	USA	G. Kim, J. Schoenung, V. Provenzano, L. Ajdelsztajn, E.J. Lavernia
009.11-2029.1	Corrosion Resistant Amorphous Metals and Methods of Forming Corrosion Resistant Amorphous Metals	USA	J.C. Farmer, F. Wong, J. Haslam, N. Yang, E.J. Lavernia, C. A. Blue, O. A. Graeve, R. Bayles, J. Perepezko, L. Kaufman, J. Schoenung, L. Ajdelsztajn

(3) Products

None

4. Other (including important awards, part-time positions held in international academic organizations, important reports given at international academic conferences, etc.)

(1) Important awards won:

- 2011 Society for Advancement of Chicanos/Native Americans in Science (SACNAS) "Outstanding Scientist Award"
- 2011 named by *Hispanic Engineer and Information Technology Materials Magazine* as "The Most Influential 200 Hispanic Americans in Technology"
- 2011 winner of the HENAAC Great Minds in STEM (GMiS) award
- 2005 Winner of the US Brown University "Outstanding Engineering Alumnus Medal"
- 1995 Granted membership in the Alexander Von Humboldt Foundation
- 1993 Winner of the ASM International Bradlee Stolton award
- 1990 Winner of the US Navy special project (ONR) "youth researcher award"

(2) Part time positions in international academic organizations:

- February 2013 Selected as a member of the US National Academy of Engineering (NAE)
- 1998 to present Editor in chief of Materials Sciences & Engineering A
- 2006 Engaged as "fellow" of the American Society of Mechanical Engineers (ASME)
- 2000 Engaged as "fellow" of the American Association for the Advancement of Science (AAAS)
- 1998 Engaged as "fellow" of ASM International

(3) Reports at international academic conferences: invited to make academic presentations at international conferences 140 times

Work plan (including work objectives, primary approaches, expected contributions and current foundation, team, etc.)

Work objectives: with light weight high strength (Al based, Ti based nano composite materials) materials combining structure and function (such as heat sink materials, thermal control materials, conductor materials) as research subjects, focus on developing multimodal, multiscale material design and composite technological research, explore nano crystal (fortified) multimodal, multiscale composite material microstructures and improvements of its dynamic performance and impact on performance characteristics. Break through traditional conceptions in designing composite materials, establish production platforms for multimodal, multiscale composite materials, and initiate engineering applications for "light weight high strength" and "unifying structure and function" composite materials in high and new technology fields.

Primary approaches: The parties will communicate from time to time on the progress of the project, jointly research and discuss the various challenges encountered in the project using the parties' technological and scientific research strengths, undertake various experiments on the principles of division of labor, cooperation, and synergy of strengths. The parties will hold regular academic and research work forums and conferences each year to ensure the ongoing success of the project.

Expected contributions: (1) develop new production techniques for multimodal, multiscale composite materials, form core technology with independent intellectual property rights, and structure the research and development platform for multimodal, multiscale composite materials. (2) Publish deliver more than 40 high level academic papers in internationally significant academic journals and at academic conferences, apply and obtain 3-5 invention patents, endeavor to win national or provincial level technological awards. (3) Strengthen cooperation with US University of California Davis, advise more than 10 graduate degree candidates, invite high level experts to visit China to lecture or carry out academic exchange for 15 person trips or more, select outstanding researchers for further training abroad or to participate in international conferences for 15 person trips or more.

Current foundation and team: Since the 1990s, Wuhan University of Technology has established excellent long-term relationships of international cooperation and academic exchange. Dean Lavernia is currently

serving as a visiting professor and strategic scientist at Wuhan University of Technology, and has made important contributions to Wuhan University of Technology in establishing international cooperation of academic exchange and cultivation of talent to great effect, and has cultivated many high level and innovative talented individuals engaged inhigh level technology. Currently, primarily relying on Wuhan University of Technology's Vice-President Professor ZHANG Lianmeng (who qualified for level 1 and level 2 of the national "Billion Talents Program"), important members of the research team with [Professor Lavernia] at the helm include: Professor SUN Taolei (Ministry of Education "Changjiang Scholar" professor by special appointment), Professor TU Rong (Hubei Province "Hundred Talents Program", "Chutian Scholar" professor by special appointment), Professor SHEN Qiang (Ministry of Education Century Outstanding Talent), Professor WANG Chuanbin (Ministry of Education New Century Outstanding Talent), Professor WANG Yucheng (returned to China after overseas study at UC Davis), Professor CHEN Fei (returned to China after overseas study at UC Davis), Professor QIN Guangyan, Associate Professor LUO Guoqiang, Associate Professor ZHANG Song, Associate Professor LI Meijuan, Associate Professor LI Junguo, have been engaged in long term work on the front line of scientific research, and have taken on many important projects at the national and provincial levels as well as international technology cooperative projects.

Have you signed any agreement of intent or non-competition with any other unit that is still valid? If so, please list.
Application status □ First application □ Not first time application (Please place √ mark in the selected □)
All my information above is truthful and valid. I earnestly undertake: If approved for inclusion in the "Thousand Talents Program," [I] will arrive at my post within six months, and work in China continuously for at least six months, and no less than nine months each year. Signature of applicant: Year Month Day

Employer unit opinion

1. Reason for recommendation:

Professor E. J. Lavernia is a member of the US National Academy of Engineering, currently serves as the dean of US University of California, Davis, and is a senior member of the American Association for the Advancement of Science and the American Society of Mechanical Engineers, and a fellow of US ASM International. In addition, Professor Lavernia is a researcher for the Ford Foundation, the Alexander Von Humboldt Foundation, the Iketani Foundation for Science and Technology, as well as Rockwell International. Professor Lavernia has made outstanding contributions in the spray painting technique of advanced materials and the synthesis of nano material alloys, achieving a series of world-renowned research achievements. Professor Lavernia was the first to synthesize nano crystals (strengthened) and coarse crystals (increased plasticity) through research and development of production techniques for multiscale, multimodal composite materials, breaking through the traditional conceptions of nano material design and production technology, pioneering the application of such new nano materials in military materials and civil materials. Professor Lavernia introduced spray paint deposition technology into metal production techniques, wrote the first and most authoritative book on spray deposition techniques – *Spray Atomization and Deposition*, and successfully produced a new type of Al-Si alloy and related materials. He used virtual simulations and advanced sensor technology to uncover latent heat, flow, and solidification mechanisms in the spray deposition process, defined the formation and control mechanisms for major Si phases with unique forms, and dramatically increased the wear resistance and strength of Al-Si alloy, successfully achieving commercial rollout of this type of Al-Si alloy around the world. To date, he has published more than 700 high level research papers, published 18 monographs, and has been invited to more than 140 international academic forums.

Since being appointed as a visiting professor of our university in 2006, Professor E. J. Lavernia has made outstanding contributions in promoting cooperation and exchange between UC Davis and our university. He has proactively invited the university's research personnel to travel to the US to undertake joint research and has given them ample guidance, taking on major national and international scientific and technological cooperative projects and jointly published numerous high-level research papers. In January 2013, Professor E. J. Lavernia was hired as a "Strategic Scientist" at the university.

By appointing Professor E. J. Lavernia, we will add an outstanding leader in our university in the fields of materials science and engineering. His academic capabilities, research experience, and influence in the academic world are sure to provide strategic, forward looking, and innovative research ideas to the development of materials science at our university, promoting an accelerated rise in these fields to reach international leading levels. In addition, Professor E. J. Lavernia's capabilities will be fully expressed in certain research of new materials with important applications and will form a high level innovative research team during the actual work, which can further increase the university's recognition and international influence.

2. Supportive conditions (including working and living conditions):

Where laboratories are concerned, 5 million RMB will be provided as seed money funding, to be used for establishing a new direction and building infrastructure, and with Wuhan University of Technology's materials synthesis new technology national key laboratory and materials research and testing center as the anchor, provide the relevant materials production, structural characteristics and performance testing and various other such testing capabilities, meet research needs. Provide corresponding office facilities and facilitate living conditions, assign dedicated research assistants and scientific research assistance, provide international travel expenses, living expenses, domestic travel expenses, and salary subsidies, etc., to ensure that [Professor Lavernia will] be able to work without undue stress.

The applicant's relevant information is truthful, and this unit undertakes to give the support stated above, and does hereby recommend the application to the "Thousand Talents Program."

Signature of primary person in charge: Official seal of unit

Month Day Year

List of attached materials for application to the “Thousand Talents Program”

1. Duplicate copies of documents evidencing academic background and degrees;
2. Duplicate copies of personal identification or passport;
3. Duplicate copy of employment contract or employment agreement of intent executed with the employer unit;
4. Materials evidencing employment abroad;
5. Major achievements (duplicate copies or materials evidencing representative publications, patent certificates, product certificates);
6. Materials evidencing major projects led (participated in);
7. Duplicate copies of awards certificates;
8. Other materials to be submitted.

I. Copies of academic credentials and degree certificates

1. Baccalaureate degree received in 1982 from Brown University, USA
2. Master's degree received in 1984 from Massachusetts Institute of Technology, USA
3. Doctoral degree received in 1986 from Massachusetts Institute of Technology, USA

UNIVERSITAS BRUNENSIS

PROVIDENTIAE

ENRIQUE JOSE LAVERNIA

CUM

BACCALAUREATO IN SCIENTIA

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

UPON THE RECOMMENDATION OF THE FACULTY
HEREBY CONFERS ON

Enrique Jose Lavernia

THE DEGREE OF

MASTER OF SCIENCE

IN

METALLURGY

IN RECOGNITION OF PROFICIENCY IN THE GENERAL AND THE SPECIAL STUDIES AND EXERCISES PRESCRIBED BY SAID INSTITUTE FOR SUCH DEGREE GIVEN THIS DAY UNDER THE SEAL OF THE INSTITUTE AT CAMBRIDGE IN THE COMMONWEALTH OF MASSACHUSETTS

FEBRUARY 15, 1996

Vincent A. Fulmer
PRESIDENT

CONFIDENTIAL

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

UPON THE RECOMMENDATION OF THE FACULTY

HEREBY CONFERS ON

Enrique Jose Lavernia

THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN RECOGNITION OF SCIENTIFIC ATTAINMENTS AND THE ABILITY TO CARRY ON ORIGINAL RESEARCH AS DEMONSTRATED BY A THESIS in the field of Materials Engineering entitled

Development of the Liquid Dynamic Compaction Technique and Its Application to Two High Strength Aluminum Alloys

GIVEN THIS DAY UNDER THE SEAL OF THE INSTITUTE AT CAMBRIDGE IN THE COMMONWEALTH OF MASSACHUSETTS

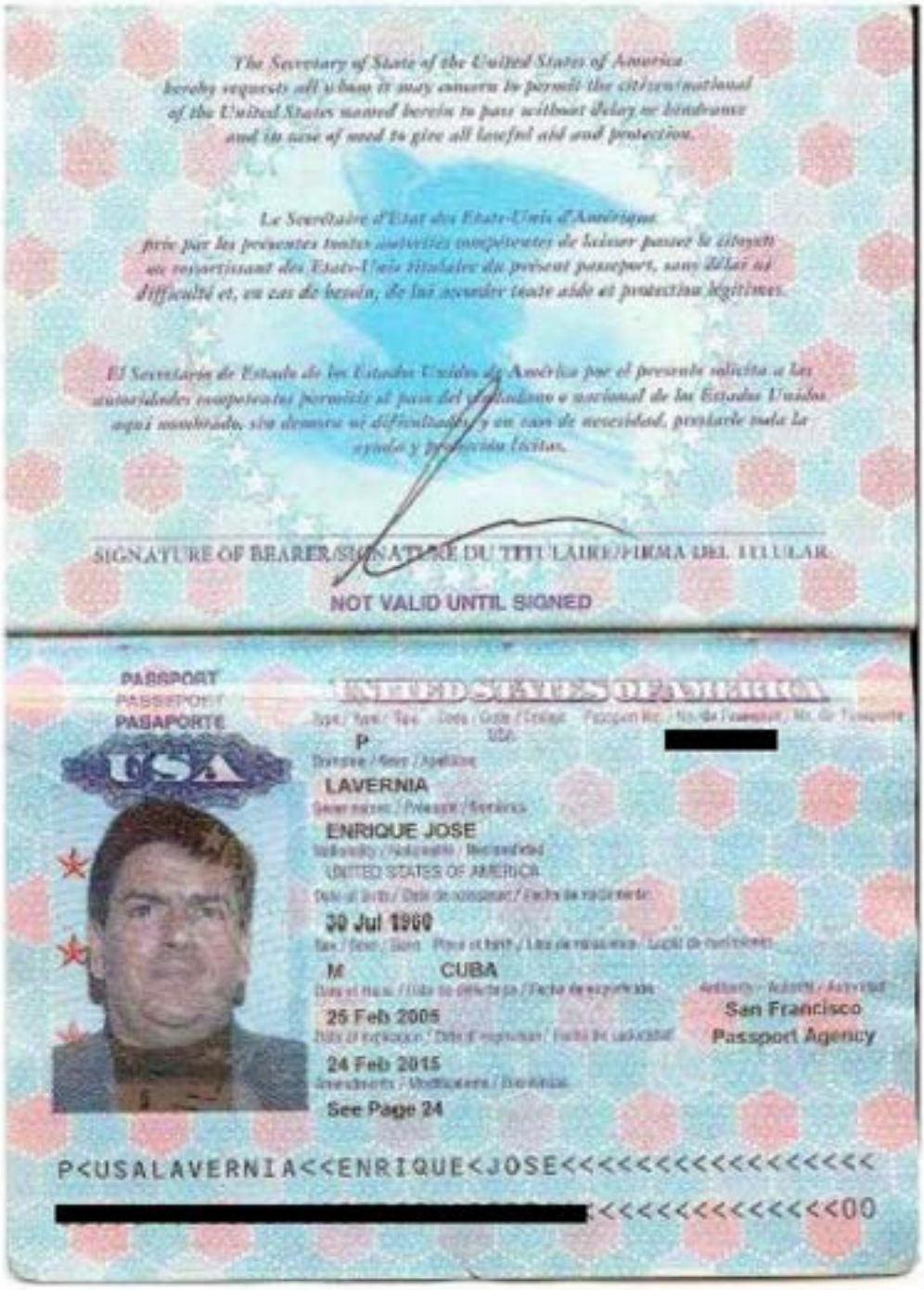
FEBRUARY 19, 1986

SECRETARY

PRESIDENT

Lavernia_00097

II. Copy of personal identification or passport


The Secretary of State of the United States of America
hereby requests all whom it may concern to permit the citizen/national
of the United States named herein to pass without delay or hindrance
and in case of need to give all lawful aid and protection.
Le Secrétaire d'Etat des Etats-Unis d'Amérique
prie par les présentes toutes autorités compétentes de laisser passer le citoyen
ou ressortissant des Etats-Unis titulaire du présent passeport, sans délai ni
difficulté et, en cas de besoin, de lui accorder toute aide et protection légitimes.
El Secretario de Estado de los Estados Unidos de América por el presente solicita a las
autoridades competentes permitir el paso del ciudadano o nacional de los Estados Unidos
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III. Copy of employment contract or employment agreement of intent executed with employer unit

Appendix to Memorandum of Understanding

between Wuhan University of Technology (WUT) and Prof. Enrique J. Lavernia, University of California, Davis (UCD)

I. Wuhan University of Technology (WUT) and its State Key Laboratory of Advanced Technology for Materials Synthesis and Processing (SKLWUT) conclude the following agreement to promote close cooperation between the two parties after discussions with Professor Enrique J. Lavernia.

II. Period of Collaborative Research

Period of Collaborative Research will last from January 2014 to December 2018.

III. Professor Enrique J. Lavernia should promise to be in position in half a year after the admission of "One-thousand-talent Plan" and should have been working in China for at least 5 years with no less than the equivalent of 9 months' working hours devoted to the interaction each year. Professor Enrique J. Lavernia's payment will be 1,000,000 Chinese Yuan a year if he works in China for 9 months for 3 years.

IV. This agreement shall be effective if Professor Enrique J. Lavernia has selected to be in the One-thousand-talent Plan by the State Administration of Foreign Expert Affairs.

Representative of WUT	Representative of UC Davis
Qing-Jie Zhang	Professor Enrique J. Lavernia
President of WUT	Professor of UC Davis
Director of SKLWUT	Dean of College of Engineering, UC Davis
Signature:	Signature:
Date:	Date: April 1, 2013

IV. Materials evidencing overseas employment

1. 2013 Selected as a member of the US National Academy of Engineering
2. 2011 to present Served as dean of the University of California Davis School of Engineering
3. 1998 to present Served as Editor in Chief of *Materials Science & Engineering A*
4. 2006 Engaged as "fellow" of the American Society of Mechanical Engineers (ASME)
5. 2000 Engaged as "fellow" of the American Association for the Advancement of Science (AAAS)
6. 1998 Engages as "fellow" of the ASM International Materials Information Society (ASM)

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February 6, 2013

Prof. Enrique J. Lavernia
Dean, College of Engineering and Distinguished Professor
of Chemical Engineering and Materials Science
University of California, Davis
Kemper Hall 1021A
One Shields Avenue
Davis, CA 95616

Dear Prof. Lavernia:

Congratulations. I am very pleased to inform you that in recognition of your distinguished contributions to engineering, you have been elected a Member of the National Academy of Engineering (NAE). The enclosed press release lists the names of the other individuals with whom you share this honor. This information will be made available to the public on Thursday, February 7 and can be found on our website (www.nae.edu).

The Induction Ceremony for the NAE "Class of 2013" will be held Sunday afternoon, October 6 during the NAE Annual Meeting in Washington, DC. The Induction Ceremony is the formal inauguration of new Members and Foreign Associates into the Academy. Your attendance is very important, and we look forward to seeing you at this event. Your family and friends are encouraged to attend the Induction Ceremony and may also attend the public sessions of the Annual Meeting (see preliminary program enclosed).

Prior to the official start of the Annual Meeting, there will be an orientation for the Class of 2013 on Saturday, October 5. That evening, the NAE Council will host a black-tie dinner for you and one guest. Detailed information about these events and the Annual Meeting will be mailed to you in June.

Currently, I need your immediate attention on the forms which are included with this letter. Please complete each item and return it to the NAE Membership Office. A checklist with descriptions, instructions and deadlines is also included for your convenience.

The enclosed *2012 NAE Directory of Members and Foreign Associates* includes the Academy's "Policies and Procedures for Nomination and Election (Appendix 1)" and "Articles of Organization and Bylaws of the National Academy of Engineering of the United States of America (Appendix 2)". If you have questions regarding your membership or election to the Academy, please contact Jenney Resch in the NAE Membership Office by phone at (202) 334-3877 or by e-mail at jresch@nae.edu or naemembershipoffice@nae.edu. If you prefer you may contact me at tfbudinger@lbl.gov or at (510) 847-2158.

I look forward to working together on NAE activities in the years to come; such activities range from organizational activities in which all members participate, to the technological and scientific initiatives of great importance to our nation.

On behalf of the NAE Officers and Councillors, welcome to the Academy, and I offer you my personal congratulations.

Sincerely,

Thomas F. Budinger

Thomas F. Budinger
Home Secretary

Enclosures

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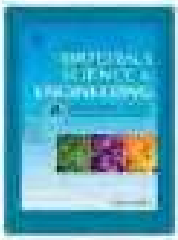

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Fellow

who is now entitled to all the privileges granted by the Constitution of the Society, an organization for promoting the art, science, and practice of mechanical engineering.

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LANE, ROBERT	1999	CA	USA	B	
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LANSTON, WRIGHT	1992	TX	USA	D	
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LARKINS, BRIAN	2001	NE	USA	X	
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LARSON, DANIEL	2001	PA	USA	B	TEMPLE UNIVERSITY
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LASTER, HOWARD E.	1998	VA	USA	M	
LAST, ROBERT J.	2005	MI	USA	C	MICHIGAN STATE UNIVERSITY
LASTER, RICHARD	1996	NY	USA	D	
LAURIE, LINDA L.	2001	WA	USA	C	
LAYMAN, DAVID K.	1992	MA	USA	C	
LAYMON, DANIEL P.	1991	MD	USA	B	
LAZO, VICTOR D.	1992	NY	USA	C	UNIV OF ROCHESTER MED CTR
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V. Copies or evidentiary materials of major achievements

- Representative publications
  - Patent certificates

Representative publications

[1] T. Hu, K. Ma, T. Topping, J.M. Schoenung, E.J. Lavernia. Precipitation phenomena in an ultrafine-grained Al alloy, **Acta Materialia**, 2013.

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Precipitation phenomena in an ultrafine-grained Al alloy

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Received 14 September 2012; received in revised form 22 December 2012; accepted 26 December 2012
Available online 1 February 2013

Abstract

To provide insight into the influence of length scales on precipitation phenomena, a bulk Al 7025 alloy with an ultrafine grain (UFG) structure was fabricated via cryomilling, hot isostatic pressing and extrusion, followed by solution treatment and artificial aging. The precipitation behavior in the UFG material was studied by transmission electron microscopy (TEM) and compared to its coarse grain (CG) counterpart. Results indicate that there are important differences in the size, chemistry and spatial distribution of precipitates between these two bulk materials. Differences in grain size were noted to influence the dislocation substructure, which in turn governed precipitation kinetics. Specifically, a high volume of grain boundaries (GBs) leads to a low concentration of vacancies in the UFG material, which hinders homogeneous nucleation of precipitates during aging. The nucleation of Guinier–Preston (GP) zones in UFG after extrusion is influenced by the presence of dislocations, which provide heterogeneous nucleation sites. The density of precipitates in the UFG was comparatively lower than that in the CG counterpart, because of the lower dislocation density in the grain interior. Solution treatment promoted recovery of dislocations in the UFG material. Then GP zones and nanoscale platelet η′ phase precipitates nucleated homogeneously during artificial aging. In comparison, the network of dislocations that remained in the CG material after solution treatment facilitated the formation of plate-like η′ phase precipitates around dislocations during artificial aging. Moreover, copious GP zones were observed in the CG interior after artificial aging with a comparatively higher density than those in the UFG.
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Keywords: Transmission electron microscopy (TEM); Precipitation; Ultrafine grains (UFG); Al–Zn–Mg alloy

1. Introduction

Bulk nanostructured (NS) metals and alloys, defined hereafter as bulk NS materials (e.g. not particles or thin films) having grain sizes in the range of 50–100 nm, have been widely studied during the past several decades [1–5]. These studies have been primarily motivated by two factors: scientific interest and technological potential. For example, reports of length-scale-dependent phenomena have led to the discovery of novel deformation mechanisms, such as twinning in face-centered cubic (fcc) Al [6,7]. The goal of attaining unprecedented property combinations has been fueled by the well-known Hall–Petch relationship, which predicts a continuous increase in strength with decreasing grain size [8]. Bulk NS materials usually can be synthesized by either a "two-step" approach, in which nanoparticles or powders with nanocrystalline grains are first synthesized and then consolidated to form bulk, ultrafine grain (UFG) materials [9,10], or a "one-step" approach, such as electrodeposition [11,12] and severe plastic deformation (SPD), e.g. equal channel angular pressing (ECAP) [4], high pressure torsion (HPT) [13], surface mechanical attrition treatment (SMAT) [14], cryorolling (rolling at liquid nitrogen temperature) [15] and sliding wear [16]. Using these methods, various NS or UFG materials have been successfully fabricated and systematically studied.

Inspection of the published literature reveals numerous studies involving pure metals or single-phase alloys, e.g. Cu, Ti, Fe, Ni, Al, Cu–Zn [17–22], aimed at uncovering the underlying mechanisms of grain refinement and related mechanical behavior. More recently, however, research has broadened to include alloys with dual/multiple phases,

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Taylor & Francis

Hybrid Al + Al_3Ni metallic foams synthesized *in situ* via laser engineered net shaping

Baoking Zheng[a]*, Ying Li[a], John E. Smugeresky[b], Yizhang Zhou[a], Dean Baker[c] and Enrique J. Lavernia[a]*

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(*Received 22 November 2010; final version received 2 May 2011*)

A hybrid, Al + Al_3Ni metallic foam was synthesized *in situ* via laser engineered net shaping (LENS®) of Ni coated 6061 Al powder in the absence of a foaming agent. During LENS® processing, the Ni coating reacted with the Al matrix, resulting in the simultaneous formation of a fine dispersion of Al_3Ni, and a high volume fraction of porosity. As a reinforcement phase, the intermetallic compound formed particles with a size range of 1–5 μm and a volume fraction of 63%, with accompanying 35–300 μm pores with a 60% volume fraction. The microstructure of the as-deposited Al + Al_3Ni composite foams was characterized using SEM, EDS, XRD and TEM/HRTEM techniques. The evolution of the microstructure was analyzed on the basis of the thermal field present during deposition, paying particular attention to the thermodynamics of the Al_3Ni intermetallic compound formation as well as discussing the mechanisms that may be responsible for the observed porosity. The mechanical behavior of the as-deposited material was characterized using compression and microhardness testing, indicating that the yield strength and hardness are 190 MPa and 320 HV, respectively, which represents an increase of over three times higher than that of annealed Al6061, or similar to heat treated Al6061 fully dense matrix, and much higher than those of traditional Al alloy foams, and with a low density of 1.64 g/m^3.

Keywords: metallic foam; composite; interface; laser deposition; properties

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1. Introduction

Cellular, metallic foams have engendered scientific and technical interest as a result of their unique physical and mechanical properties, such as high stiffness in conjunction with very low specific weight, and hence their ability to absorb energy [1–12]. The potential applications of cellular metallic foams include cushioning, insulating, damping, construction, biomedical implants, and filtering purposes [13]. In the particular case of Al-based foams, applications of relevance include

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Acta MATERIALIA

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Boundaries and interfaces in ultrafine grain composites

Y. Li, Z. Zhang, R. Vogt, J.M. Schoenung, E.J. Lavernia*

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Received 3 July 2011; received in revised form 3 August 2011; accepted 7 August 2011
Available online 23 September 2011

Abstract

The present study was motivated by two questions. First, what are the characteristics of grain and phase boundaries in a nanostructured material containing multiple phases? Second, what is the influence of these interfaces on mechanical behavior? Accordingly, a three constituent Al 5083/B_4C ultrafine grain (UFG) composite, consisting of a coarse grain (CG) phase (1–2 μm), an UFG phase (100–300 nm) and B_4C particles (~0.7 μm), was selected for study. Interest in this particular Al 5083/B_4C system stems from its hierarchical architecture, which comprises multiple scales, as well as from a reported yield strength of 1145 MPa. The associated grain boundaries (GB) and interfaces were investigated by transmission electron microscopy (TEM), high resolution TEM, energy dispersive X-ray spectroscopy and electron energy loss spectroscopy methods. The role of high/low angle GB, equilibrium and non-equilibrium GB within and between the CG and UFG regions, twin boundaries, twist transition boundaries and impurity segregation at GB in strengthening mechanisms is discussed.

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Keywords: High resolution electron microscopy; Transmission electron microscopy; Electron energy loss spectroscopy; Particulate reinforced composites; Metal matrix composites

1. Introduction

During the past few decades, it has become increasingly straightforward to introduce a nanometric (1–100 nm) length scale into metallic microstructures, with concomitant modifications to physical and mechanical behavior [1–4]. As an illustration of this strategy, nanostructured Cu with a bimodal structure exhibits both high strength and high ductility [1]; nanostructured BiSbTe bulk alloys show high thermoelectric performance [2] and the presence of nanoscale grains on the surface of Fe can decrease the nitriding temperature from 500 °C to 300 °C [3]. It is proposed that the introduction of nanostructured length scales into a microstructure is an approach which provides additional degrees of freedom to selectively "design" a structure with predetermined properties. Review of the literature shows that in fact there are documented studies describing strategies which combine multiple length scales successfully to attain high strength and high ductility, e.g., Refs. [1,6–8]. Study of the ensuing multi-dimensional structures is rendered complex, however, not only by the resolution limits (e.g., sometimes hundreds of nanometers) of current diagnostic techniques, but also by the emergence of novel phenomena, such as twinning [7,9,10], which complicate quantitative analysis of behavior.

To analyze the structure property relationships for a multi-dimensional structure systematically, it is perhaps useful to introduce the concept of hierarchical length scales, which will be defined hereafter as Level 0 (e.g., phase size, morphology and volume), Level 1 (e.g., grain size), Level 2 (e.g., twin and phase boundaries) and Level 3 (e.g., atomic segregation). One example of a hierarchical structure can be found in the Al 5083/B_4C ultrafine grain (UFG) composite (also described in the literature as a "trimodal" material) fabricated by cryomilling, degassing, cold isostatic pressing (CIP) and extrusion [11–13]. Previous studies have suggested that UFG Al 5083 and B_4C particles

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High strength, nano-structured Mg–Al–Zn alloy

Baolong Zheng[a], Osman Ertorer[a], Ying Li[a], Yizhang Zhou[a], Suveen N. Mathaudhu[b], Chi Y.A. Tsao[c,d], Enrique J. Lavernia[a,*]

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[b] Weapons and Materials Research Directorate, U.S. Army Research Laboratory, Aberdeen Proving Ground, MD 21005, USA
[c] Dept. Mater. Sci. Eng., National Cheng Kung University, Tainan, Taiwan, ROC
[d] Taiwan Materials and Microfabrication Science and Technology Center, National Cheng Kung University, Tainan, Taiwan, R.O.C.

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Sintering

ABSTRACT

The mechanical behavior and microstructure of nanocrystalline (nc) Mg AZ80 alloy, synthesized via a cryomilling and spark plasma sintering (SPS) approach are reported and discussed. The effects of cryomilling processing on chemistry, particle morphology, and microstructure of the Mg alloy powder are described and discussed. The experimental results show that cryomilling for 8 h yields nc Mg aggregates, approximately 30 μm in size, with an internal average grain size of approximately 40 nm. The mechanisms that are thought to be responsible for deformation twins that were observed in the cryomilled AZ80 powder are discussed. The cryomilled Mg powder was subsequently consolidated using SPS at 250, 300 and 350 °C. The consolidated material consisted of a bimodal microstructure with fine and coarse grains formed in the SPS'ed Mg AZ80 microstructure. Inside of the coarse grains, nano-sized $Mg_{17}Al_{12}$ precipitates were observed. A maximum microhardness of 149 HV, compressive yield strength of 442.3 MPa, and ultimate strength of 546 MPa are measured, which compare favorably to published values for conventional Mg alloys.

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1. Introduction

Mg alloys provide an opportunity to engineer light weight structures, and interest in these materials has increased as one consequence of the global energy crisis. Mg alloys have advantages when used as structural materials, such as an attractive combination of low density of 1.74 g/cm^3 (35% lighter than Al, about 78% lighter than Fe) and high specific strength, along with good damping capacity, castability, weldability, machinability and recyclability [1–3]. Thus, Mg alloys have been widely used as replacement for Al alloys, as well as steel in weight-critical, automotive and aerospace structural applications. Mg alloys have also been used as an alternative to polymeric materials in the electronic and computer industries [1,4]. Despite some encouraging results, it is acknowledged that widespread application of Mg alloys has been hindered, in part, by their relatively low strength.

Strengthening of Mg alloys via the introduction of solid solution atoms and grain refinement additives represent effective approaches actively being researched and implemented. To that effect, much progress has been achieved in the development of high strength Mg alloys through solid solution strengthening using various types of solute atoms [5–7]. Review of the literature shows that the highest tensile strength of cast Mg alloys reported thus far is 414 MPa, achieved in a Mg–18.2Gd–1.9Ag–0.34Zr (wt.%) alloy [8]. However, this Mg alloy system contains large amounts of rare-earth and noble metal elements for solid solution strengthening resulting in high costs for many practical applications.

Grain refinement via severe plastic deformation methods represents another recently proposed approach to achieve high strength in Mg alloys. It has been well established that nanocrystalline (nc) metals and alloys with grain sizes less than 100 nm generally exhibit significantly improved strength, an observation that has been partially attributed to the well known Hall–Petch mechanism [9,10]. Consequently, there are some studies describing the synthesis of nc Mg and its alloys using mechanical alloying at room temperature [11,12]. Other severe plastic deformation methods, such as equal channel angular pressing (ECAP) [13–15] and high pressure torsion (HPT) [16], have been reported to provide samples with no porosity and straightforward processing routes. However, these studies reveal that structural evolution of Mg during warm ECAP produces inhomogeneous grain/subgrain microstructures with sizes ranging around 1–20 μm and ultimate tensile strength (UTS) values of 329 MPa [15].

More recently, the cryogenic milling process has attracted considerable interest, primarily as a result of its ability to generate nc and non-equilibrium structures in relatively large quantities (i.e., up to 35 kg). Inspection of the scientific literature shows that this technique has been widely used to synthesize nc metals and alloys

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Structure Modulation Driven by Cyclic Deformation in Nanocrystalline NiFe

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Theoretical modeling suggests that the grain size remains unchanged during fatigue crack growth in nanocrystalline metals. Here we demonstrate that a modulated structure is generated in a nanocrystalline Ni-Fe alloy under cyclic deformation. Substantial grain coarsening and loss of growth twins are observed in the path of fatigue cracks, while the grains away from the cracks remain largely unaffected. Statistical analyses suggest that the grain coarsening is realized through the grain lattice rotation and coalescence and the loss of growth twins may be related to the detwinning process near crack tip.

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In contrast to coarse-grained material, the grain structure of nanograined metals sometimes becomes unstable under an applied stress, as suggested by the grain growth recently reported for nanocrystalline (NC) Cu deformed under indenter at liquid-nitrogen temperature and the room-temperature grain growth in NC Al [1–3]. Analytical modeling suggests that the mobility of grain boundaries (GBs) is related to dislocation activities in GBs [4]. In the case of cyclic deformation, the stability of the grain structure is of particular interest, as it is known that the adaptability of grains to the stress field in front of a fatigue crack tip governs the crack growth rate [5]. Molecular dynamics (MD) simulations suggest that a fatigue crack propagates intergranularly in NC Ni with nanovoids formed and twins nucleated in the grains in front of the crack tip, and that the grain structure remains intact in terms of size and geometry [6,7]. However, because MD simulations are computation intensive, the present simulation results only capture the early stage of the crack propagation (<100 cycles) [7]. In practical applications, fatigue samples usually undergo millions of cycles. How the nanograined structure evolves, particularly in the late stage of cyclic deformation when extensive damage occurs, is presently unknown. A careful investigation of structure evolution under high cycle fatigue conditions is therefore of both scientific and technological interest. In this Letter, we present experimental evidence in NC Ni-Fe alloys that paints a rather different picture, in that a modulated and coarsened grain structure is generated and growth twins are removed.

NC Ni-20% (w.t.) Fe alloy was synthesized by pulse electrodeposition at Integran (Canada). Transmission electron microscopy (TEM) analysis reveals slightly columnar grains with a high density of growth twins and sharp large-angle boundaries in the view perpendicular to the deposition growth direction. Selected area diffraction indicates the grain orientations are approximately random. Statistical analyses indicate that the grain size ranges from ~5 to 60 nm with an average value of ~19 nm, while most of the grains fall in the range between 10 and 20 nm. High resolution TEM (HRTEM) shows that these nanograins contain very few dislocations ($\sim 1.0 \times 10^{16}$ m^{-2} on average) in the as-received state, and that the growth twins show straight and parallel twin boundaries (TBs) with few random dislocations detected (see supplemental material [8]). Cyclic deformation was performed under a compressive-compressive mode ($R = \sigma_{min}/\sigma_{max} = 0.1$). Rectangular samples of $3 \times 3 \times 6$ mm^3 are used with the loading direction normal to the deposition growth direction [8]. Owing to the compressive stress (type II loading mode), a high fatigue life of $>10^6$ cycles can be achieved with $\sigma_{max} = 2.2$ GPa, compared to very poor fatigue deformation behavior exhibited in NC materials with a tensile stress component [9].

After the cyclic deformation, the initially random structure is replaced by a modulated structure near the sample surface, i.e., alternating NC and ultrafine-grained (UFG) regions. Figure 1(a) representatively shows an integrated TEM image, where the alternation from the NC to UFG and to NC region is illustrated and transition zones are established in between the NC and UFG regions. TEM observation over wide areas indicates that the widths of the UFG regions are 10–15 μm, and the average wavelength of the fluctuation is approximately ~15 μm [Fig. 1(e)]. Careful inspection revealed not only substantial grain coarsening in these UFG regions, but also significant reduction in the growth-twin density. Most of the grains in the UFG regions are sized from 100 to 200 nm (with some as large as 500 nm) and mostly free of the growth twins [Fig. 1(d)], while in the NC region they nearly maintained their grain size and twin density similar to that prior to deformation [Fig. 1(b)]. In the transition regions, the TBs are found distorted and the original nanograins reoriented, leading to close orientation [Fig. 1(c)]. Inspection of the surface area of the fatigued sample reveals a number of

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ARTICLE

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Nanostructural hierarchy increases the strength of aluminium alloys

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Increasing the strength of metallic alloys while maintaining formability is an interesting challenge for enabling new generations of lightweight structures and technologies. In this paper, we engineer aluminium alloys to contain a hierarchy of nanostructures and possess mechanical properties that expand known performance boundaries—an aerospace-grade 7075 alloy exhibits a yield strength and uniform elongation approaching 1 GPa and 5%, respectively. The nanostructural architecture was observed using novel high-resolution microscopy techniques and comprises a solid solution free of precipitates, featuring (i) a high density of dislocations, (ii) submanometre intragranular solute clusters, (iii) two geometries of nanometre-scale intergranular solute structures and (iv) grain sizes tens of nanometres in diameter. Our results demonstrate that this novel architecture offers a design pathway towards a new generation of super-strong materials with new regimes of property–performance space.

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REVIEW

The rapid solidification processing of materials: science, principles, technology, advances, and applications

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Abstract The purpose of this technical manuscript is to present an explanation of rapid solidification processing in an easily understandable manner so that the technique is widely accepted and put to commercial practice by many working in the industries of materials processing and manufacturing engineering. The comprehensive review article presents a comprehensive overview of the widely accepted and used rapid solidification processes. To better, understand rapid solidification in comparison with conventional solidification, the intrinsic aspects and types of nucleation and the kinetics governing nucleation and subsequent growth of the crystal during rapid solidification are presented and discussed. The commercially viable methods for the rapid solidification processing of metal-based and even intermetallic-based composites are presented. The technically viable methods for the consolidation of rapidly solidified powders are discussed. A succinct description of notable recent advances in the technique of spray processing is presented. In the last section of this article, we highlight the key findings of selected studies in the area of rapid solidification processing of advanced metallic, intermetallics, and composite materials that have helped to advance the processing technique for emerging applications that is synchronous with advances in technology.

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Introduction

Rapid solidification (RS) is "loosely" defined in the scientific literature as the rapid extraction of thermal energy to include both superheat and latent heat during the transition from a liquid state at high temperatures, to solid material at room or ambient temperature. The rapid extraction of heat can cause undercoolings as high as 100 °C or more prior to the initiation of solidification. This is in direct comparison to the few degrees obtained for the case of conventional casting about 1 °C or less per second. For a process to be considered in the RS regime, the cooling rate would have to be of the order greater than 10^4 K/s although cooling rates of 10^3 K/s sometimes generate rapidly solidified microstructures. The time of contact at high temperatures is limited to milli-seconds followed by rapid quenching to room temperature. The choice of the quenching medium, be it water, brine solution, or liquid nitrogen, has a profound influence on solidification rate and the resultant microstructural development to include the distribution of second-phases in the final product. The high-cooling rate results in a significant amount of undercooling of the melt, which is conducive for the occurrence of several metastable effects that can be categorized as being either constitutional or microstructural.

The rapid extraction of thermal energy that occurs during RS permits large deviations from equilibrium, which offers the salient advantages of:

(i) an extension of solid solubility, often by orders of magnitude;
(ii) enhanced compositional flexibility;
(iii) formation of non-equilibrium or metastable crystalline phases from the melt through alternate phase selection processes and/or an incorporation of

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Deformation twinning in boron carbide particles within nanostructured Al 5083/B_4C metal matrix composites

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The presence of deformation twins is documented in boron carbide reinforcement particles within a nanostructured Al 5083/B_4C metal matrix composite. High resolution transmission electron microscopy analysis suggests that these are (0001) twins. This work discusses the mechanisms responsible for their formation based on crystallographic analysis and mechanical loading conditions. Specifically, we propose that there are two potential models that can be used to describe twin formation in boron carbide particles. The structural models involve slip in the $1/3\langle\bar{1}100\rangle(01\bar{1}0)$ or $1/3\langle 01\bar{1}0\rangle$ $(01\bar{1}0)$ planes of C–C–C chains and the appropriate reconfiguration of B–C bonds. Analysis of the loading conditions experienced by the boron carbide particles indicates that local high stress intensity and the presence of a high shear force around the boron carbide particles are two factors that contribute to twin formation.

Keywords: microstructural characterization; nanostructured materials; TEM

1. Introduction

The compound boron carbide (B_4C) is of considerable interest as a monolithic material for a variety of applications including high-temperature semiconductors [1–3], and ballistic-resistant armor [4], primarily as a result of its remarkable combination of physical and thermal properties. For example, boron carbide is characterized by high temperature stability (melting temperature ~2600 K), high mechanical hardness (Vickers hardness, 3.7 GPa), and high electrical conductivity (140 S/m). Additional attributes make boron carbide a material of choice as the ceramic reinforcement in metal matrix composites [5]: it ranks third in hardness, just after diamond and cubic boron nitride, and possesses a low density of 2.51 g/cm^3 (which is even less than that of Al, 2.75 g/cm^3) [6]. The structure of boron carbide is also unusual with distinctive chemical bonding (the three carbon atoms are directly linked as C–C–C chains). This solid nominally has a rhombohedral (D^5_{3d}–$R\bar{3}m$) crystal structure [2]. The building blocks of this structure are 12-atom-deformed

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Enhanced tensile strength and high ductility in cryomilled commercially pure titanium

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The room temperature tensile behavior of cryomilled and quasi isostatically forged commercially pure (CP) Ti was investigated. Enhanced tensile strength (yield strength – 840 MPa, ultimate tensile strength – 902 MPa) in combination with high ductility (elongation to failure – 27.5%) was observed. This mechanical behavior is rationalized on the basis of processing history, microstructure (multimodal grain distribution, high angle grain boundaries, high dislocation density) and chemistry. Relevant mechanisms are discussed and the results compared to those reported in earlier studies.
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Keywords: Titanium; Cryomilling; Mechanical properties; Microstructure; Nanostructured materials

Nanocrystalline and ultrafine-grained metals are well known for their high strength, which makes them attractive for many engineering applications [1,2]. However, despite early encouraging results there is now a wide body of literature confirming that bulk nanocrystalline metals suffer from an inherently low ductility, regardless of the processing approach used [3,4]. The low ductility of nanocrystalline metals has been attributed to limited dislocation slip in general, which is the dominant deformation mechanism for polycrystalline metals [2,5,6]. More recent studies on nanocrystalline metals have proposed strategies aimed at obtaining a good tensile ductility in combination with high strength [7–14]. For example, the early work of Tellkamp et al. [10] and Han et al. [15] reported combinations of high strength and engineering ductility using an approach that involves introducing coarse grains into the nanocrystalline matrix for Al alloys. Related studies on nanostructured Cu also showed that the presence of coarse grains in a nanocrystalline matrix resulted in significant improvements in ductility [14,16]. Very recently, a similar approach yielded promising results for Ni by introducing bimodal and multimodal grain size distributions [17]. There are also several important publications reporting improved ductility in nanostructured materials processed via severe plastic deformation (SPD) routes [8,9,18].

In the case of commercially pure (CP)-Ti, published studies on nanocrystalline and ultrafine-grained CP-Ti with promising combinations of tensile strength and ductility are limited to equal channel angular pressing (ECAP) and high-pressure torsion (HPT) experiments [19–25]. For example, in one study Valiev et al. [23] reported up to 25% tensile elongation (with ultimate tensile strength, UTS = 730 MPa and yield strength, YS = 625 MPa) for ECAP + HPT (1.5 GPa) material with an average grain size of 200 nm. In that study, the reported ductility levels were attributed to the presence of high-angle and non-equilibrium grain boundaries in the microstructure, which were argued to facilitate plastic deformation via grain boundary sliding [26–28]. In another study by Stolyarov et al. [19] a YS of 970 MPa and an UTS of 1050 MPa were obtained with 8% tensile elongation via the processing route of ECAP + cold extrusion (75%).

The current study was motivated by three primary considerations. First, there are few published studies on cryomilling of Ti [29–31] and consequently fundamental information on the behavior of nanostructured Ti produced via powder metallurgy methods is lacking. Second, Ti is of interest as a result of its hexagonal close-packed (hcp) crystal structure and its well-established advantages such as high specific strength, thermal stability and corrosion resistance. Third, the present study sought to answer the question of whether it is possible to improve the mechanical properties of CP-Ti (Grade II) by cryomilling so that they become comparable to those of commercial Ti alloys, such as Ti–6Al–4V, combining the high strength and ductility required in many engineering applications. In this sense, earlier cryomilling studies on Al and Ni alloys [10,15,17,32] provided insight into the processing

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ADVANCED MATERIALS

High Plasticity and Substantial Deformation in Nanocrystalline NiFe Alloys Under Dynamic Loading

By *Sheng Cheng,* Yonghao Zhao,* Yazhou Guo, Ying Li, Qiuming Wei, Xun-Li Wang, Yang Ren, Peter K. Liaw, Hahn Choo,* and *Enrique J. Lavernia*

Bulk nanocrystalline (NC) materials (with an average grain size <100 nm) have been widely reported to exhibit high strength but disappointingly low plasticity. In this Communication, upon dynamically deforming an NC NiFe alloy, we report impressively large plastic deformation, from 8% quasi-static strain to a maximum prescribed dynamic strain of ~22% without failure. This large, dynamic plastic deformation is accompanied by a much elevated yield strength (33% increase compared with quasi-static strength). Detailed postmortem microstructure analysis reveals that the dynamic deformation resulted in significant grain coarsening and detwinning manifested by a great reduction of the twin density *vis à vis* slight grain coarsening without detwinning in quasi-static deformation. We envisage that such mechanisms are responsible for the unique texture as compared with the conventional deformation texture as uncovered by in-depth texture analysis based on X-ray diffraction (XRD) using synchrotron radiation. Our efforts highlight potential ingenious avenues to exploit the superior behavior of NC materials under extreme conditions by invoking the favorable deformation mechanisms, such as reported herein.

In recent years, bulk NC metals and alloys have attracted a great deal of attention as potential candidates for next-generation high-strength materials. Indeed, success has been achieved on the strength improvement with grain refinement to nanometer scale, extending from the well-known Hall–Petch relation to at least ~20 nm.[1–3] However, often it appears that the increased strength is at the expense of the capability of the materials to sustain plastic deformation. In fact, poor ductility associated with NC materials has become a seemingly insurmountable obstacle for their widespread technological applications.[4,5] Most of the recently developed strategies for improving tensile ductility have been limited to ultrafine grained materials (with an average grain size >100 nm) with a dislocation dominated plastic deformation mechanism,[6–11] which may not be applicable to bulk NC materials where grain boundary mediated plasticity prevails.[12–14] Although large plastic deformation has been observed in compression of micrometer-sized pillars of NC materials,[15,16] little has been said regarding the deformation mechanism. Therefore, it still remains an open question as to how considerable plastic deformation can be possible in bulk samples of NC materials. Moreover, the application of materials under dynamic loading in many occasions requires a combination of a high resistance to sample yielding and a good tolerance of plastic deformation. In this paper, we provide strong evidence for very large plastic deformation under dynamic loading of bulk NC samples and we also attempt to unravel the underlying deformation mechanism responsible for such behavior via careful and in-depth postmortem microstructural analysis.

NC NiFe alloy samples (Ni 20 wt% Fe) were prepared by pulse electrodeposition. Uniaxial dynamic compression at strain rates of around $10^3\,s^{-1}$ was performed using the Kolsky bar technique with loading direction in the deposition (or thickness) direction. For the purpose of comparison, quasi-static compression tests were carried out at a strain rate of $1\times10^{-3}\,s^{-1}$ in the same direction of loading. Microstructural evolutions upon dynamic and quasi-static loading were characterized using synchrotron XRD and transmission electron microscopy (TEM) as well as high-resolution TEM (HRTEM).

Figure 1 shows the true-stress–strain curves of the NC NiFe alloy under dynamic and quasi-static loading conditions. The dynamic yield stress approaches ~2 GPa as compared with ~1.5 GPa under quasi-static condition. This translates into ~33% increase in strength upon dynamic loading. More importantly, Figure 1 reveals a remarkably enhanced plasticity of this NC NiFe alloy upon dynamic loading: while the quasi-static specimens fail at ~8% strain, no failure is observed under dynamic loading. It is worth pointing out that dynamic loading was stopped at a prescribed strain. Close examination of the dynamic stress–strain curves also suggests that, although flow softening is present in all the curves, the softening is more or less steady, that is, it proceeds in a uniform manner, and no precipitous stress collapse is observed due to the development of adiabatic shear banding.[17,18] This is further asserted by postmortem examination of the specimens. In contrast, the quasi-static stress–strain curve exhibits an initial hardening

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CONFIDENTIAL

New Deformation Twinning Mechanism Generates Zero Macroscopic Strain in Nanocrystalline Metals

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Macroscopic strain was hitherto considered a necessary corollary of deformation twinning in coarse-grained metals. Recently, twinning has been found to be a preeminent deformation mechanism in nanocrystalline face-centered-cubic (fcc) metals with medium-to-high stacking fault energies. Here we report a surprising discovery that the vast majority of deformation twins in nanocrystalline Al, Ni, and Cu, contrary to popular belief, yield zero net macroscopic strain. We propose a new twinning mechanism, random activation of partials, to explain this unusual phenomenon. The random activation of partials mechanism appears to be the most plausible mechanism and may be unique to nanocrystalline fcc metals with implications for their deformation behavior and mechanical properties.

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When a metal is plastically deformed, its macroscopic strain is usually produced by deformation twinning and/or dislocation slip. Deformation twinning is a common and important phenomenon in materials including steels, shape-memory alloys, ferroelectric, and ferromagnetic materials, rocks, and geological minerals [1]. The twinning tendency of a face-centered-cubic (fcc) metal is largely determined by its stacking fault energy (SFE). For example, coarse-grained fcc metals with medium-to-high SFEs such as Cu, Al, and Ni usually prefer to deform by dislocation slip at room temperature and low strain rate, while low SFE fcc metals like Ag primarily deform by twinning [2].

Coarse-grained metals are believed to twin via conventional mechanisms including the pole [3], prismatic glide [4], faulted dipole [5], and others [6–8]. These deformation twins form by the glide of partials with the same Burgers vector on successive (111) planes. This collectively produces a net macroscopic strain at the grain level and changes the shape of the twinned grain as shown in Fig. 1(a).

Nanocrystalline (NC) fcc metals, in comparison, undergo deformation twinning via partials that are emitted from grain boundaries (GBs) and are believed to have the same Burgers vector [9–14]. We call this mechanism the monotonic activation of partials (MAP). Like conventional mechanisms in coarse-grained metals, the MAP twinning also generates a discernible shape change in the twinned grain. We indeed find evidence of MAP twins, albeit infrequently, in NC fcc metals [see Fig. 1(b)].

Twinning propensity dramatically increases in nanocrystalline grains of fcc metals with medium-to-high SFE [9–18]. Since both conventional and MAP twinning cause significant shape change and produce a net strain, it is widely assumed that enhanced twinning in nanocrystalline metals must also generate significant macroscopic strain compared to coarse-grained metals. However, in this Letter, we present experimental evidence that most of the deformation twins in nanocrystalline fcc metals produce zero macroscopic strain. We explain these unexpected findings by proposing a new twinning mechanism in nanocrystalline metals.

Results.—Three nanocrystalline fcc metals, Al, Ni, and Cu, were used in this study. Their nanostructures were produced by cryogenic milling [11], cryotension [16], and high-pressure torsion [10]. Figure 2 shows typical high-resolution electron microscopy (HREM) images of deformation twins in nanocrystalline Al, Ni, and Cu. As shown, GB segments are smooth even at locations where they intersect the twin boundaries. Thus, unlike the classi-

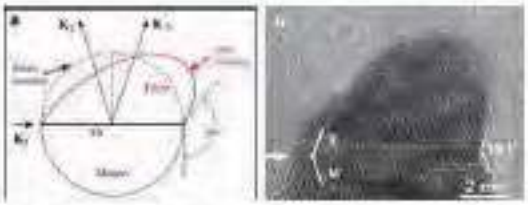

FIG. 1 (color online). (a) Conventional deformation twinning generates macroscopic strain and changes the grain shape. (b) High-resolution-electron micrograph of a MAP twin in nanocrystalline Cu synthesized by high-pressure torsion of 99.99 wt.% purity coarse-grained copper disk, 0.5 mm thick and 10 mm diameter. Arrows indicate the twin boundaries. Twins and matrix are labeled *T* and *M*, respectively.

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COMMUNICATION

ADVANCED MATERIALS

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High Tensile Ductility and Strength in Bulk Nanostructured Nickel**

By *Yonghao Zhao, Troy Topping, John F. Bingert, Jeremy J. Thornton, Andrea M. Dangelewicz, Ying Li, Wei Liu, Yuntian Zhu, Yizhang Zhou,* and *Enrique J. Lavernia**

Bulk nanostructured (NS) materials have relatively high strength but disappointingly low tensile ductility (elongation to failure) at ambient temperatures.[1–4] The limited ductility of NS materials has emerged as a particularly challenging issue in the study and application of this novel class of materials. Recently, a variety of strategies aimed at improving the poor ductility of NS materials have been reported, the results reveal varying degrees of success.[5–11] Despite some encouraging reports, the improvements in ductility remain quite limited, usually below 15% for most of the strategies, except possibly for bi modal Cu (with a ductility of 65%) and ultrafine grained (UFG) Fe Cr Ni Mn steel (ca. 30%).[12,13] In this Communication, we use cryomilling and subsequently quasi isostatic (QI) forging processes (formerly known as Ceracon forging), to prepare bulk dense multimodal and bimodal NS Ni with tensile ductility of 42% and 49%, and yield strengths of 437 and 312 MPa, respectively. This combination of strength and ductility is much superior to those of the NS Ni prepared by electro deposition (ED),[9,14] cryomilling,[15] equal channel angular pressing (ECAP) and high pressure torsion (HPT) methods[16] and cold drawing.[17] Microstructural analyses suggest that significantly reduced extrinsic processing artifacts, the presence of equilibrium high angle grain boundaries (including twin boundaries), and multi /bimodal grain size distributions are responsible for the measured high ductility. The high strength is argued to originate from several sources, including a high density of dislocations, UFGs, and from solid solution strengthening. Compared with other synthesis methods, the synthesis methodology described in the present work has no scale or material limitations, and therefore has important implications in terms of its potential for the large scale fabrication of bulk NS metals, alloys, and composites that can be used in applications requiring both high ductility and strength.

Bulk NS materials are usually synthesized by either a two step approach involving the synthesis and consolidation of nanoparticles (e.g., via inert gas condensation)[5,18] or nanocrystalline powders (e.g., via ball milling or cryomilling),[19] or a one step approach such as severe plastic deformation (SPD).[8,11] In the case of NS materials prepared by the two step approach, powder handling can yield extrinsic processing artifacts (such as porosity, incomplete bonding, impurities, and others). It is now well established that these artifacts, when present, will cause premature failure under tensile stresses, sometimes even before the onset of yielding.[19] In a recent study, the material was consolidated in situ via an approach involving cryomilling followed by room temperature milling.[20] In this case, the NS Cu prepared by this novel method was reported to have a uniform tensile elongation (strain before necking) of 14% and a high yield strength of 790 MPa. Despite these encouraging results, this approach has material and scale limitations: the NS spheres are limited to a size comparable to that of the milling media, and it is only applicable to metals with low melting point that can be welded into dense spheres at room temperature. Moreover, the structural features responsible for this excellent strength and ductility behavior are not fully understood, and this has hindered the search for procedures that may be used effectively to improve the ductility of NS materials.

The one step SPD approaches can be used to synthesize flaw free NS materials with higher ductility than those synthesized by the two step approach. However, even these NS materials often exhibit a very low or near zero uniform tensile elongation owing to their low strain hardening (dislocation storage capacity). Several different strategies have recently been developed to improve the poor ductility of NS materials; these include approaches such as the introduction of a bimodal grain size distribution,[7,10] or pre existing nanoscale twins,[8,12,21] using dispersions of nanoparticle s/ precipitates,[10,22] preparing a mixture of two or multiple phases,[7,12,23] transformation /twinning induced plasticity,[8,24] and changing the deformation conditions.[10,18] Despite varying degrees of success, most of the strategies have inherent processing and/or material limitations. The objective of the present study was two fold. First, to explore a generic synthesis

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Plastic deformation and fracture of ultrafine-grained Al Mg alloys with a bimodal grain size distribution

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Abstract

Four different ultrafine grained (ufg) Al 7.5wt.% Mg alloys were synthesized by consolidation of a mixture of as received and cryo milled Al Mg powders with a ratio of 1:9, yielding a bimodal microstructure consisting of coarse grains (grain sizes, d_{cg}, typically of several micrometers) evenly distributed in the ufg matrices (average grain sizes $d = 120$, 142, 197, and 338 nm). The deformation behavior under uniaxial compression and tension of the as extruded alloys was investigated. The Ramberg Osgood equation was used to fit the compressive stress–strain curves of the bimodal ufg alloys. The compressive yield stresses of the ufg matrices with different average grain sizes indicated a reduced slope in the Hall–Petch relation. The plastic deformation of the ufg Al–Mg alloys with a bimodal microstructure was highly localized. The fracture of the alloys was attributed to shear localization under the compressive tests, and to a combination of shear localization, cavitation, and necking under the tensile tests.
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Keywords: Mechanical alloying; Aluminum alloys; Mechanical properties; Ultrafine grained microstructure

1. Introduction

Bulk ultrafine-grained (ufg) metals and alloys with grain sizes, d, typically in the range 100 nm to 1 μm have been the subject of much interests recently, primarily due to their excellent mechanical properties for potential engineering applications [1]. Due to the ufg structure, bulk ufg metals and alloys exhibit extraordinarily high strengths as well as excellent superplasticity at high strain rates compared with coarse-grained materials [2–7]. However, bulk ufg metals and alloys often show a limited ductility at room temperature, which was attributed to the lack of efficient hardening during plastic deformation and/or to the defects introduced during the processing [4,8]. Recently, it was found that ufg metals and alloys with a bimodal microstructure exhibit a combination of high strength and good ductility [9–15]. In this toughening strategy, the ufg matrix in the bimodal microstructure provides the high strength, while the relatively large grains of the order of micrometers contribute to the ductility.

Bulk bimodal ufg metals and alloys can be synthesized by: (a) thermomechanical treatment involving severe plastic deformation, i.e., cold rolling or equal-channel angular pressing, followed by an appropriate thermal annealing under controlled conditions [10]; and (b) mechanical milling plus the consolidation of the milled powders mixed with certain volume fractions of the as-received coarse-grained powders [9,11]. The latter synthesis method has an apparent advantage in that a tailored bimodal microstructure can be conveniently achieved using a desired ratio of starting powders with a bimodal grain size distribution. The mechanical properties can be easily optimized via design of the appropriate bimodal microstructure.

In this paper, we investigate bimodal Al 7.5 wt.% Mg alloys with ufg matrices having various average grain sizes, which were synthesized using a mechanical milling machine followed by hot pressing and extrusion. The plastic

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Synthesis and mechanical behavior of nanostructured materials via cryomilling

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Abstract

Cryomilling, the mechanical attrition of powders within a cryogenic medium, is a method of strengthening materials through grain size refinement and the dispersion of fine, nanometer scale particles. The technique was developed as a means to decrease both the size of these particles and their spacing within a metallic matrix to increase threshold creep stress and intermediate temperature performance. More recent work has been concerned with increasing the strength of lightweight structural materials. In this overview paper, the available literature is reviewed that covers the microstructural evolution during cryomilling, consolidation and processing, the thermal stability of the microstructure, and mechanical properties of consolidated materials. The properties of cryomilled materials are compared to those results for powders and consolidated materials generated by mechanical alloying, milling at ambient temperatures and other means to produce fine grained materials.
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Creep behaviour and thermal stability of cryomilled Al alloy

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The creep behaviour of a cryomilled 5083 Al alloy has been investigated at two temperatures, namely 573 K and 623 K. The creep resistance of the cryomilled sample is found to exceed that of conventional 5083 Al alloy, an observation that is attributed to the presence of nanoscale precipitates and impurities. The creep behaviour is analogous to that of dispersion strengthened aluminium alloys processed via mechanical alloying and powder metallurgical techniques, as manifested by three creep regions, i.e. a low stress region with a stress exponent of 1.1, an intermediate stress region, characterized by a much higher stress exponent, and a high stress region with a stress exponent of 9. The present work reveals that the microstructure is extremely stable during elevated temperature exposure. After a long time exposure at temperatures of 573 and 623 K there is only slight grain growth, associated with the appearance of extremely fine precipitates approximately 20–50 nm. The existence of second phases (nanoscale aluminium oxide, nitride, carbide, or precipitates), in combination with grain boundary segregation of solute and/or impurity elements is considered to play a significant role in stabilizing the microstructure.

1. Introduction

Nanostructured (1–200 nm) or ultrafine-grained (UFG, 300–500 nm) aluminium alloys are of interest as a consequence of their unusual physical characteristics, such as high strength and relatively high ratio of strength to density. Inspection of recently published papers reveals that there are several approaches currently being implemented to process bulk nanostructured or ultrafine-grained (UFG) aluminium alloys. Among these, severe plastic deformation (equal-channel angular pressing or torsion straining) [1] and consolidation of mechanically alloyed (MA) aluminium alloy powders [2–4] reportedly provide the potential for the production of nanostructured alloys in near commercial quantities. In addition, cryomilled aluminium alloys possess a thermally stable microstructure owing to small amounts of impurities and nanoscale dispersions [5, 6].

Based on the chemical composition and microstructural characteristics of cryomilled aluminium alloys, it is recognized that the grain-size effect

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Deformation and activation volumes of cryomilled ultrafine-grained aluminum

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Abstract

The deformation behavior of cryomilled UFG C.P. Al and Al 5083 has been investigated. Deformation patterns on the surfaces of tensile samples indicate that deformation in uniaxial tension is localized in these materials. The activation volumes calculated from strain rate jump tests performed at room temperature and 422 K are relatively low in value and invariant with strain, suggesting that dislocation–dislocation interactions within the grain interiors do not take place. Strain rate sensitivities calculated from the strain rate jump tests are also low, indicating that grain boundary sliding does not contribute to the tensile deformation of this material. The activation volumes and strain rate sensitivities support the notion that in both alloys grain boundaries act as sources and sinks for dislocations that contribute to plastic deformation. This is consistent with numerous TEM images of deformed UFG materials which show either no or very limited dislocation activity within the grain interiors following deformation. These features are also consistent with the elastic–nearly perfectly plastic stress–strain behavior exhibited by UFG materials.
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Keywords: Aluminum alloys; Mechanical milling; Ultrafine grained microstructures

1. Introduction

Over the past two decades numerous research groups have studied the fundamental nature of plastic deformation mechanisms in nanocrystalline (NC) materials, for two primary reasons. The first has been an effort to provide insight into the overall physical behavior of NC materials. The second represents an attempt to ascertain whether there are deformation mechanisms that may be uniquely activated at NC length scales. Carsley et al. [1] found that the stress–strain behavior of Fe–10Cu (at.%) over a wide grain size range (45 nm to 1.7 μm) exhibited characteristics similar to those of bulk metallic glasses. Elastic–perfectly plastic (i.e., absence of work hardening after yield) stress–strain behavior was observed over this range of grain sizes. This stress–strain behavior was accompanied by the formation of intense shear bands as the only mechanism of plastic deformation. The shear band angle in compression measured 49° relative to the direction of the applied stress. In tension the shear band angles measured between 52° and 54° relative to the applied stress direction. These shear band angles corresponded with neither the plane of maximum shear nor the plane of zero extension. In addition to the elastic–perfectly plastic stress–strain behavior and intense shear banding, Carsley et al. [1] also observed a tension–compression asymmetry of the yield strength. The yield strength was 30% higher in compression than it was in tension, another characteristic which is common to bulk metallic glasses and glassy polymers. Despite these similarities with bulk metallic glasses, the Fe–10Cu possessed some deformation characteristics typical of traditional polycrystalline metal. For example, the temperature and strain rate dependence of the flow

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Al–Mg alloy engineered with bimodal grain size for high strength and increased ductility

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Abstract

Al–7.5Mg powders were cryomilled, then consolidated and extruded to produce bulk nanostructured material. The extrusions had a tensile yield strength of 641 MPa and an ultimate strength of 847 MPa. Additional samples were prepared by combining cryomilled powder unmilled Al–7.5Mg, resulting in extrusions with high strength and increased ductility.
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Keywords: Aluminum alloys; Nanocrystalline materials; Mechanical properties

1. Introduction

The development of nanostructured metals for structural applications must address issues related to the both fabrication of bulk samples and overall material performance. For the first task, several techniques have proved successful for fabricating nanocrystalline metals, including inert gas condensation, rapid solidification and mechanical attrition e.g., [1–4]. In many cases, however, the techniques have yielded small samples for research but are not conducive to production of bulk forms required for structural applications. Regarding material performance, nanocrystalline metals generally exhibit increased strength in comparison to their coarser-grained counterparts, but at the expense of ductility [5,6]. This observation has been attributed to limited dislocation activity, and thus absence of work hardening, leading to mechanical instability.

Ductility enhancements have been achieved in nanostructured metals through the incorporation of larger grains in a fine-grained matrix. Legros et al. [7] and Tellkamp et al. [8] observed this in tensile tests of copper and Al 5083 alloy, respectively. In both cases, considerable strengthening was achieved relative to conventional counterparts, with a yield strength of 535 MPa for Cu and 334 MPa for Al 5083. The tensile fracture strains were 2.1% and 8.4%, respectively, both of which are higher than typical nanocrystalline

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Thermo–fluid mechanisms controlling droplet based materials processes

S. Q. Armster, J.-P. Delplanque, M. Rein, and E. J. Lavernia

Recently, the successful application of thermal spray deposition techniques to the manufacture of bulk materials and thin film coatings with improved structural properties has illuminated the need for a fundamental understanding of the physical phenomena that control the deposition process. However, the spray parameters have a complex statistical interdependance that renders their analysis difficult. Discrete droplet deposition processes provide phenomenologically simpler systems than thermal spray deposition processes while still retaining their salient features. Furthermore, discrete droplet deposition processes have found important manufacturing applications from soldering to rapid prototyping. Consequently, this review focuses on recent research in the area of droplet based materials processes. The emphasis is on fluid dynamics and thermal aspects as they relate to materials science issues. The design and operation of a number of representative droplet deposition approaches is also discussed in detail, paying special attention to applications in near net shape manufacturing and digital microfabrication. Finally, outstanding questions are identified. IMR/381

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List of symbols*

A_i	parameter proportional to atomic attachment factor for particular impurity element i
b	thermal capacitance
b	liquid thickness
Bi	Biot number
c	speed of sound
Ca	capillary number
c_p	specific heat
D	droplet diameter
Ec	Eckert number
E_a	activation energy for atomic diffusion
E	energy
f	interface characteristic function
$\mathbf{F}_D$	drag force
$\mathbf{F}_b$	body force
Fo	Fourier number
Fr	Froude number
ΔG	change in free energy
ΔG_{crit}	critical free energy associated with critical nucleus
ΔG_{vol}	volumetric free energy
ΔG_{het}	free energy of heterogeneous nucleation
h	coefficient of heat transfer
h	specific enthalpy
ΔH_m	enthalpy of melting (heat of fusion)
I	nucleation rate
k	wavenumber
k_b	Boltzmann's constant
K	equilibrium solidification parameter
K_m	kinetic parameter
L	latent heat of fusion
Ma	Mach number
N	parameter proportional to atomic attachment factor
Nu	Nusselt number
Oh	Ohnesorge number
p	pressure
Pe	Peclet number
Pr	Prandtl number
q_b	heat flux across droplet/substrate interface
q_i	heat flux across solidification interface
R	radius
R	gas constant
Re	Reynolds number
r_c	radius of nucleus
r_{crit}	critical radius of nucleation site
S	position of solid/liquid interface
St	Stefan number
dS/dt	interface velocity
T_L	equilibrium liquidus temperature
T_m	melting temperature
$T_{n,e}$	homogeneous nucleation temperature
ΔT_c	homogeneous undercooling ($= T_L - T_{n,e}$)
T^*	temperature at solid/liquid interface
ΔT^*	undercooling at solid/liquid interface
ΔT_{het}	undercooling of heterogeneous nucleation
dT/dt	cooling rate
We	Weber number
y	solid/liquid interface position during spreading
α	thermal diffusivity
β	sine of impact angle
β	spread factor
ε	ratio of initial effective splat radius to droplet diameter before impact
θ_e	equilibrium contact angle
θ_s, θ_d	static and dynamic contact angle
Θ	dimensionless temperature
Θ	solid volume fraction
Θ_{sh}	superheat

* Variables not defined in the list of symbols are defined when first used in the main text.

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Mechanical Behavior and Microstructure of a Thermally Stable Bulk Nanostructured Al Alloy

V.L. TELLKAMP, A. MELMED, and E.J. LAVERNIA

A commercial aluminum alloy, 5083, was processed using a cryomilling synthesis approach to produce powders with a nanostructured grain size. The powders were subsequently degassed, hot isostatically pressed, and extruded. The grain size at each processing step was measured utilizing both X-ray diffraction and transmission electron microscopy (TEM). The mechanical properties of the *n*-5083 extruded material were determined utilizing ASTM E8-93, *Standard Test Methods for Tension Testing of Metallic Materials*. This processing technique was found to produce a thermally stable nanostructured aluminum alloy which maintained an average grain size of 30 to 35 nm through several processing steps up to 0.61 T_{mp}. The thermal stability was attributed to Zener pinning of the grain boundaries by AlN and Al_2O_3 particles and solute drag of numerous atomic species. The nanostructured 5083 was found to have a 30 pct increase in yield strength and ultimate strength over the strongest commercially available form of 5083, with no corresponding decrease in elongation. The enhanced ductility is attributed to the presence of a few large, single-crystal aluminum grains acting as crack-blunting objects.

I. INTRODUCTION

INTEREST in the field of nanostructured materials has grown tremendously in recent years. The potential for improved mechanical properties, by reducing the grain size to the nanostructured regime, of both metals and ceramics has been demonstrated by several researchers.[1–4] Evidence of the incredible amount of interest in nanostructured materials is found in an overview article by Rittner and Abraham.[5] Rittner and Abraham state that "More than 2775 nanomaterials-related research publications have appeared in print since 1991.... Since 1991, the U.S. government has spent more than $20 million funding work to develop and commercialize nanostructured materials through Small Business Innovation Research and Technology Transfer programs..... More than 300 U.S. patents have been awarded....."[5] Most of this research has generated samples which are thin films or extremely small samples, using either hardness data or compression data to project mechanical behavior. The ductility data have been especially susceptible to question, due to the inherent differences between tension and compression tests. The surface condition has also been shown to play an important role in data collection for extremely small samples.[1] Very few data have been presented on tensile samples due to the difficulty in manufacturing a large quantity of material with a nanostructured (<100 nm) grain size.

Significant data have been produced by a technique referred to as equal-channel angular extrusion (ECAE) or equal-channel angular pressing (ECAP). References 6 through 8 present a significant amount of research into the microstructure and mechanical behavior of ultrafine-grained (UFG) or submicrometer-grained (SMG) Al-Mg alloys produced by ECAE and ECAP. This technique, however, has produced materials with grain sizes in the range of 200 to 500 nm.[9] The microstructure of the UFG or SMG materials have been shown to be thermally unstable at relatively low temperatures.[6]

In related studies, several researchers have examined the thermal stability of nanostructured powders generated by mechanical alloying or mechanical milling.[10,11] The materials that were found to have the highest thermal stability were either pure Al or alloys that contained significant quantities of Al. In the present study, a commercial aluminum alloy, 5083, was selected to promote thermal stability of the nanostructured grains while simultaneously providing a well-characterized material to compare mechanical behavior. The objective of this study was to accurately characterize the mechanical behavior of a nanostructured material and correlate this behavior to the observed microstructures, in an attempt to provide insight into the fundamental mechanisms governing mechanical behavior. This was achieved through development of a processing technique that would produce large enough quantities of material so that standardized tensile tests could be employed to generate data.

II. EXPERIMENTAL

Spray-atomized 5083 Al (4.4Mg, 0.7Mn, 0.15Cr, and the balance Al) powder with a particle size less than 150 μm was mechanically milled in a liquid nitrogen slurry in a process known as cryomilling. Details of this processing method can be found in Reference 11. A schematic diagram is found in Figure 1. The resultant powders were degassed at 573 K under a vacuum of 10^{-6} torr, and the cans were welded shut under an argon atmosphere. Consolidation was completed with an ABB Autoclave MIH-3.1 hot isostatic press, operating at 523 K and 200 MPa. The hot-isostatic pressed (hipped) samples were then extruded at 523 K with an extrusion ratio of 9 to 1. Luvak Inc. (Boylston, MA) analyzed the composition of the cryomilled powder and found it to be 0.41 pct O, 0.16 pct N, 0.132 pct C, 5.05 pct Mg, 0.59 pct Mn, 0.20 pct Fe, 0.13 pct Cr, 0.16 pct Ni, with

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Spray Atomization and Deposition

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O'Handley et al.

[11] Patent Number: 5,225,004

[45] Date of Patent: Jul. 6, 1993

[54] BULK RAPIDLY SOLIFIDIED MAGNETIC MATERIALS

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[73] Assignee: Massachusetts Institute of Technology, Cambridge, Mass.

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 629,077, Dec. 17, 1990, which is a continuation of Ser. No. 922,790, Oct. 24, 1988, abandoned, which is a continuation of Ser. No. 788,881, Aug. 15, 1985, abandoned.

[51] Int. Cl.[5] H01F 1/02

[52] U.S. Cl. 148/101; 148/538; 148/540; 148/555; 164/463; 164/479

[58] Field of Search 148/101, 538, 540, 555; 164/463, 479

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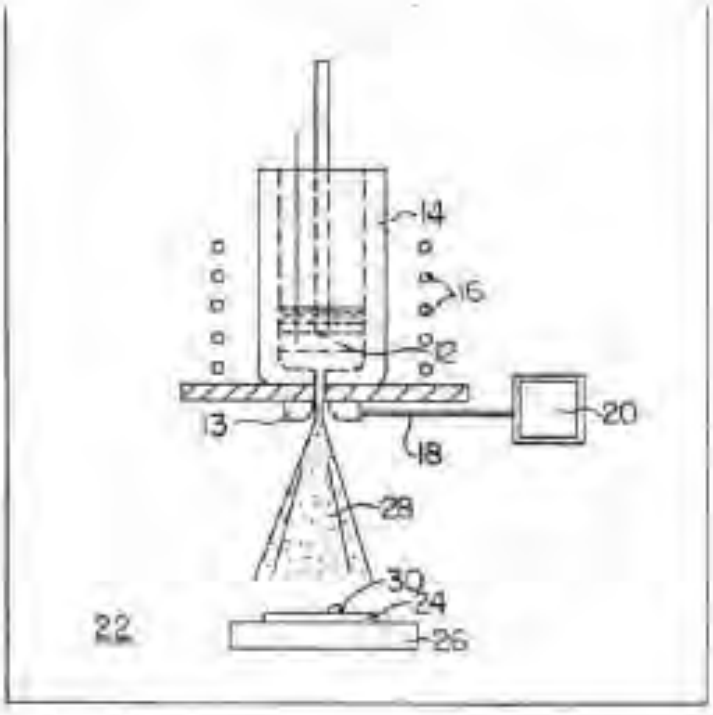
Primary Examiner—John P. Sheehan
Attorney, Agent, or Firm—Bruce F. Jacobs

[57] ABSTRACT

Bulk rapidly solidified magnetic materials having a density of greater than 90%, a thickness of at least 250 microns, and preferably a low oxygen content, are produced by a liquid dynamic compaction process which, depending upon the chosen operating conditions, can yield materials ranging from crystalline to partially crystalline to amorphous. The materials so produced are directly useful, i.e. without having to be reduced to a powder and consolidated into a shape, to produce permanent magnets. When the materials are amorphous they can be directly used as soft magnetic materials and for other purposes.

17 Claims, 8 Drawing Sheets



US005939146A

United States Patent [19]

Lavernia

[11] **Patent Number: 5,939,146**

[45] **Date of Patent: Aug. 17, 1999**

[54] **METHOD FOR THERMAL SPRAYING OF NANOCRYSTALLINE COATINGS AND MATERIALS FOR THE SAME**

[75] Inventor: **Enrique J. Lavernia**, Santa Ana, Calif.

[73] Assignee: **The Regents of the University of California**, Oakland, Calif.

[21] Appl. No.: **08/988,881**

[22] Filed: **Dec. 11, 1997**

Related U.S. Application Data

[30] Provisional application No. 60/031,217, Dec. 11, 1996.

[51] **Int. Cl.**[6] **C23C 4/04**

[52] **U.S. Cl.** **427/446**; 29/DIG. 39

[58] **Field of Search** 427/446; 264/9; 29/DIG. 39

[56] **References Cited**

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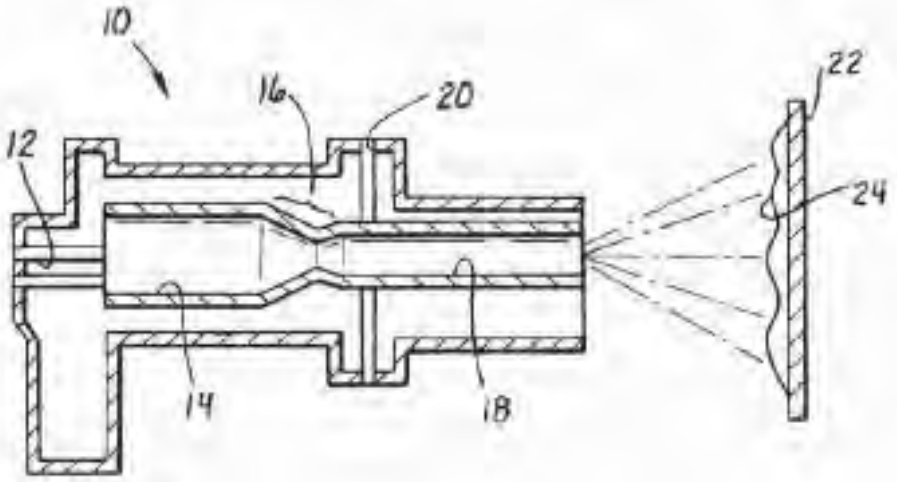
Primary Examiner—Katherine A. Bareford
Attorney, Agent or Firm—Daniel L. Hayes

[57] **ABSTRACT**

Nanocrystalline coating are prepared using a two step approach. First, the grain size of micrometer sized powders is reduced to nanometer dimensions using high energy ball milling. This is undertaken using an inter mills. Second, the nanocrystalline powders are dried and introduced into the high velocity oxygen fuel (HVOF) process and produce a coating with refined microstructure. The finished coating can be several mm in thickness. In addition a three dimensional device can be easy formed.

14 Claims, 1 Drawing Sheet



US005980604A

United States Patent [19]

Lavernia

[11] Patent Number: 5,980,604

[45] Date of Patent: *Nov. 9, 1999

[54] SPRAY FORMED MULTIFUNCTIONAL MATERIALS

[75] Inventor: Enrique J. Lavernia, Santa Ana, Calif.

[73] Assignee: The Regents of the University of California, Oakland, Calif.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: 08/652,709

[22] Filed: Jun. 13, 1996

[51] Int. Cl.[6] B22F 3/06

[52] U.S. Cl. 75/338; 75/230; 75/331; 75/335; 75/338; 148/415; 148/416; 148/417; 148/418

[58] Field of Search 75/337, 230, 331, 75/335, 338; 148/415, 416, 417, 418

[56] References Cited

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4,978,589	12/1990	Kim et al.	428/614

(List continued on next page.)

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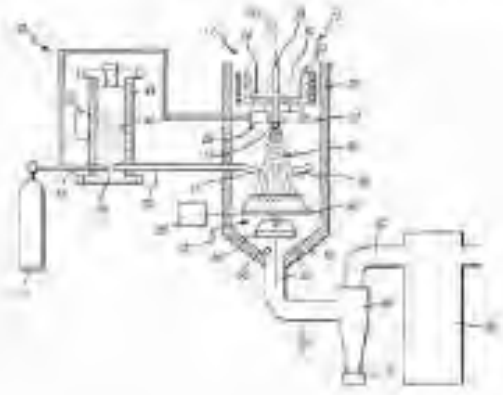
"The Structure and Properties of a Nickel–Base Superalloy Produced by Osprey Atomization–Deposition", by Rodger H. Kirkwell, Metallurgical Transactions A, vol. 17A, Apr. 1986, pp. 593–601

Primary Examiner—Patrick Ryan
Assistant Examiner—M. Alexandra Elve
Attorney, Agent, or Firm—Dinnin L. Dalton

[57] ABSTRACT

Spray atomization of molten metal under intermetallic matrix composites reinforced with ceramic particles is practiced by atomizing the matrix into micron-sized droplets and depositing the semi-solid droplets in a bulk deposition upon a temperature controlled substrate. The semi-liquid droplets are injected with reinforcing particles while in a range of 0 to 40% by volume solid phase and deposited on the substrate surface while in a 60 to 99% by volume solid phase. Refined grain morphology, increased solid solubility, controlled phase chemistry, absence of macrosegregation, and elimination of the need to handle fine reactive particles are all achieved by performing the spray deposition process under a controlled atmosphere. Materials fabricated by the process exhibit unusual combinations of properties, such as spatially varying properties.

27 Claims, 2 Drawing Sheets



US006702982B1

(12) **United States Patent**
Chin et al.

(10) **Patent No.: US 6,702,982 B1**
(45) **Date of Patent: Mar. 9, 2004**

(54) **ALUMINUM-LITHIUM ALLOY**

(75) Inventors: **Ernest S. C. Chin**, Bentington, MA (US); **Enrique Lavernia**, Irvine, CA (US)

(73) Assignees: **The United States of America as represented by the Secretary of the Army**, Washington, DC (US); **The Regents of the University of California**, Oakland, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/396,386**

(22) Filed: **Feb. 28, 1995**

(51) **Int. Cl.**[1] **C22C 21/00**
(52) **U.S. Cl.** **420/552**; 420/528; 148/437
(58) **Field of Search** 420/528, 552; 148/437

(56) **References Cited**

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4,916,030	A	* 4/1990	Christodoulou et al.	420/614
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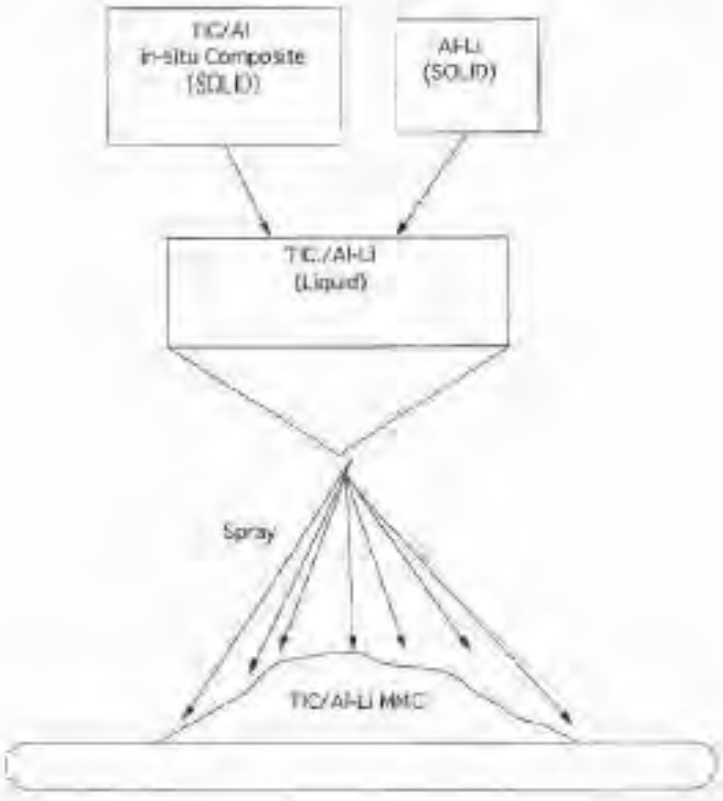
* cited by examiner

Primary Examiner—M. Alexandra Elve
(74) *Attorney, Agent, or Firm*—Milton B. Rosenberg; Dr. John B. Bond; William V. Adams

(57) **ABSTRACT**

A method for mixing an in-situ aluminum matrix composite with an aluminum-lithium alloy via the spray deposition process to obtain an Al—Li composite.

1 Claim, 2 Drawing Sheets



US 20040131865A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2004/0131865 A1

Kim et al. (43) Pub. Date: Jul. 8, 2004

(54) FUNCTIONAL COATINGS FOR THE REDUCTION OF OXYGEN PERMEATION AND STRESS AND METHOD OF FORMING THE SAME

(76) Inventors: George E. Kim, (a.k.a. Seung-Ki Kim) Palo Alto, CA (US); John M. Schoenung, Santa Ana, CA (US); Virgil Provenzano, Gaithersburg, MD (US); Enrique J. Lavernia, Davis, CA (US); Farzad (Bill) Ajdelsaljoki, Los Angeles, CA (US)

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Irvine CA 92612 (US)

(21) Appl. No.: 10/624,294

(22) Filed: Jul. 22, 2003

Related U.S. Application Data

(60) Provisional application No. 60/397,503, filed on Jul. 22, 2002. Provisional application No. 60/403,863, filed on Aug. 22, 2002.

Publication Classification

(51) Int. Cl.[7] B32B 15/04

(52) U.S. Cl. 428/633; 428/678; 428/680; 428/637; 428/629; 427/453; 427/454

(57) ABSTRACT

The oxidation behavior of the bond coat is improved using LAVOF nanolaminated NiCoAlY coating. NiCoAlY powder is mechanically cryomilled and HVOF sprayed onto Ni-based alloy to form a nanocrystalline bond coat. Oxidation is minimized on the coating as does the thermally grown oxide layer (formed by grown oxide). Alumina treatment at 1000° C. for 24 hrs in H_2 and H_2O + Ar + O_2 (H_2O + Ar + O_2) is formed on top of the bond coat. The microstructural characteristic of the coating and the presence of Al-rich oxides are responsible for the oxidation resistant during controlling (retard) effects the nucleation of the chemical form on the top of the coating. The formation of a continuous alumina scale layer protects the coating from further oxidation and avoids the formation of mixed oxide components such as those generated in the coating applied using the as-received powder.

US007618500B2

(12) **United States Patent**
Farmer et al.

(10) **Patent No.: US 7,618,500 B2**
(45) **Date of Patent: Nov. 17, 2009**

(54) **CORROSION RESISTANT AMORPHOUS METALS AND METHODS OF FORMING CORROSION RESISTANT AMORPHOUS METALS**

(75) Inventors: **Joseph C. Farmer**, Tracy, CA (US); **Frank M. G. Wang**, Livermore, CA (US); **Jeffery J. Haslam**, Livermore, CA (US); **Nancy Yang**, Lafayette, CA (US); **Enrique J. Lavernia**, Davis, CA (US); **Craig A. Blue**, Knoxville, TN (US); **Olivia A. Graeve**, Reno, NV (US); **Robert Bayles**, Annandale, VA (US); **John H. Perepezko**, Madison, WI (US); **Larry Kaufman**, Brookline, MA (US); **Julie Schoenung**, Davis, CA (US); **Leo Ajdelsztajn**, Walnut Creek, CA (US)

(73) Assignee: **Lawrence Livermore National Security, LLC**, Livermore, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 114 days.

(21) Appl. No.: **11/595,676**

(22) Filed: **Nov. 9, 2006**

(65) **Prior Publication Data**

US 2007/0113692 A1 May 24, 2007

Related U.S. Application Data

(60) Provisional application No. 60/736,782, filed on Nov. 14, 2005.

(51) **Int. Cl.**
B05D 1/02 (2006.01)

(52) **U.S. Cl.** **148/403**
(58) **Field of Classification Search** 148/403
See application file for complete search history.

(56) **References Cited**

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(Continued)

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Bhat, T. et al. "An investigation of thick Hf-based bulk metallic glass-forming alloys." Journal of Alloys and Compounds 389 (2005) 112-118.

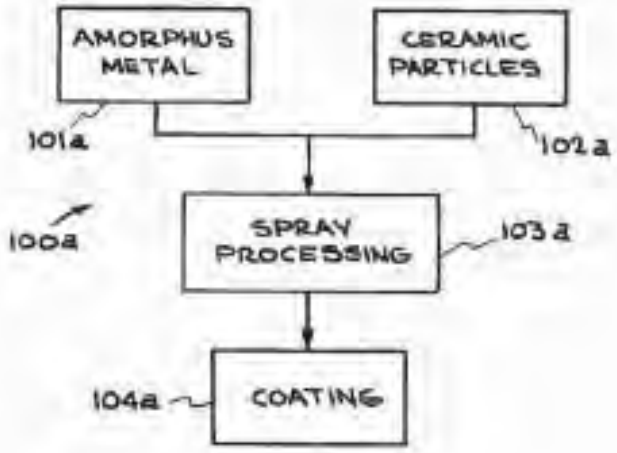
(Continued)

Primary Examiner—Roy King
Assistant Examiner—Yoshitoshi Takeuchi
(74) *Attorney, Agent, or Firm*—Eddie E. Scott; John H. Lee

(57) **ABSTRACT**

A system for coating a surface comprises providing a coating of amorphous metal, providing ceramic particles, and applying the amorphous metal and the ceramic particles to the surface by a spray. The coating comprises a composite material made of amorphous metal that contains one or more of the following elements in the specified range of concentration: yttrium (≥1 atomic %), chromium (14 to 19 atomic %), molybdenum (≥7 atomic %), tungsten (≥1 atomic %), niobium (≤5 atomic %), or carbon (≤4 atomic %).

22 Claims, 6 Drawing Sheets



VI. Materials evidencing projects led (participated in)

VII. Duplicate copies of award certificates

1. 2011 Society for Advancement of Chicanos/Native Americans in Science (SACNAS) "Outstanding Scientist Award"
2. 2011 Rated as one of the "200 Most influential Hispanic Americans in Technology" by *Hispanic Engineers and Information Technology Magazine*.
3. 2011 HENAAC "Great Minds in STEM award."
4. 2005 Winner of the Brown University "Engineering Alumni Medal."
5. 1997 Winner of the "Alexander Von Humboldt Award."
6. 1993 Winner of the ASM International Bradlee Stolton award
7. 1980 Winner of the US Presidential Young Engineer Award.

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CONFIDENTIAL

HENAAC names 23rd annual top STEM professional award winners

Los Angeles, CA ■ Grant Middle of STEM has announced the 23rd annual HENAAC Award winners in science, technology, engineering and math. The winners were honored at the HENAAC Conference & Science, FL early in October.

For twenty-three years HENAAC has recognized the accomplishments of America's best and brightest engineers and scientists in the Hispanic community. The honorees are chosen by the HENAAC award for committee made up of representatives from industry, government, military and academic institutions.

The selection committee met in Lake Buena Vista, FL on July 23. It was co-chaired by Dr. Nazeran A. Sanson, Sees, Florida 21st Century chair and distinguished professor of the college of engineering and computer science at the University of Central Florida (UCF) and Dr. Arno Wiemann, Jr., dean and professor of the college of engineering and computing at Florida International University (FIU). UCF and FIU were academic sponsors for the 2011 conference.

The winners were honored at the recognition, quantitative the significance: the HENAAC awards chair and the HENAAC awards scientists. A separate series of awards for military individual professionals was also presented at the conference.

Among the award winners were:

Engineer of the year: Rear Admiral Patrick H. Brady, commander, Space and Naval Warfare Systems (SPAWAR), U.S. navy.

Executive excellence: Antonio Gallardo, president and CEO, Dole AgroScientific; **J. Frank Armijo**, 4th energy solutions 15 and global solutions, vice president, mission support affairs, Lockheed Martin Corp.

Outstanding technical achievement & academia: Enrique J. Lavernia, PhD, Jean, college of engineering, university of California-Davis.

Outstanding technical achievement & industry: Julio A. Navarro, PhD, Boeing technical fellow, the Boeing Company; **Maria (Mary) F. Fernández, PhD**, executive director, distributed computing research, AT&T Labs.

Outstanding technical achievement & government: Luz Marina Calle, PhD, technical lead and principal investigator, corrosion technology lab, materials testing and corrosion control branch, Materials science division, engineering directorate, NASA-Kennedy Space Center.

Dr. Albert Boez Award: Gustave Ring, PhD, professor, electrical and computer engineering department, Florida International University.

Pioneer award: Jaime Brauerman, program manager, R&D, global nonwoven, Kimberly Clark Corp.

Lifetime Achievement: Fernando Guerra, PhD, IEEE Fellow, senior engineer/scientist, semiconductor R&D sensor, IBM Microelectronics and Engineering, IBM.

Chairman's award: Ivan R. Diaz, director of pre-to-development and integration, Walt Disney Parks & Resorts design and engineering, the Walt Disney Company.

Professional achievement & government: Joseph M. Acaba, NASA astronaut, NASA Johnson Space Center; Diana S. Centeno Gomez, research aerospace engineer, NASA Glenn Research Center.

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in der Bundesrepublik Deutschland.
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am Institut für Werkstoffwissenschaften,
Max-Planck-Institut für Metallforschung Stuttgart

Bonn-Bad Godesberg, im September 1997

Der Präsident

Professor Dr. Reimar Lüst

ASM INTERNATIONAL

The Materials Information Society

This certifies that

Enrique J. Lavernia

has received

The Bradley Stoughton Award for Young Teachers

in recognition of excellence in the teaching of materials science, materials engineering, design and processing.

Signed by the authority of the Board of Trustees this 19th day of October 1993

The President of the United States of America

presents

The Presidential Young Investigator Award

to

Enrique J. Lavernia

VIII. Other materials to be submitted

1. A discussion of the Chinese team cooperating with Professor Lavernia
- Proof of high level talent
- Award certificates (national and provincial level 1 awards)
- Representative publications

2. Basis for cooperation with Professor Lavernia in China
- Contract for appointment by Wuhan University of Technology as “strategic scientist”
- Papers published jointly by the team that worked with Professor Lavernia

Proof by high level talent

1. Ministry of Education “Chang Jiang Scholar” Professor by Special Appointment: SUN Taolei
2. Hubei Province “Hundred Talents Program” Expert by special appointment: TU Rong

Chang Jiang Scholars Award Program
Chang Jiang Scholars Program

Professor by Special Appointment
Chang Jiang Scholar

SUN Taolei

Ministry of Education of the People's Republic of China
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Ministry of Education of the People's Republic of China

CONFIDENTIAL Lavernia_00152

Recruitment Program
Global Experts of Hubei

Hubei Province Expert by Special Appointment Certificate

“Huanghe Tower””

[Illegible] TU Rong [Illegible]

[Illegible]

“Rise to the clouds and breathe its energies”

[Illegible]

[Illegible], 2013

Award certificates (national and provincial level 1 awards)

1. 2011 Winner of the level 2 national technological invention award (ZHANG Lianmeng)
2. 2003 Winner of the level 1 Hubei Province science and technology award (ZHANG Lianmeng)
3. 2008 Winner of the level 1 Hubei Province science and technology award (ZHANG Lianmeng)
4. 2012 Winner of the level 1 Hubei Province science and technology award (ZHANG Lianmeng)
5. 2011 Winner of the level 1 Hubei Province science and technology award (SUN Taolei)

National Technological Invention Award certificate

This certificate is hereby issued to honor the winner of the National Technological Invention Award.

Project name: A new technique for controllable production of the co-deposition of continuous scale materials and its application in the field of dynamic high pressure.
Award level: Second level
Award winner: ZHANG Lianmeng, Wuhan University of Technology

[Circular seal: “People’s Republic of China [illegible]”]
December 23, 2011

Certificate number: 2011-F-214-2-01-R01

Science and Technology Award Certificate

Project name: A method for the design and structuring of non-homogenous materials and the structure control theory

Award type: Natural sciences award

Award level: Level 1

Award winner: ZHANG Lianmeng

Certificate number: 2003Z-033-1-008-003-R01

[Circular seal: "The People's Government of Hubei Province"]
December, 2003

CONFIDENTIAL Lavernia_00156

Science and Technology Award Certificate

Project name: A technique for the controlled arrangement of particles, the formation of continuous scale structures, and its densification technology

Award type: Technological invention award

Award level: Level 1

Award winner: ZHANG Lianmeng

Certificate number: 2008F-017-1-005-003-R01

[Circular seal: "The People's Government of Hubei Province"]
December, 2008

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Science and Technology Award Certificate

Project name: The design and preparation of composite materials with piezoelectric damping mechanism and its typical engineering applications

Award type: Science and technology advancement award

Award level: Level 1

Award winner: ZHANG Lianmeng

Certificate number: 2012J-245-1-036-008-R01

[Circular seal: "The People's Government of Hubei Province"]
December, 2012

CONFIDENTIAL Lavernia_00158

Science and Technology Award Certificate

Project name: Synthesis and application of bionic bio-interface materials

Award type: Natural sciences award

Award level: Level 1

Award winner: SUN Taolei

Certificate number: 2011Z-025-1-007-002-R01

[Circular seal: "People's Government of Hubei Province"]
December, 2011

Representative Publications

[1] ZHANG Lianmeng, CHENG Xiaomin, CHEN Wen, **Materials Science**. Higher Education Press.

[2] ZHANG Lianmeng, HUANG Xuehui, SONG Xiaolan, **Fundamentals of Materials Science**. Wuhan University of Technology Press

[3] **L. M. Zhang**, R. Z. Yuan, M. Oomori, T. Hirai. Residual and working stresses of a TiC/Ni_3Al FGM and its structure optimization, **Journal of Materials Science Letters**, 1995.

[4] **L. M. Zhang**, T. Hirai, A. Kumakawa, R. Z. Yuan. Cyclic thermal shock resistance of TiC/Ni_3Al FGMs, **Composites Part B**, 1997.

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National level curriculum material for general higher education during the “Tenth Five Year Plan”

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Residual and working stresses of a TiC/Ni_3Al FGM and its structure optimization

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Metal/ceramic type functionally gradient materials [1] (FGMs) are new-generation composite materials for future use in aerospace, nuclear engineering, etc. The key problem for their practical use is how to ensure no damage is caused by the thermal stresses in the preparation and working processes. In analysing the residual and working stresses of ceramic/metal FGMs, Kawasaki [2], Kato [3], and Yuan *et al.* [4] have done some interesting work. However, work which optimizes the composition and structure by comprehensively surveying the residual and working stresses has not been done until now. In fact, these studies are very important to the thermal stress relaxation design of FGM.

In this paper, a TiC/Ni_3Al FGM is studied. As a ceramic phase, TiC has a high electronic expansion coefficient and high-temperature strength; as a metal phase, the intermetallic Ni_3Al has a fine creep-resistance at elevated temperature, and an excellent interface bondability with TiC [5, 6]. The thermo-mechanical properties of TiC/Ni_3Al composites with different TiC–Ni_3Al ratios are first tested. The tested properties are then used as a basis of axisymmetric finite element calculation for the two different types of stresses. For a disc-like TiC/Ni_3Al FGM, by surveying the stresses, the stress sites, and the stress state at the pure ceramic side, the second optimization for the FGM compositional distribution and structure is obtained.

TiC/Ni_3Al composites with Ni_3Al volume fraction of 0, 20%, 40%, 60%, 80% and 100% were sintered by the HP method for 2 h at 1300 °C and 300 MPa under Ar gas protection. These sintering conditions are the same as the conditions for sintering TiC/Ni_3Al FGM. The sintered composites were cut and ground into 36 × 4 × 3 mm strip samples; the properties were then tested with a four-point bending test method in a materials test system. In the test, the test span of the samples was 30 mm and the underpart span 20 mm. Strain gauges were fixed at the centre of the samples. Young's modulus E was calculated through the tested load–deflection curve; the Poisson ratio μ was determined by the ratio of the tested cross-strain to the longitudinal strain, and the fracture strength of the samples was indicated as the four-point bending strength σ. The average values of E and μ were obtained from 30 samples and the average σ from seven samples. In addition, the thermal expansion coefficient was tested by a non-loaded thermal dilatometer and the thermal diffusion coefficient ζ and specific heat C_p were tested by a laser perturbation method (SHINKO RIKO TC-700). The samples were 10 mm long and 2 mm wide; they were tested at 25 °C, 300 °C, 600 °C, 800 °C and 1200 °C, respectively. The thermal conductivity λ was calculated from $\lambda = \zeta \times C_p \times d$, where d is the sample density. The tested properties are indicated in Table I.

Fig. 1 is a finite element model for the thermal stress calculation of a disc-like TiC/Ni_3Al FGM. The material is 30 mm in diameter, 6 mm in thickness, and has 11 gradient layers. The top side is the metal phase, the bottom is the ceramic phase, and between the two sides are the FGM interlayers. Due to the

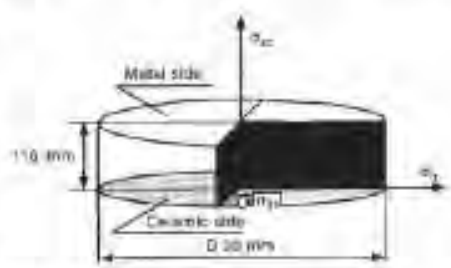

Figure 1. Finite element model for calculation.

TABLE I. Thermomechanical properties at the FGM interlayers

Ni_3Al volume fraction (%)	0	20	30	40	60	80	100
Volume density (g/cm³)	4.60	5.25	5.27	5.80	6.30	6.81	7.24
Thermal expansion coefficient (10^{-6})	7.40	7.35	5.00	6.15	9.40	11.70	11.90
Specific heat (J/g·K)	0.222	1.198	1.233	1.571	1.641	1.472	1.289
Thermal diffusion coefficient ($cm^2/s \times 10^{-3}$)	9.650	3.454	4.120	4.944	3.670	2.840	4.728
Thermal conductivity (W/m·K)	15.47	21.67	25.23	45.50	37.40	25.37	41.34

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Cyclic thermal shock resistance of TiC/Ni_3Al FGMs

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Cyclic thermal shock tests on three TiC/Ni_3Al FGM specimens were carried out under simulated large temperature-difference conditions. The effective thermal conductivity was measured and the variation of microstructure was observed. The effects of the sample geometry and the TiC side surface finish on the cyclic thermal shock behavior were investigated, together with thermal stresses under steady-heating conditions. The relation between the variation of effective thermal conductivity and crack propagation was also investigated. The damage which occurred in these FGMs was mainly caused by excessive in-plane compressive stresses on the surface of the TiC side during the cyclic thermal shock tests. © 1997 Elsevier Science Limited. All rights reserved

(Keywords: cyclic thermal shock; TiC/Ni_3Al; functionally graded materials)

1 INTRODUCTION

Thermal stress relaxation in ceramic/metal type FGMs (functionally graded materials) is believed to hold promise for applications in the thermal protection systems of space planes and in the innermost wall of thermonuclear experimental reactors[1], where the materials must endure high temperatures and cyclic heat loads under temperature-gradient conditions. Therefore, thermal shock characteristics of FGMs should be evaluated according to different research aims. Recently, evaluations of heat-resistant properties of oxide/metal and carbide/carbon FGMs have been carried out with a laser shock test system, a xenon arc-lamp/liquid nitrogen test system, and a gas burner test systems, all of which simulate the practical circumstances found in the space plane[2–4].

TiC/Ni_3Al FGM specimens for potential use as the innermost wall materials of thermonuclear experimental reactors have been successfully fabricated by the authors[5]. The innermost wall is in direct contact with the plasma, so the materials must be of low atomic number and have high temperature resistance and excellent cyclic thermal shock resistance[6,7]. In this paper, the cyclic thermal shock characteristics of TiC/Ni_3Al FGMs were tested under large temperature-difference conditions with a xenon arc-lamp/liquid nitrogen test system. The relationships among the variations in effective thermal conductivity, damage, and morphology of the FGMs were also investigated.

2 EXPERIMENTAL

2.1 Design and fabrication of TiC/Ni_3Al FGMs

Three disk-shaped specimens, W1-80, S1 and S2, were designed and prepared according to the rule of minimum stress ratio in the residual stress of TiC/Ni_3Al FGMs.

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Microstructures of W-Mo functionally graded material

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Since the concept of functionally graded materials (FGM) was proposed, a great deal of research work on such a kind of advanced material has been done worldwide for different applications. It is also possible for the FGMs to be applied to dynamic high-pressure technology. Shock wave techniques offer unique capabilities for the experimental characterization of material properties at very high pressures and strain rates [1]. But the usefulness of the shock wave experiments can be expanded by using a kind of materials with a density gradient [2], from which extremely-high pressure can be offered at a much cooler temperature, and one can deduce some of the properties of different materials at the pressure and temperature. Recently, the application of graded-density layered materials in high-pressure technology has been reported [3]. However, they were only fabricated by bonding a series of thin plates such as Ta, Cu, Ti, Al, Mg and TPX-plastic, thus the density of the layered materials rises with great steps in the thickness direction. It is possible to produce a better effect if using a graded material with a continuous or quasi-continuous density change. R. Tu *et al.* [4] reported the fabrication of the kind of graded materials, Al-Cu system FGM, but such a FGM with a middle density should be improved. Moreover, it is necessary to investigate the graded material in a higher-density range, because for the ideal FGM with the density gradient to be fabricated, its density of one surface should be kept very low, while that of another surface should be kept as high as possible [2].

In fact, the thermophysical properties of W match well with those of Mo, and the brittleness of pure W and Mo themselves can be eliminated by using suitable elements as sintering additives. Moreover, according to the diagrams of W-Mo binary alloys, there is no trend to form brittle compounds between the two metals. The densities of pure W and Mo are high; that is, 19.3 g/cm^3 and 10.22 g/cm^3 respectively. Taking all of the previous factors into account, we chose the W-Mo system to investigate the FGM in the high-density range. This W-Mo FGM is one part of FGM with a wide density range we will fabricate in the future.

Only when high relative density of every transient layer of such a FGM is ensured can good performance be obtained in factual application. The liquid-phase sintering method is usually applied to acquire tungsten heavy alloys with full density, but the corresponding sintering temperatures reach 1683–1793 K [5–7]. The research [8] on densification of tungsten refractories at lower temperatures is still insufficient. On the other hand, Mo bodies with nearly full density can be obtained at sintering temperature of 1573 K by using suitable additions [9]. In this paper, the authors initially chose the hot-pressing method and studied the densification of tungsten alloys at the low sintering temperature of 1573 K with Ni-Cu sintering aids. It was found through the supplementary experiments that the W-Mo alloys and Mo alloy also can be densified under the same sintering conditions. On this basis, we fabricated the dense W-Mo system FGM, focusing on discussing the formation of microstructures in the W alloy and W-Mo alloys as well as the W-Mo FGM.

The fresh powders of W, Mo, Ni, and Cu with average particle size of 1.7, 2.4, 20 and 16 μm respectively were used. The powders were mechanically mixed in the designed ratio, and blended for enough time to make them homogeneous. Then, the mixture was put into a cylindrical graphite mold, and hot-pressed in a furnace with a flowing argon atmosphere. An initial pressure of 5 MPa was exerted on the powder mixture at room temperature. The temperature was increased to 1573 K at a rate of 15 K/min. Concurrently the pressure was also increased to 30 MPa. For all samples, the sintering temperature of 1573 K and the pressure of 30 MPa were held constant for 1 h. The total size of the sintered compact is 26 mm in diameter and about 3 mm in height. The density was measured by the water-immersion technique. The microstructures of W95Ni3Cu2 (wt. pct) alloy and Mo76W19Ni3Cu2 (wt. pct) alloy were observed and the corresponding element area distribution of elements Ni, Cu and elements W, Mo was determined respectively by scanning electron microscopy (SEM) with an X-ray length wave dispersion spectrometry (XRWDS). In preparing the W-Mo

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Theoretical Design of Sedimentation Applied to the Fabrication of Functionally Graded Materials

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A new method was proposed to design raw material powders on both the size distribution and the masses during the fabrication of functionally graded materials (FGMs) by co-sedimentation. This method was confirmed by producing Mo-Ti compositionally graded material and the experimental results show that it is fairly valid in the design of the particle size distribution of raw material. Analysis of the electron probe reveals that a smooth transition in composition through the thickness of the sintered body has been achieved and the tested values are fairly consistent with the design ones.

I. INTRODUCTION

SINCE the concept of functionally graded material (FGM) was proposed, growing efforts have been exerted on such material, especially on its fabrication methods, which are of importance for application.[1] In recent years, a variety of methods have been developed to produce FGM, in which the popular and normally used way is the stepwise powder-layered method.[2] Two steps are included in this method to form FGM, that is, die filling by stacking powder mixtures layer by layer according to the initially designed ratios and consolidation by sintering the powder packing body. However, such a way unavoidably leads to an abrupt change in composition between the packed layers in final products. In many cases, such compositional interfaces are undesirable. Recently, much interest has been raised in developing new processing techniques, which can be used to produce continuously graded composition. Centrifugal casting,[3,4] continuous casting,[5] infiltration,[6,7,8] co-sedimentation, *etc.* are newly developed methods. Of these methods, co-sedimentation is special due to its simple operation, low consumption, and the characteristics suitable for most FGM systems.

Jingling *et al.*[9] and Huang *et al.*[10] successively proposed production of continuous composition-graded materials by the co-sedimentation method. However, their research only confirmed the feasibility of this method in forming smoothly varying composition FGM. Later, Kapelski and Varloteaux reported their recent progress regarding co-sedimentation.[11] They studied the effects of settling parameters on the graded structures of the sediment body. So far, this technology has remained in an experimental stage, mainly due to a lack of theoretical research.

Recent study demonstrated that we could predict the compositional distribution of sediment body based on a mathematical model of particle settling.[12] However, a problem still exists regarding how to choose the particle size distributions of raw material powders meeting the requirements of application. The conventional trial-and-error method is not only costly but also time-consuming. In the present article, a method was proposed to calculate the particle size distributions of raw material powders. And, finally, this method has been verified by the sedimentation experiment.

II. DESCRIPTION OF THE PROPOSED METHOD

A. *Target Function*

Consider a disk-shaped FGM sample consisting of two components A and B. The top side of the sample is pure component B, the other side is pure component A, and between the two sides is a smooth transition gradient in composition. In the design process of thermal stress relaxation for cylindrical or oblate FGM,[13] a compositional distribution function is widely used. In the present study, this function is also employed as the target function to which the compositional distribution of sediment body is conformed. This function can be expressed as

$$C_A(x) = \left(\frac{x}{l}\right)^P \qquad [1a]$$

or

$$C_B(x) = 1 - \left(\frac{x}{l}\right)^P \qquad [1b]$$

where $C_A(x)$ and $C_B(x)$ are the volume fractions of components A and B, respectively; x is the thickness coordinate in the cylindrical coordinate system in which the Y-axis coincides with the disk's symmetric axis and the origin of the coordinate lies on the bottom of the sample; l is the thickness; and P is the compositional distribution exponent. It is obvious that P values control the shape of the compositional distribution curve. Much research revealed that the residual thermal stress can be reduced to a lower degree by choosing a proper P value.[14,15,16]

Taking a microelement with a height dx at the position x_i along the thickness of the sample, we can calculate the mass of component A or B in the microelement by the following formula:

$$M_A(x_i) = \rho_A C_A(x_i) S dx \qquad [2a]$$

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Substrate temperature dependent morphology and resistivity of pulsed laser deposited iridium oxide thin films

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Abstract

Iridium oxide (IrO_2) thin films were deposited on Si (100) substrates by means of pulsed laser deposition technique at various substrate (deposition) temperatures ranging from 250 to 500 °C. Effects of substrate temperature on the crystalline nature, morphology and electrical properties of the deposited films were analyzed by using X-ray diffraction, Raman spectroscopy, Scanning electron microscopy and four point probe method. It was found that the above properties were strongly dependent on the substrate temperature. The as-deposited films at all substrate temperatures were polycrystalline tetragonal IrO_2 and the preferential growth orientation changed with the substrate temperature. IrO_2 films exhibited fairly homogeneous thickness and good adhesion with the substrate, the average feature size increases with the substrate temperature. The room temperature resistivity of IrO_2 films decreased with the increase of substrate temperature and the minimum resistivity of (42±6) μΩ cm was obtained at 500 °C. The resistivity of IrO_2 films correlated well with the corresponding film morphology changes.
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1. Introduction

Iridium oxide (IrO_2) is one of the versatile oxide materials among the transition metal oxides that exhibit metallic resistivity at room-temperature. It crystallizes in the tetragonal rutile structure and has been used for many applications due to its attractive electrical, optical, and electrochemical properties [1–3]. These applications include such uses as excellent diffusion barrier and suitable electrode material in ferroelectric's devices, optical switching layers in electrochromic displays, sensing material in PH sensors and durable electrodes for chlorine and oxygen evolution [4,5].

IrO_2 thin films have been deposited using plethora of physical and chemical techniques including reactive sputtering [6], electrochemical processes [7], sol-gel processing [8] and pulsed laser deposition (PLD) [9,10]. Among them, the main focus has been given on the fabrication process and electrochromic properties. The PLD technique is an energetic deposition process that has been shown to produce high-quality, dense, and most often nanostructured films [11]. But compared with other preparation techniques, similar data for IrO_2 films fabricated by PLD is very scarce.

It is well known that the properties of the IrO_2 films are susceptible to the structure, which will be influenced by PLD parameters (such as characters of the laser, oxygen pressure, deposition temperature, etc.). The deposition temperature is one of the most important parameters, which influences the structure and properties of films and can be controlled to obtain desired properties for application.

In the present investigation, IrO_2 thin films were deposited on Si (100) substrate at different substrate temperatures ranging from 250 to 500 °C by means of *PLD* technique. The effects of substrate temperature on the structural, morphological, and electrical properties of IrO_2 films were mainly studied.

2. Experimental details

The PLD IrO_2 thin films were deposited by ablating a pure polycrystalline Iridium target by means of a pulsed Nd:YAG laser under an ambient pressure of oxygen. A laser

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Effect of Ho Content on Microstructure and Ferroelectric Properties of $Bi_{4-x}Ho_xTi_3O_{12}$ Thin Films Prepared by Sol–Gel Method

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$Bi_{4-x}Ho_xTi_3O_{12}$ (BHT-x) thin films with Ho content x = 0.2, 0.4, 0.6, 0.8, and 1.0 were prepared on Pt/Ti/SiO_2/Si substrates by a sol–gel method. Effects of Ho contents on the microstructure and ferroelectric properties of BHT-x thin films were investigated. All the BHT-x samples consist of the Bi-layered Aurivillius phase. The lattice constants along the a, b, and c axes decrease with the increase of x. The remanent polarization ($2P_r$) and dielectric constant (ε_r) increase firstly and then decreases with the increase of the Ho content, while the leakage current density shows opposite trend. BHT-0.4 film exhibits the best electrical properties with $2P_r$ 44.2 μC/cm², $2E_c$ 323.7 kV/cm, ε_r 489 (at 1 MHz), dielectric loss 0.018 (at 1 MHz), leakage current density 8.0×10^{-8} A/cm² (under 200 kV/cm), as well as the strongest fatigue resistance (the polarization loss is only 3% after 4.46×10^9 switching cycles).

I. Introduction

Ferroelectric thin films have been extensively investigated for applications in ferroelectric random access memory (FeRAM).[1–3] Among these ferroelectrics, bismuth titanate ($Bi_4Ti_3O_{12}$, BTO), a typical Bi layered Aurivillius material, is considered to be a good candidate material, because its bulk value of the twice remanent polarization ($2P_r$) is about 60 μC/cm².[4–6] But the BTO films show the poor fatigue resistance and unexpectedly low value of P_r due to the anisotropic property, which making the BTO films unsuitable for FeRAM devices. Recent reports reveal that the fatigue free thin films with excellent ferroelectric properties can be obtained by the substitution of lanthanide ions (including La^{3+}, Pr^{3+}, Ce^{3+}, Nd^{3+}, Sm^{3+}, Eu^{3+}, Dy^{3+}, and Gd^{3+} ions) for the Bi^{3+} ions in the $(Bi_2Ti_3O_{10})^{2-}$ pseudoperovskite layers of BTO.[2,7–16] The fatigue free behavior of lanthanide substituted BTO thin films can attribute to the enhanced stability of oxygen in the TiO_6 octahedron cell caused by the substitution of lanthanide ions for Bi^{3+} ions located at near the TiO_6 octahedron cell.[2] Because the ferroelectricity of BTO is known to originate from a tilting of the TiO_6 octahedron cell from the c axis and a rotation in the a–b plane, the substitution for the Bi^{3+} ions in the pseudoperovskite layers with the suitable lanthanide trivalent ions has an effect on the shifts of some ions contributing to dipole displacement. The larger dipole displacement was obtained by the lanthanide substitution in the recent reports.[17,18] In our previous work,[19] we have reported the $Bi_{3.6}Ho_{0.4}Ti_3O_{12}$ ferroelectric thin films showed large P_r and fatigue free behavior. However, the effect of Ho content on the microstructure, ferroelectric and electrical properties of $Bi_{4-x}Ho_xTi_3O_{12}$ (BHT-x) have not been studied systematically.

In the present work, BHT-x thin films with different Ho contents were prepared on the Pt/Ti/SiO_2/Si substrates by a sol–gel method. The microstructure and ferroelectric properties of BHT-x thin films with x ranging from 0.2 to 1.0 were investigated.

II. Experimental Procedure

$Bi(NO_3)_3$, $Ho(NO_3)_3$, and titanium butoxide ($Ti(OC_4H_9)_4$) were used as the precursors for Bi^{3+}, Ho^{3+}, and Ti^{4+} ions, respectively. All chemical agents used in this experiment were analytic purity. The desired amounts of $Bi(NO_3)_3$ (with 10 mol% excess), $Ho(NO_3)_3$, and $Ti(OC_4H_9)_4$ corresponding to BHT-x with x = 0.2, 0.4, 0.6, 0.8, and 1.0 composition were dissolved in acetic acid, and the acetylacetone was added to the solution as the stabilizing agent. The concentration of all the precursors is 0.3 mol/L. The BHT-x thin films were deposited on Pt/Ti/SiO_2/Si substrates using a spin coater, Model KW-4A (Institute of Microelectrics of Chinese Academy of Sciences, Beijing, China), at 3000 r/min for 30 s. The as-coated films were heated at 350°C for evaporation of the solvent and decomposition of the residual organics for 15 min. In order to obtain the desired thickness, the above process was repeated six times. The thickness of the films was measured by a surface profiler (FTS2 540C 3D, Taylor Hobson, Leicester, U.K.). The thickness of the BHT-x films in the present work was approximately 600 nm. Finally, the samples were crystallized in a conventional furnace at 700°C for 60 min in oxygen atmosphere. In order to investigate the effect of x on the crystal structure, the xerogel powders of BHT-x were calcined at 700°C for 60 min from the same precursor solutions.

Phase composition and crystallization of the BHT-x films were performed by X-ray diffraction (XRD), using the Bruker D8 Advance X-ray diffractometer (Bruker AXS Inc., Madison, WI) with CuKα radiation. The scanning rate was 4°/min. The surface morphologies were observed by the atomic force microscope operating in the contact mode (AFM, SPM 9500J3, Shimadzu, Kyoto, Japan). Top electrode with the area of 3.0×10^{-4} cm² was fabricated by sputtering Pt. The ferroelectric properties were measured by the precision workstation ferroelectric tester system (Radiant Technologies, Inc., Albuquerque, NM). Dielectric constant and loss were measured using an Agilent 4294A precision impedance analyzer (Agilent Technologies, Inc., Santa Clara, CA). All measurements of electrical properties were carried out at room temperature.

III. Results and Discussion

Figure 1 shows XRD patterns of BHT-x powders calcined at 700°C for 60 min. All BHT-x powders consist of the single Bi-layered Aurivillius phase within the detection limit of the XRD

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Effect of Mo substitution on ferroelectric properties of $Bi_{3.6}Ho_{0.4}Ti_3O_{12}$ thin films prepared by sol-gel method

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The series of $(Bi_{3.6}Ho_{0.4})_{4-2x/3}Ti_{3-x}Mo_xO_{12}$ (BHTM) (x=0, 0.9%, 1.5%, 3.0%, and 6.0%) thin films on $Pt/Ti/SiO_2/Si$ substrates is prepared by sol-gel method, and the effect of Mo content on the microstructure and ferroelectric properties of these films are investigated. When the Mo content is not excessive, the BHTM films consisted of the single phase of Bi-layered Aurivillius phase. The B-site substitution with high-valent cation of Mo^{6+}, in $Bi_{3.6}Ho_{0.4}Ti_3O_{12}$ films, enhanced the $2P_r$ (remanent polarization) and reduced the $2E_c$ (coercive field) of these films. The BHTM thin film with x=1.5% exhibited the best electrical properties with $2P_r$ of 48.4 $\mu C/cm^2$, $2E_c$ of 263.5 kV/cm, dielectric constant of 391 (at 1 MHz), good insulting behavior, as well as the fatigue-free characteristic. © *2008 American Institute of Physics*. [DOI: 10.1063/1.3063121]

Ferroelectric thin films have been extensively investigated for applications in ferroelectric random access memory (FeRAM).[1–3] Bismuth layer-structured ferroelectrics (BLSF) are recognized as promising film materials for FeRAM applications due to the fatigue-free behavior.[4–6] Among these ferroelectrics, $Bi_4Ti_3O_{12}$ (BTO)-based films are the typical members of the BLSF family. It was reported that some A-site or B-site substitution in BTO crystal showed large remanent polarizations (P_r).[2,7–12] It was also found that the coercive field (E_c) in the A-site and B-site substituted BTO films became larger.[13–15] Our group reported a remarkable improvement of $2P_r$ in the BTO films by adding Ho^{3+} ions to the A-site.[16,17] But the $2E_c$ of the $Bi_{3.6}Ho_{0.4}Ti_3O_{12}$ (BHT) films became abnormally large. It was suggested that the A-site and B-site cosubstitution in BTO films could balance the P_r and E_c.[18–20] In selection of species for substitution, one of the important factors is the ionic radius, which must satisfy a tolerant factor for the formation of perovskite phase. In this case, the ionic radius of Mo^{6+} (0.059 nm) is compatible with that of Ti^{4+} (0.0605 nm).[21] In this letter, we report on the result of the B-site substitution in BHT films with higher valence cation Mo^{6+} for the purpose of achieving large P_r and small E_c. The effect of Mo content on the microstructure and ferroelectric properties is investigated.

The series of $(Bi_{3.6}Ho_{0.4})_{4-2x/3}Ti_{3-x}Mo_xO_{12}$ (x=0, 0.9%, 1.5%, 3.0%, and 6.0%, the samples are abbreviated to BHTM, followed by 0, 09, 15, 30, and 60, respectively) thin films were prepared on $Pt/Ti/SiO_2/Si$ substrates by sol-gel method. $Bi(NO_3)_3$, $Ho(NO_3)_3$, $(NH_4)_2MoO_4$, and titanium butoxide [$Ti(OC_4H_9)_4$] were used as the precursors for Bi^{3+}, Ho^{3+}, Mo^{6+}, and Ti^{4+} ions, respectively. All chemical agents used were analytic purity. The desired amounts of $Bi(NO_3)_3$ (with 10 mol % excess), $Ho(NO_3)_3$, $Ti(OC_4H_9)_4$, and $(NH_4)_2MoO_4$ corresponding to $(Bi_{3.6}Ho_{0.4})_{4-2x/3}Ti_{3-x}Mo_xO_{12}$ composition were dissolved in acetic acid and pure water, respectively. After they were fully dissolved, the solutions were put together, and then acetylacetone was added to the BHTM solutions as a stabilizing agent. The concentration of all the precursors was 0.3 mol/l. The BHTM thin films were coated on $Pt/Ti/SiO_2/Si$ substrates using a spin coater, model KW-4A, at 3000 rpm for 30 s. The as-coated films were heated at 350 °C for evaporation of the solvent and decomposition of the residual organics for 15 min. In order to obtain the films with desired thickness, the above process was repeated for several times. The films' thickness in the present work was measured by scanning electron microscopy (SEM). Finally, the samples were crystallized at 700 °C for 60 min in oxygen atmosphere.

X-ray diffraction (XRD) measurements were performed using a RiGaKu D/MAX-IIIA x-ray diffractometer with Cu $K\alpha$ radiation. The scanning rate was 4 deg/min. The cross-sectional microstructures were characterized by SEM (JSM-5610LV). Top electrode with the area of 1.0×10^{-3} cm^2 was fabricated by sputtering Pt. The ferroelectric properties, fatigue, and leakage current were measured by a precision workstation ferroelectric tester system (Radiant Technologies). Dielectric property was measured by an Agilent 4294A precision impedance analyzer. All measurements of electrical properties were carried out at room temperature.

Figure 1 shows the microstructure of BHTM thin films. According to the XRD patterns, although the BHTM60 film shows a little amount of Bi_2O_3 phase, all the other crystal structures of BHTM thin films consist of the Bi-layered Aurivillius phase, which indicates that the Mo^{6+} ions in the films do not form minority phases or segregate from the interior grain. This implied that Mo^{6+} ions have entered into the pseudoperovskite unit cell and substituted for the Ti^{4+} ions maintaining the Bi-layered Aurivillius structure. MoO_3 is so evaporative that the Mo content in these films is likely to be less than the nominal content in the precursors. When the Mo content is higher, more Mo volatilize, which leads to the Bi content exceeding the optimal value. So there is a

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Optimal design of light trapping in thin-film solar cells enhanced with graded SiN_x and SiO_xN_y structure

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Abstract: In this paper, a graded SiN_x and SiO_xN_y structure is proposed as antireflection coatings deposited on top of amorphous silicon (a-Si) thin-film solar cell. The structural parameters are optimized by differential evolution in order to enhance the optical absorption of solar cells to the greatest degree. The optimal design result demonstrates that the nonlinear profile of dielectric constant is superior to the linear profile, and discrete multilayer graded antireflection coatings can outperform near continuously graded antireflection coatings. What's more, the electric field intensity distributions clearly demonstrate the proposed graded SiN_x and SiO_xN_y structure can remarkably increase the magnitude of electric field of a-Si:H layer and hence, enhance the light trapping of a-Si:H thin-film solar cells in the whole visible and near-infrared spectrum. Finally, we have compared the optical absorption enhancements of proposed graded SiN_x and SiO_xN_y structure with nanoparticles structure, and demonstrated that it can result in higher enhancements compared to the dielectric SiC and TiO_2 nanoparticles. We have shown that the optimal graded SiN_x and SiO_xN_y structure optimized by differential evolution can reach 33.31% enhancement which has exceeded the ideal limit of 32% of nanoparticles structure including plasmonic Ag nanoparticles, dielectric SiC and TiO_2 nanoparticles.

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Biomimetic Smart Interface Materials for Biological Applications

Taolei Sun and Guangyan Qing*

Controlling the surface chemical and physical properties of materials and modulating the interfacial behaviors of biological entities, e.g., cells and biomolecules, are central tasks in the study of biomaterials. In this context, smart polymer interface materials have recently attracted much interest in biorelated applications and have broad prospects due to the excellent controllability of their surface properties by external stimuli. Among such materials, poly(*N*-isopropylacrylamide) and its copolymer films are especially attractive due to their reversible hydrogen-bonding-mediated reversible phase transition, which mimics natural biological processes. This platform is promising for tuning surface properties or to introduce novel biofunctionalities via copolymerization with various functional units and/or combination with other materials. Important progress in this field in recent years is highlighted.

1. Introduction

Interactions between biological systems and artificial materials normally occur at their interface; thus, the "biointerface" and the corresponding biological-system/material interactions are of fundamental importance for the study of biomaterials, and directly govern their success or failure for in vivo and in vitro applications.[1] In this respect, biochemists collaborate closely with materials scientists to combine various biomolecules, including DNA, peptidomimetics, aptamers, and ribozymes. Specially engineered proteins have been designed by biochemists, while materials scientists have developed the tools to position these biomolecules with molecular precision, using various techniques to observe and control the behaviors of biomolecules on the surfaces, to further integrate them into various functional devices.[2] The simplest biointerface is created when a biomolecule (e.g., DNA, RNA, protein, antibody) touches a solid surface, while complex biointerfaces include larger biological objects such as membranes, viruses, or cells that are brought into contact with inorganic, synthetic, or other artificial materials.[3] From the point of view of materials science, the interfacial interaction between biological objects and artificial materials is largely determined by the physical and chemical properties at the surface of the materials, e.g., wettability, topographic structures, chemical compositions, etc. Therefore, the regulation and control of the surface properties of such materials are important requirement in these studies.[4]

Smart interface materials, especially those based on responsive polymer films or grafts, have recently attracted much interest in biological applications due to the excellent response of their physical and chemical properties to external stimuli, e.g., light irradiation, thermal treatment, pH value, solvent treatment, electric field, or biomolecule binding and release.[5] Such materials are actually typical examples of a material that mimics the behavior of living systems, which are capable of undergoing rapid, reversible conformational and chemical changes when triggered by small changes in their immediate environment.[6] These materials are playing increasingly important roles in a wide range of biorelated applications, such as controllable bioseparation, drug release, delivery systems of diagnostic agents, tissue engineering, cell-culture supports, biosensors, and actuators.[7]

To design smart polymer materials, two critical problems should be addressed: One is the reversibility of the material alteration, and the other is the tunability of the functions and properties.[8] In nature, biological systems usually use weak interactions to solve these problems, among which the hydrogen bonding (H-bonding) interaction is one of the most popular driving forces for various bioprocesses. For example, the inheritance process, including the copy and transcription of genetic information (DNA and RNA, etc.), is mainly completed by the complementary base pairing of nucleotide bases dA, dT, dC, dG, and dU, driven by highly specific H-bonding interactions.[9] The formation of secondary and tertiary structures of biomacromolecules, e.g., proteins or DNA, is also largely driven by the multiple H-bonds between different units, which play a crucial role in their activity and functionality.[10] This process inspires the design of novel high-performance smart biointerface materials.

Inspired by the exquisite architectures in nature created by H-bonds, smart materials based on such modulation mechanism are very suitable to mimic the behaviors of biological species and realize special biofunctions. Poly(*N*-isopropylacrylamide) (PNIPAAm) is a smart polymer well known for its reversible

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CRITICAL REVIEW

Functional biointerface materials inspired from nature

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Controlling the interfacial chemical and physical properties, and thus modulating the behaviours of cells and biomolecules on material surfaces, form an important foundation for the development of high performance biomaterials and devices. Biological systems in nature exhibit unique features in this aspect. The first one is that the superior properties of natural biomaterials are normally not determined by their bulk properties, but more related to the multi scale micro- and nanostructures on the surface; the second is that biological systems usually utilize highly specific weak interactions (*e.g.* hydrogen bonding interaction, hydrophobic interaction, etc.) to solve the problems of biomolecule interactions; the third is that the biomolecules in nature are often chiral molecules and show high preference for one specific enantiomorphous configuration, suggesting a distinctive chiral recognition mechanism in biological systems. These features bring much inspiration to design novel biointerface materials with special functionalities, *e.g.* structural biointerface materials, smart biointerface materials and chiral biointerface materials. The purpose of this *critical review* is to give a brief introduction of recent advances in these aspects (90 references).

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1. Introduction

With the development of modern medicine and biotechnology, more and more artificial materials and devices have been used in human bodies and biological applications, such as bio-detection and biochemical devices, implantable materials, bioengineering materials, *etc.*[1,2] For these applications, there are two

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Prof. Taolei Sun received his PhD in the Chinese Academy of Science (CAS) in 2002. After two-year postdoctoral research in Institute of Chemistry, CAS, he worked in Physics Institute of Muenster University, Germany, as an Alexander Von Humboldt Fellow. In 2006, he was awarded the Sofja Kovalevskaja by Alexander von Humboldt Foundation and got funding support from the Federal Ministry of Education and Research of Germany at the same time to build an independent Bio & Nano Interface research group in Germany. In late 2009, he joined Wuhan University of Technology, China, and was appointed as the "Chang Jiang Scholar" distinguished professor. He mainly works on functional biointerface materials.

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Preparation of Magnéli phases of $Ti_{27}O_{52}$ and Ti_6O_{11} films by laser chemical vapor deposition

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ABSTRACT

Magnéli phases of $Ti_{27}O_{52}$ and Ti_6O_{11} films were prepared by laser chemical vapor deposition using $Ti(dpm)_2(O\,i\,Pr)_2$ as a precursor. Ti_6O_{11} film was obtained at a laser power (P_L) of 200 W and a deposition temperature (T_{dep}) of 1270 K. $Ti_{27}O_{52}$ film was obtained at P_L = 150 to 200 W and T_{dep} = 1020 to 1250 K. Ti_6O_{11} and $Ti_{27}O_{52}$ films had a faceted texture about 2 μm in grain size and a columnar cross section. The deposition rate of $Ti_{27}O_{52}$ and Ti_6O_{11} films were 90 and 70 μm h^{-1}, respectively.

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1. Introduction

The Ti–O system includes a series of compounds, such as TiO_2, Ti_2O_3, Ti_3O_5 and Ti_nO_{2n-1} ($4<n<10$), as shown in the phase diagram in Fig. 1 [1]. TiO_2 has three well known polymorphs, i.e., rutile, anatase and brookite, and has been widely applied in photo catalysis, self cleaning and high refractive index materials. On the other hand, Ti_nO_{2n-1} ($4<n<10$), namely, the Magnéli phase, has structures and characteristics of continuous transition from the Ti_2O_3 structure type to rutile ordering in the (121) plane [2]. The crystal structure and characteristics of the Magnéli phase consisting of rutile like edge-, corner- and partially face-shared TiO_6 octahedra in every nth octahedron at a shear plane (121) [3] have been studied for basic understanding [4]. Liborio et al. thermodynamically calculated the formation mechanism of the Magnéli phase, results indicating that oxide vacancies tend to be ordered in planes under low oxygen potentials [5]. Since the Magnéli phase has high electrical conductivity (10^2 S m^{-1} of Ti_6O_{11} at room temperature) comparable to that of graphitized carbon [6], and high oxidation resistance [7], the Magnéli phase is attractive as a durable electrode material for electrochemical applications under severe conditions [8]. Such material can be applied to gas sensors for detecting H_2, O_2 and CO, electrodes for batteries, antireflection coatings in solar cells and in photoelectrolysis. The Magnéli phases have high absorbance for visible light and can be applied as highly emissive coatings for furnace walls.

Magnéli phase films have been prepared by sol–gel, physical vapor deposition and plasma spraying. Langlade et al. prepared rutile TiO_2 films by a sol–gel method and converted them to Magnéli phase films by a UV laser irradiation [9]. Geraghty et al. prepared a film with a mixture of Magnéli phases and TiO_2 by a diode RF reactive sputtering method [10]. Storz et al. prepared Magnéli phase coatings by thermal spraying as a wear resistant coating and reported that a Magnéli phase (Ti_6O_{11}) coating showed high wear resistance [11]. Tomastek et al. prepared Magnéli phase films mixed with rutile and anatase by suspension plasma spraying as a field electron emitting coating [12].

Chemical vapor deposition (CVD) has been commonly applied in the preparation of rutile and anatase TiO_2 [13,14]. However, no report on Magnéli phase films has been published. In the present study, Magnéli phase films were prepared by laser CVD (LCVD) in a N_2 atmosphere, and the effects of laser power (P_L) and deposition temperature (T_{dep}) on crystalline phases, microstructures and deposition rates (R_{dep}) were investigated.

2. Experimental details

Ti–O films were prepared by a cold wall vertical laser CVD apparatus, shown in Fig. 2. A Nd:YAG laser beam was enlarged to 15 mm in diameter and irradiated on a pre-heated Al_2O_3 substrate (10 by 10 by 2.5 mm). The substrate pre-heating temperature (T_{pre}) and P_L were changed from 673 to 973 K and from 0 to 200 W, respectively. T_{dep} were measured by a thermocouple inserted into a slot (2 mm in depth) on the back of the Al_2O_3 substrate. Fig. 3 shows the molecular structure of $Ti(dpm)_2(O\,i\,Pr)_2$ precursor, in which six O atoms surround the Ti atom. $Ti(dpm)_2(O\,i\,Pr)_2$ was vaporized at 473 K and carried into the chamber with N_2 gas (99.999% in purity) at a flow rate

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Laser chemical vapor deposition of SiC films with CO_2 laser

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ABSTRACT

SiC films were prepared by laser chemical vapor deposition using a CO_2 laser (maximum laser power: 245 W) with HMDS (hexamethyldisilane) precursor and the effects of deposition conditions on the phase, microstructure and deposition rate were investigated. At pre-heating temperature of 1233 K and laser power (P_l) above 119 W (deposition temperature (T_{dep}) above 1410 K), (1 1 1)-oriented 3C SiC (β-SiC) films were obtained. With increasing T_{dep}, the microstructure of these SiC films changed from glass-like (T_{dep} < 1480 K) to cauliflower-like (T_{dep} = 1480–1560 K) to granular (T_{dep} > 1560 K). Conical facets formed on the surface of granular SiC films at around T_{dep} = 1650 K. The deposition rate (R_{dep}) of SiC films showed a maximum at T_{pre} = 1373 K and P_l = 119 W (T_{dep} = 1490 K) and reached 2200 μm h^{-1}.

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1. Introduction

Silicon carbide (SiC) has excellent wear, oxidation resistance and high-temperature strength, and thus SiC-coated carbon composites and SiC fiber-reinforced aluminum alloys are widely used as high-temperature structural materials with high thermal shock resistance and high specific strength [1,2]. Moreover, superior functionalities of SiC such as high electron mobility, impurity controllability of pn types and high breakdown voltage make SiC attractive for use as wide bandgap semiconductors and power devices [3,4].

Chemical vapor deposition (CVD) has been commonly used for SiC coatings. Conventional thermal CVD often uses silicon halides, mainly $SiCl_4$ and methyltrichlorosilane (CH_3SiCl_3), as precursors with H_2 gas [5,6], and we have reported achievement of high-speed deposition (2000 μm h^{-1}) of SiC film by using $SiCl_4$ and C_3H_8 gases [7]. Since H_2 gas and intermediate Si–C–H–Cl compounds are highly explosive, safety during experimentation is an important issue. Moreover, by-products of Cl-containing species, mainly HCl, are corrosive, and therefore the inside of the CVD chamber and exhaust gas line should be carefully designed to prevent corrosion. Low pressure CVD (LPCVD) [8–13] and plasma-enhanced CVD (PECVD) [14] using metalorganic compounds containing Si are possibly available to avoid explosion and corrosion; however, the deposition rate of SiC films, less than several 10 μm h^{-1}, is too low to obtain a thick coating. Laser-assisted CVD has been conducted to prepare SiC films, but the deposition rate as with those of LPCVD and PECVD, is still too low. Furthermore, the deposition is limited to a small area, less than a few mm^2, hardly applicable to practical usage for oxidation and wear-resistant engineering coatings [15].

We have previously reported high-speed, low-temperature deposition of thick Y_2O_3, SiO_2 and Al_2O_3 films with several hundred micrometers in thickness onto substrate with a relatively large area (12.5 mm × 12.5 mm) by laser CVD (LCVD) using a continuous wave of a high-power Nd:YAG laser (200 W) [16–18], and succeeded in coating a practical complex-shaped gas turbine blade by moving and rotating the substrate [19,20]. Unlike the conventional CVD process [21], with a high-power laser, plasma can be produced by ionizing precursor gases, which enhances the chemical reactions in the gas phase, and also accelerates the surface mobility of absorbed species on the substrate surface.

In the conventional CVD process using metalorganic compounds as precursors, O_2 or H_2 gases are added to eliminate excess hydrocarbon species. However, it is almost impossible to obtain non-oxide compounds in an O_2 containing atmosphere, and H_2 gas would inevitably result at the potential risk of explosion. In the present study, SiC films were prepared in a wide area (15 mm in diameter) at a high deposition rate by laser CVD with a CO_2 laser using an organic precursor in the absence of H_2 and O_2 gases. Moreover, the effects of laser power and pre-heating temperature on the phase, microstructure and deposition rate were investigated.

2. Experimental procedure

Fig. 1 depicts a schematic of the LCVD apparatus, and Table 1 lists the deposition conditions. HMDS (hexamethyldisilane; $Si(CH_3)_3$–$Si(CH_3)_3$) liquid was used as a precursor. It was slightly heated to a vaporization temperature (T_{vap}) of 298 K and carried into the CVD chamber with Ar gas. The gas flow rate of Ar gas was 1.7×10^{-6} m^3 s^{-1} (100 sccm) and the total pressure (P_{tot}) was fixed at 400 Pa. A graphite disc (Toyo Tanso Co., Ltd., IG-743, 50 mmϕ × 5 mm) was used as

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The foundations of cooperation with Professor Lavernia in China

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Employment Contract

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Wuhan University of Technology
Strategic Scientist Employment Contract

Employer (Party A)
Unit name: Wuhan University of Technology
Legal representative: ZHANG Qingjie
Employee: Strategic Scientist (Party B)
Name: Enrique Jose Lavernia

To ensure the smooth and successful implementation of the Wuhan University of Technology Strategic Scientist system and guarantee the legal rights and interests of both parties A and B, the parties have hereby concluded this contract in Wuhan, China through equitable negotiations between the parties.

Article 1 Term of Employment

The term of employment for the position of strategic scientist shall be five years, from January 9, 2013 through January 8, 2018. Upon the expiration of this term, renewal or re-employment may be undertaken through negotiations between the parties.

Article 2 The work objectives and tasks of Party B's post

1. Seizing upon the direction of development for the [scientist's] field or the scientific research base, put forth strategic, forward-looking, and innovative research ideas, lead the department or scientific research base to achieve national leading or internationally advanced levels in its cutting edge areas.
2. Cultivate young instructors or accept young instructors in further studies and visits, advise or jointly advise (post)doctoral and master's degree candidates, such as to allow them to move towards the cutting edge of international academia in their fields. Jointly publish academic papers with young instructors in leading international periodicals (with Wuhan University of Technology as the author unit, and the Wuhan University of Technology instructor or student as the top author) or publish high level academic books. Advise young instructors in obtaining national level science and technology awards or international academic awards of significant impact.
3. Build a team for innovation in science and technology in [Party B's] field, recruit and cultivate high level talent such as "Youth Thousand Talents Program," Chang Jiang scholars employed by special appointment, and National Outstanding Youth Science Fund winners.

4. Looking to the State's significant strategic needs and the international scientific and technological cutting edge, proactively organize a team in [Party B's] field to take on the State's significant (key) projects or international cooperative projects.
5. Develop international exchange and cooperation, hold or jointly hold international academic conferences in [the scientist's] field in Wuhan University of Technology's name.

Article 3 Rights and obligations

1. Party A's rights and obligations
   i. Undertake service management of Party B in accordance with the work objectives and tasks of the strategic scientist's post.
   ii. Protect the various rights that Party B is entitled to in accordance with Chinese law and the university's relevant rules.
   iii. Provide good work and living conditions for Party B.
      (1) During the term of employment, provide 1 million RMB to Party B as scientific research seed funding, to be used for laboratory construction and purchase of dedicated laboratory equipment.
      (2) The salary standard for renowned overseas experts is 50,000 USD per month (pretax standard, includes State wages won), to be assessed weekly in accordance with the actual time served at the post.
      (3) Assist Party B in assigning team members.
      (4) Facilitate Party B's recruitment of high quality master's degree candidates, doctoral degree candidates, and postdoctoral researchers.
      (5) Provide business class flights to and from China.
   iv. In the event that Party B successfully applies for relevant talent programs of the State, Party A shall convert the relevant compensation to Party B based on the principle of "taking the higher of the two" (without double-dipping).
2. Party B's rights and obligations
   i. Comply with Party A's various rules and regulations as well as the State's relevant laws and regulations.
   ii. In accordance with the provisions of the *Wuhan University of Technology Strategic Scientist Employment Management Measures*, guarantee that the time worked at Party A (the mandatory work hours regulations may be relaxed or flexibly implemented as is appropriate for those who have made outstanding contributions to the building and development of the university), and enjoy the salary and related compensation provided by Party A.
   iii. Comprehensively perform the duties of the post of strategic scientist and complete the work objectives and tasks of the strategic scientist post in a timely manner;

submit to Party A's evaluation and management.

Article 4 Evaluation

Party A's evaluation of Party B shall be undertaken pursuant to the relevant provisions of the *Wuhan University of Technology Strategic Scientist Employment Management Measures*.

Article 5 Contract modification and cancellation

1. Where Party B has failed to perform the duties stipulated in this contract during the term of employment, Party A shall be entitled to terminate this contract.
2. Where Party B resigns during the term of employment for special reasons, [Party B] must submit an application to Party A three months in advance and may only resign upon Party A's consent.
3. In the event that incidents that are unforeseeable and unpreventable by both parties have occurred during the term of employment, such as to render the normal performance of this contract impossible, and there is a need to modify or cancel the contract, the employer and employed parties shall handle such in accordance with the relevant regulations.

Article 6 Supplementary provisions

1. This contract is made in three identical copies, with Party A, Party B, and the employer unit each holding one copy, and this contract shall take effect on the date of its signature and seal by both parties.
2. For matters not set forth in this contract, the parties shall negotiate and make supplementary provisions. Supplementary provisions shall have the same force and effect as this contract.

Employer: [signature] Employee: [signature]

January 8, 2013 January 8, 2013

CONTRACT OF EMPLOYMENT

WUHAN UNIVERSITY OF TECHNOLOGY

(Photocopy not Accepted)

WUHAN UNIVERSITY OF TECHNOLOGY
Contract of Strategic Scientist's Appointment

Employer(Party A)
Name of the Employer: Wuhan University of Technology (WUT)
Legal Representative:ZHANG Qingjie

Employed Strategic Scientist(Party B)
Name: Enrique Jose Lavernia

This contract is hereby made and concluded by and between Party A and Party B in Wuhan, China, on the principle of equality and mutual benefit and through amicable consultation.

Article One Effective duration of the Contract

The appointment period for WUT strategic scientists is generally five years. The period of service will be from 9th January, 2013 to 8th January, 2018. After the expiration of this contract, the renewed appointment or re-appointment can be decided by both parties' mutual consent.

Article Two Employment Objective and Tasks for Party B

1. Make strategic, visionary and creative research proposals to guide the advancement of disciplines or scientific research institutes to become first class disciplines or scientific research institutes in China or the world, especially in frontier areas.

2. Supervise young teachers or researchers, receive them as visiting scholars. Guide or co-guide postgraduate students (including post-doctoral researchers), lead them to the international forefront of related fields, jointly publish academic papers in the world top international journals (in the name of WUT, and WUT faculty or students as the first author) or publish high-level academic monographs and guide

young teachers and researchers to win national awards or influential international academic awards.

3. Build up a Discipline Innovative Team, introducing and cultivating high-level talents to be as qualified as those of China's 1000 Young Talents Plan, Distinguished Professors of Chang Jiang Scholars and winners of National Science Fund for Distinguished Young Scholars.

4. Conduct national level important (key) projects or key international cooperation projects that meet China's national strategic development requirements or stand at the forefront of international science and technology research field.

5. Promote international exchanges and cooperation, and host or jointly host prominent international academic conferences in the name of WUT.

Article Three Rights and Obligations

1. Rights and Obligations for Party A

1. Provide Party B with service management according to the employment objective and tasks mentioned above.

2. Safeguard Party B's legal rights in accordance with Chinese laws.

3. Provide Party B with favorable working and living conditions, including:

① Party A shall provide research funds of 1 million Chinese Yuan per year for constructing laboratory, purchasing special experimental equipments and so on.

② International strategic scientist will be paid 50,000 USD per month. Party B' actual payment will be calculated according to Party B' actual work time in WUT on a weekly basis (pretax, government stipend included).

③Party A shall assist Party B to recruit team members.

④Party A shall create favorable conditions to enable Party B to recruit top-quality postgraduate students, doctoral students and postdoctoral researchers.

⑤Party A shall provide Party B with international round-trip ticket (business-class).

4. Once Party B gains a Chinese national government-sponsored position through successful application for other kind of Chinese talent-related projects, Party A shall adjust its payment terms to ensure that Party B enjoys more benefits on the principle of "prioritizes the higher payment", and the same payment terms will not be implemented twice.

II. Rights and Obligations for Party B

1. Party B shall respect all the rules and regulations made by Party A, and abide by laws, decrees and relevant regulations enacted by the Chinese government.

2. According to the stipulations of "WUT Strategic Scientists Appointment Regulations", Party B shall ensure the working hours in WUT. (The required working hours can be negotiable when significant contributions are made by Party B for the construction and development of Party A), and shall enjoy the remuneration and related benefits provided by Party A.

3. Party B shall fulfill WUT strategic scientists' position responsibilities, complete their work objectives and tasks on time, and accept Party A's evaluation and management.

Article Four Evaluation

The evaluation of Party B made by Party A shall be conducted according to "WUT Strategic Scientists Appointment Regulations".

Article Five Revision and Cancellation of the Contract

1. Party A has the right to terminate the contract if Party B fails to fulfill the obligations specified in the contract during the employment period.

2. If Party B wishes to terminate the contract due to special reasons, notice must be presented to Party A at least three months in advance, and

only with Party A's consent can the contract be terminated.

3. If the contract needs to be revised or cancelled due to unforeseeable or unpreventable circumstances or events, both parties should handle it properly according to relevant regulations.

Article Six Supplementary Articles

1. This contract is executed in triplicate to be held by Party A, Party B and Party B's work place in WUT respectively, which shall become valid from the date of both parties' signature/seal.

2. What is left unmentioned in this contract can be written down as additional regulations based on both parties' consent after consultation. The additional regulations shall have the same legal effect as this contract.

Party A: (Signature)

Party B: (Signature)

Date of the signature: Jan 8, 2013

Date of the signature: January 8th 2013

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Effect of post-annealing on the electrical conductivity of spark plasma sintered antimony-doped tin oxide (ATO) ceramics

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High-density antimony doped tin oxide (ATO) ceramics are prepared by spark plasma sintering (SPS). In order to enhance the electrical conductivity of the ATO ceramics, a post-annealing process at 800 °C for 100 h in air was carried out. The results suggest that post-annealing is effective in increasing the carrier concentration and Hall mobility, which ultimately control the electrical conductivity. The electrical resistivity is reduced by approximately two orders of magnitude, to a value of $5.68 \times 10^{-3}\ \Omega$ cm.
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Keywords: Annealing; Spark plasma sintering; Ceramics; Electrical properties

Tin-doped indium oxide (ITO) has been widely used as a transparent conducting oxide (TCO) electrode in displays, heat mirrors and solar cells, because it has extremely high conductivity and transparency [1–4]. Nevertheless, indium (In) in ITO is toxic and quite scarce as a resource, rendering the development of ITO unsustainable. Thus, it is necessary to develop alternative TCO materials with similar properties but from resources that are abundantly available, non-toxic and low cost, such as antimony-doped tin oxide (ATO). Tin oxide (SnO_2) is an n-type semiconductor with a wide band gap (3.6 eV), which exhibits high transparency in visible light, and good mechanical properties and good chemical stability [5–7]. However, its electrical conductivity is limited because it is only caused by non-stoichiometry associated with oxygen vacancies available in the SnO_2 lattice [8]. Doping SnO_2 with Sb can improve the electrical conductivity, due to the n-type carriers supplied by both oxygen vacancies and through the substitution of Sb^{5+} for Sn^{4+} [9,10].

In the past few years, many studies on the electrical conductivity of ATO ceramics have been reported. Behr et al. [11] studied the effect of Sb dopant concentration on the electrical conductivity of the ATO ceramics and reported that the electrical resistivity for a 1 mol.% Sb-doped polycrystalline pellet and a 0.1 mol.% Sb-doped single crystal are 1.9×10^{-1} and $2.1 \times 10^{-4}\ \Omega$ cm, respectively. Nisiro et al. [12] used CuO as a sintering aid in ATO ceramics and reported that the electrical resistivity varied from 10^{-1} to $10^{4}\ \Omega$ cm, depending on the starting composition and processing conditions. Yanagiya et al. [13] studied the effect of Zn dopant concentration on the electrical conductivity of ATO ceramics, and the results showed that the electrical resistivity of the samples without Zn doping reached a low value of $\sim 1 \times 10^{-2}\ \Omega$ cm at room temperature. From these studies, it is clear that the electrical conductivity of ATO ceramics is still too low for application in devices.

In order to be used as electrodes, ATO ceramics with high density and high electrical conductivity are required as magnetron targets for depositing thin films [14]. Spark plasma sintering (SPS) is a novel sintering method that has been applied to prepare ATO ceramics with high density [15,16]. ATO ceramics sintered in vacuum or inert atmosphere lead to the formation of oxygen vacancies in materials consolidated by SPS, which promotes grain boundary diffusion and mass transport, and therefore results in an increase in densification rate

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High temperature microstructure and microhardness evolution in dense NiCrAlY bulk material fabricated by spark plasma sintering

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ABSTRACT

NiCrAlY is commonly used as the bond coat material in thermal barrier coatings (TBCs). Detailed investigation into the microstructural evolution at high temperatures and the consequent changes in microhardness in NiCrAlY bond coats is challenging due to the complexity in microstructure and composition caused by thermal spray processes and the presence of a superalloy substrate and a ceramic top coat in the TBC. In an effort to simplify the system, fully dense NiCrAlY bulk samples were prepared by spark plasma sintering (SPS) at 1000 °C. The microstructure, phase composition and microhardness of the samples, in the as-sintered condition and select heat-treated-in-argon-and-quenched conditions (1000 °C, 10 h & 50 h; 1050 °C, 10 h & 50 h; 1100 °C, 10 h & 50 h), were studied by means of SEM, EDAX, HR-TEM and microhardness testing. It was found that the microstructure and phase compositions changed significantly after heat treatment. Additionally, the average microhardness of the samples decreased as the heat-treatment temperature and time increased, except for in the samples heat treated at 1000 °C for 50 h, 1050 °C for 10 h and 1050 °C for 50 h. To clarify this anomalous behavior, microhardness was carefully measured within select grains. Results indicate that the α-Cr phase, as confirmed with HR-TEM, which appeared within the β-NiAl grains after these three heat-treatment conditions but subsequently disappeared from the β-NiAl grains after heat treatment at 1100 °C, strengthened the overall microstructure.

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1. Introduction

The degradation of turbine blades during service is one of the major concerns in material science research within the field of energy production. Applying thermal barrier coatings (TBCs) on the surfaces of blades is an effective method for protecting the materials from hot corrosion and high temperature oxidation. It is well established that the performance of TBCs is influenced by the properties of the bond coat layer, which lies between the top coat and the substrate [1]. NiCrAlY alloys are one of the most important bond coat materials used for protecting the substrates [2,3]. Besides exhibiting high hardness, good adhesion and good oxidation resistance, NiCrAlY bond coat materials can be tailor-made in a wide range of compositions that correspond to the demands of the working conditions and substrate materials [4]. The microstructure in NiCrAlY bond coats consists mainly of two phases, the β-NiAl intermetallic and the γ-Ni(Cr) solid solution. In some particular compositions, α-Cr and γ′-Ni_3Al precipitates are also present within the β-NiAl and γ-Ni(Cr) grains [5–8]. The Y generally separates out into Ni,Y-rich intermetallics [6,9].

During high temperature applications, the microstructure, phase composition, and mechanical properties of NiCrAlY bond coats play a significant role in the durability of the TBCs [10]. The relationship between structure and properties in these coatings has been studied to some extent through the application of micro-tensile sample preparation and testing, even at elevated temperatures [11–14]. The method is challenging, however, because the bond coat layer is only on the order of ~150–200 μm thick [15] and it is sandwiched between the ceramic top coat and the superalloy substrate. Moreover, this method does not provide the opportunity to lock-in the high temperature microstructure for further characterization. In addition to these challenges, the bond coat microstructure is inherently complex because of the thermal spray process by which it is usually applied (such as air plasma spray, APS, or high-velocity oxy-fuel, HVOF), which can result in the formation of splat boundaries, internal oxidation and other microstructural inhomogeneities [16]. In order to overcome these challenges associated with characterizing the bond coat layer

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Preparation of pore gradient silicon nitride ceramics by a high-velocity oxy-fuel spraying technique

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The preparation of pore gradient silicon nitride (Si_3N_4) ceramics was investigated by thermally spraying dense Si_3N_4 coatings onto the porous Si_3N_4 ceramic substrates via a high-velocity oxyfuel (HVOF) spraying method. Spray powders with excellent processability were developed and produced by spray drying and sintering in a nitrogen atmosphere. After sieving, the powders with average particle size of 45–75 μm were selected. Optimization of spray parameters such as spray distance and hydrogen flow rate was carried out in order to find the most decisive factor necessary for the production of dense and well-adhering coatings and pore gradient stuctures. Zirconium phosphate bonded Si_3N_4 porous ceramics were used as the substrate and coatings were obtained only when spray distance was 200 mm. A pore gradient structure was obtained at lower H_2 flow rate, while poor-adhering coatings were obtained at higher H_2 flow rate due to the etching. The hardness is significantly improved after Si_3N_4 coatings were successfully applied.

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Key words : Silicon nitride, Pore gradient, High velocity oxyfuel (HVOF), Spraying

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1. Introduction

Pore gradient structure ceramics, as one of the special functionally graded materials (FGM), has been investigated for years because of their superior mechanical and thermal properties, and potential aerospace applications.[1] In particular, several fabrication processes such as ceramic/carbon mixtures,[1] packing ceramic powders to varying densities followed by partial sintering[2] and tape casting[3] techniques have been explored to prepare pore gradient ceramics. As a high temperature ceramic, silicon nitride (Si_3N_4) ceramic is used in numerous applications because of its high-temperature strength, good oxidation resistance and low thermal expansion coefficient.[4,5] Nowadays, various processing techniques have been developed to prepare both porous and dense Si_3N_4 ceramics for structural and functional applications.[6,7] However, little effort has focused on pore gradient structure Si_3N_4 ceramics which may be used in heat insulation applications. Our previous work reported on the preparation of pore gradient Si_3N_4 ceramics by using the spark plasma sintering (SPS) method, involving the packing of the porous and dense Si_3N_4 ceramics separately and the SPS sintering thereafter.[8]

Thermal spray processes like plasma spray have demonstrated the potential in producing graded deposits, where researchers have used twin powder feed systems to mix different proportions of powders.[9] FGMs vary in composition and/or microstructure from one boundary (substrate) to another (top service surface). HVOF (High Velocity Oxy-Fuel)[10,11] is a thermal spray with extremely high spray temperature and velocity that makes it possible for preparing dense ceramic coatings and for the spray powders to penetrate into the porous substrate. **Figure 1**(a) shows a schematic illustration of the HVOF system we used in this study. The HVOF system can be operated with hydrogen, propane, propylene and ethene as fuel gases. During spraying, fuel and oxygen are fed into the chamber. The powder is injected axially into the combustion area and accelerated through a convex-concave nozzle because of a hot high pressure flame. Spray distance, fuel-to-oxygen flow rate and fuel gas category are considered to be the three most important factors that influence the coating quality. For example, when spray distance is decreased and fuel-to-oxygen flow rate is increased, the particle velocity, temperature and impact energy will be increased. As a result, coatings with reduced porosity and enhanced mechanical properties will be obtained. Compared with the other processes shown in Fig. 1(b) HVOF has the particle temperature ranging from 1400–2000°C, and particle velocity of ~500 m/s.[12] Because Si_3N_4 does not melt, but decomposes at temperatures exceeding 1900°C, the HVOF process is ideal for the spray of Si_3N_4, which is considered to be a nonsprayable material.

The most successful attempt to prepare Si_3N_4-based coatings thus far was made by Sodeoka et al.[13] using powders obtained from β'-SiAlON ($Si_{6-z}Al_zO_zN_{8-z}$) with different degrees of substitution, z. The initial powders, including Si_3N_4, Al_2O_3 and AlN with different ratios to achieve β'-SiAlON with different z values, were fired at 1600°C for 2 h before spray. The powder was then used to deposit coatings by atmospheric plasma spraying (APS) with Ar/H_2 or Ar/H_2/N_2 as plasma gases, with the maximum $z = 4$ in all classes and with $z = 3$ at higher plasma power. The reference also mentioned that no coatings could be obtained from powders with low degrees of substitution ($z = 1$–2). However, when the degree of substitution is too high, e.g., $z > 2$, the Si_3N_4 content is less than 70 mass%. The presence of the other elements in the material may severely influence the properties of the material. So, it is significant to explore a proper way to spray Si_3N_4 ceramic with high Si_3N_4 content.

In this paper, SiAlON powder, including Si_3N_4, Al_2O_3 and AlN powders, together with Y_2O_3 powder, which is the most effective additive for Si_3N_4 sintering, was used as the initial powders. β'-

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Synthesis of α silicon nitride single-crystalline nanowires by nitriding cryomilled nanocrystalline silicon powder

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Si_3N_4 nanowires (SNNWs) have been synthesized via a novel approach involving nitriding cryomilled nanocrystalline Si powder. The SNNWs formed consist of single crystal α Si_3N_4, and are 30–100 nm in diameter and ~10 μm in length. The formation of the Si–N–Si bond during the cryomilling process, as investigated theoretically by density functional theory, promotes the subsequent synthesis of the α Si_3N_4 nanowires. The mechanism for nanowire formation appears to be a vapor–solid reaction.
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Keywords: Synthesis; Nanocrystalline materials; Nitriding; Vapor–solid (VS) mechanism; Density functional

Silicon nitride (Si_3N_4) is a wide band-gap (~5.3 eV) semiconductor and ceramic material with high strength, low density, and good resistance to thermal shock and oxidation [1–3]. In recent years, silicon nitride nanowires (SNNWs) have been studied extensively for both nanoelectronic and nanomechanic applications because of their enhanced mechanical properties [4] and novel electrical and optical properties [5,6]. SNNWs have been synthesized by different methods, such as the carbothermal reduction and nitridation of a mixture containing silicon oxide [7,8], combustion synthesis [9,10], carbon nanotube confined chemical reaction [11,12], catalyzed and catalyst-less reactions of silicon with nitrogen [13–15], reaction of silicon oxide with ammonia [16], chemical vapor deposition [17,18], reaction of melt silicon with nitrogen [19], and annealing ball-milled silicon with nitrogen [20].

Since both silicon and Si_3N_4 are barriers to silicon and nitrogen diffusion, it is difficult to promote the sustained reaction of bulk silicon with nitrogen [21]. Nanoscale silicon, on the other hand, has sufficiently higher surface energy that it can react continuously with nitrogen to form silicon nitride [22]. In order to prevent the oxidation of silicon and facilitate the formation of nanoscale silicon, we report here on a new approach for synthesizing, at high yields, nanocrystalline Si powder by using a cryomilling method. Cryomilling [23] involves the ball milling of powders in a liquid nitrogen medium. The benefits of milling at cryogenic temperatures include accelerated grain refinement, reduced oxygen contamination from the atmosphere, and minimized heat generated during milling [24]. This mechanical attrition process induces severe repetitive deformation in powders. During milling, the powder particles are repeatedly sheared and fractured, resulting in severe deformation that leads to the formation of nanostructures [25]. Cryomilled powders exhibit typical grain sizes of 10–100 nm [24]. Due to the existence of some nitrogen atoms in the liquid nitrogen [26], the potential exists for silicon to bond with the nitrogen on the surface of the silicon particles, which may enhance the synthesis of single-crystal SNNWs without any catalyst.

The experiment was carried out by cryomilling silicon powder (produced by Standard Materials Corporation, Aliso Viejo, CA, US, with an average particle size of ~325 mesh and a purity of ≥99.99%) and using a

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Sintering behavior in zirconium phosphate bonded silicon nitride porous ceramics

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ABSTRACT

A new method for preparing high bending strength porous silicon nitride ceramics with controlled porosity has been developed by using a pressureless sintering technique with zirconium phosphate (ZrP_2O_7) as a binder phase. The sintering behavior in these porous ceramics is investigated in this study by using XRD, SEM, and HRTEM analysis. The results show that the sintering process can be divided into two stages: one is at temperatures below 250 °C, during which ZrO_2 can react completely with H_3PO_4 to form ZrP_2O_7, and a ZrP_2O_7 bonded Si_3N_4 porous structure is formed; the other is at temperatures above 250 °C, at which solid state sintering of the ZrP_2O_7 dominates and a continuous open porosity network is obtained. The effect of the ZrP_2O_7 binder content on sintering behavior, porosity and mechanical properties is also investigated.
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1. Introduction

Silicon nitride (Si_3N_4) ceramics are used in numerous applications because of their superior properties, such as high-temperature strength, good oxidation resistance and low thermal expansion coefficient [1–3]. Previous studies on porous applications of this material have focused mainly on achieving both superior mechanical properties and complete transformation from alpha to beta phase Si_3N_4 for porous ceramic applications [4–5]. However, the superior dielectric properties of α-Si_3N_4, e.g., dielectric constant (ε) of 5.6 and dielectric loss ($\tan\delta$) of 0.003 at room temperature, when compared to those for β-Si_3N_4 (ε = 7.9, $\tan\delta$ = 0.005) should also be considered, because they allow α-Si_3N_4 to be utilized as an electromagnetic wave penetrating material [6]. In order to prevent the phase transformation from α-Si_3N_4 to β-Si_3N_4, a new method of low temperature processing is required for the preparation of α-Si_3N_4 matrix ceramics. Porous α-Si_3N_4 matrix structures with controlled high porosity (30–50%), micropores and guaranteed strength (>30 MPa) are needed for this application.

Various processing techniques have been developed to prepare porous silicon nitride ceramics for structural or functional applications. A common method of fabricating controlled porosity ceramic materials is by adding fugitive substances [7], which are burned out to form pores. However, this method requires an extra heat treatment to remove the agents, and it is generally difficult to obtain micropores. Another method used to adjust the porosity is the so-called partial sintering process [8]. Sintering temperature and hold time are usually used to control the porosity that results from partial sintering. Porous Si_3N_4 ceramics can also be prepared by using the partial hot press process [9]. This process results in strengths of 200–300 MPa and porosities of 10–20%, which may be too dense for our application. Controlled sintering of Si_3N_4 powder with a low content of sintering additives can also be used [10], which results in porosities of 40–50% but strengths of less than 50 MPa. Other process options include reaction sintering through nitridation of silicon powder [1], reaction sintering through carbothermal nitridation of SiO_2 [11], freeze-drying [12], and combustion synthesis [13]. These processes result in porosities greater than 60% but strength values are less than 20 MPa.

It has been reported that zirconium pyrophosphate (ZrP_2O_7) can be used as a high-temperature and low linear thermal-expansion coefficient binder material [14]. Our previous research [15] described the fabrication of α-Si_3N_4 matrix porous ceramics of controlled porosity by using ZrP_2O_7 as a binder, which utilized a net shape, pressureless sintering technique. After sintering at 1000 °C, porous silicon nitride ceramics with porosity of 34–47%, and bending strengths of 40–114 MPa were obtained. The results were significant because it supplied a creative way to improve the mechanical properties of the porous Si_3N_4 by using the phosphate

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journal

Synthesis and Pressureless Sintering of Zirconium Phosphate Ceramics

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Zirconium phosphate (ZrP_2O_7) powder is synthesized by direct reaction between ZrO_2 and H_3PO_4 and is used to prepare ZrP_2O_7 ceramics with MgO and Al_2O_3 as the sintering additives by pressureless sintering technique. The mechanism of reaction between ZrO_2 and H_3PO_4 is analyzed. The results suggest that the reaction between ZrO_2 and H_3PO_4 is completed at 250°C and ZrP_2O_7 is stable up to ~1200°C. At temperatures above ~1200°C, decomposition starts to occur, resulting in the formation of $Zr_2O(PO_4)_2$. After exposure to temperatures as high as 1500°C, decomposition is still not complete. The pure ZrP_2O_7 ceramic, however, is difficult to sinter to high density. In contrast, ZrP_2O_7 ceramics with MgO and Al_2O_3 sintering additives can be liquid-phase sintered to relative densities of 90%–96% at sintering temperatures of 1250°–1500°C, without significant decomposition. The microstructure is observed by scanning electron microscopy. The effect of density, phosphate glass phase, and grain growth on bending strength is analyzed. Because of the abnormal grain growth and microcracking of ZrP_2O_7 ceramics, the bending strength first increases and then decreases as a function of the sintering temperature.

I. Introduction

Various phosphate ceramics have been intensively investigated for they are of particular interest in the field of refractories because of the high fusion temperature of many phosphates.[1–3] They are found to be a suitable and effective debonding material for high temperature ceramic/ceramic composites.[4,5] Phosphate bonded refractories have good green strength, high temperature stability, and good abrasion resistance. As a phosphate ceramic, zirconium phosphate (ZrP_2O_7) is a low thermal expansion (1.5×10^{-6}/°C) compound demonstrated to be stable up to 1500°C.[6,7] ZrP_2O_7 bonded Si_3N_4 composites have successfully been used as a radome material because of their good mechanical and dielectric properties.[8] Previous researchers who studied these materials focused on the chemical synthesis and structural characterization, and investigated the chemical properties such as ion exchange,[9] intercalation and ion conduction properties.[10–12] Few papers have reported on the fabrication methods and properties of ZrP_2O_7 ceramics, which can be promising candidate materials for radome applications. Harrison *et al.*[13] determined that several ZrP_2O_7 phases exist with different Zr P ratios. ZrP_2O_7 is the phase formed at low temperatures; it can be used as a high temperature ceramic.

The most common synthesis method to make ZrP_2O_7 is chemical deposition of zirconyl chloride octahydrate ($ZrOCl_2 \cdot 8H_2O$) and phosphoric acid (H_3PO_4) followed by calcination.[14] The solid reaction method may, however, have some potential merits in the fabrication of ceramic matrix composites. Thus, in the present study, ZrP_2O_7 powder is prepared using ZrO_2 powders as the raw material.

On the other hand, the densification of this compound is difficult without the use of additives,[1,2] which promote the appearance of a liquid phase or a solid solution. Usually, the oxides MgO, SiO_2, Al_2O_3, Fe_2O_3, ZnO, CoO_2, Nb_2O_5, etc. are added individually or in combination to obtain a dense compact at a sintering temperature of 1200–1600°C. However, such additives also lead to exaggerated grain growth and microcracking of ZrP_2O_7, which will adversely influence its mechanical properties.

The purpose of this study is to synthesize the pure ZrP_2O_7 compound and to investigate the role of sintering additives, MgO and Al_2O_3, on the densification behavior, microstructure, and mechanical properties.

II. Experimental Procedures

(1) Starting Materials

The raw materials used in this study are as follows: zirconia powder (ZrO_2) (produced by Guangdong Orient Zirconic Ind. Sci. & Tech. Co. Ltd., Shantou, China), magnesia powder (MgO) (produced by Taicho Chemical Ind. Co. Ltd., Ako, Japan), alumina powder (Al_2O_3) (produced by Taimei Chemical Co. Ltd., Tokyo, Japan) and H_3PO_4. The particle size of the commercial ZrO_2 is approximately 0.5 μm and the morphology is shown in Fig. 1(a); its purity is up to 99.9%. From Figs. 1(b) and (c), it is observed that the average particle size of the commercial MgO and Al_2O_3 is approximately 200–300 nm; the purity is up to 99.9%. The particle size distributions were determined with a laser particle analyzer. The mass concentration of H_3PO_4 is 85% and the purity is up to 99.9%.

(2) Synthesis of ZrP_2O_7

Before elucidating the processing route, it is vital to highlight the importance of stoichiometry for this system. As described before,[15] the system can easily form undesired phases if the Zr:P molar ratio differs from the ideal value, especially before calcination. Thus, a precise molar ratio between ZrO_2 and H_3PO_4 of 1:2 is used in synthesizing ZrP_2O_7 powder. This is equivalent to a mass ratio of 1:1.87.

The ZrO_2 powder and H_3PO_4 are uniformly stirred and the mixture is heated at 250°C for 2 h. ZrO_2 reacts gradually with H_3PO_4 when the Zr:P molar ratio is 1:2 and ZrP_2O_7 is achieved as a final product. A fine powder is obtained after vibratory grinding with zirconia media.

(3) Preparation of ZrP_2O_7 Ceramics

MgO powder is used at concentrations of 1, 2, 3, and 5 wt% as the first sintering additive and, for comparison, Al_2O_3 powder is used at concentrations of 1, 3, and 5 wt% together with 2 wt%

P. Brown—contributing editor

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‡Author to whom correspondence should be addressed. e-mail: sqqf@263.net

CONFIDENTIAL Lavernia_00191

Hello! I am Enrique J. Lavernia, distinguished professor, dean of College of Engineering, University of California, Davis, US. I earned my Bachelor's degree in Solid Mechanics from Brown University in 1982, Master of Science degree in Metallurgy from the Massachusetts Institute of Technology in 1984, and got the Ph.D. degree in Materials Engineering in 1986 and continually engaged in postdoctoral research at Massachusetts Institute of Technology. I have been working as the full professor and dean of college of Engineering, University of California, Davis, since 2002. Currently, I am the member of National Academy of Engineering, United States and the chief editor of "Materials Science and Engineering, A: structural materials". My research work focuses on synthesis and behavior of nanostructured and multi-scale materials with particular emphasis on processing fundamentals and physical behavior, thermal spray processing of nanostructured materials, spray atomization and deposition of structural materials, high temperature-high pressure atomization processes, and mathematical modeling of advanced materials and processes.

In 2006, I was granted the guest professor of Wuhan University of Technology. Since then, I have been working with Prof. Lianmeng Zhang's group and we have got several collaborative achievements, in terms of accepting visiting Ph.D. students from Wuhan University of Technology, co-publishing high quality journal papers, co-applying bilateral research projects, and developing ceramics/metals composites processing technologies, such as cryomilling technology and spark plasma sintering technique in Wuhan University of Technology. Early in 2013, I was granted as the "strategic scientist – the highest level of foreign expert in Wuhan University of Technology" due to my continuously collaboration with them.

In the next few years, we have discussed in mutual to focus on developing "**Advanced technology for multimodal and multiscale materials synthesis and processing**", especially the structural-functional (thermal & electrical property) materials with light weight and high strength, such as heat sink materials, thermal control materials, and conductive materials. Key areas of focus could be as follows: (1) Processing technology of multimodal and multiscale materials; (2) The effect of multimodal and multiscale structure on the mechanical properties; (3) The effect of multimodal and multiscale structure on the functional properties.

Learned from both of my colleagues in Wuhan University of Technology and online information, I know the "1000 Foreign Experts Plan", granted by the State Administration of Foreign Experts Affairs, the P.R. of China. Because of the strong support from Wuhan University of Technology,

I am willing to apply for “1000 Foreign Experts Plan” in this year through Wuhan University of Technology. In this way, I believe we can further our collaborations between our two universities and we can start a specific research on Materials Science and Engineering in the future. I also promise to finish all the expected achievements listed in the application form.

WUT NEWS

Prof. Enrique Lavernia the 2016 "Bell Award" Winner

On September 29, the 67th anniversary of the founding of the People's Republic of China and award ceremony of "Bell Award"for the outstanding foreign experts was held by Hubei Provincial People's Government. 12 foreign experts were awarded "Bell Award" for outstanding foreign experts in Hubei Province in 2016 to commend their outstanding contribution for Hubei economic construction and social development. Enrique Lavernia, expert of "1000 Foreign Talents Program" and strategic scientist of WUT, and dean of the International Demonstration School of Materials Science and Engineering, was awarded with the glory. Wang Xiaodong, Vice secretary of Hubei provincial party committee and acting governor of Hubei Provinceawarded the "Bell Award" for outstanding foreign experts to Prof. Lavernia. Vice President Zeng Chunnian, and the winner of "Bell Award" in 2013Prof. William Price of WUT were invited to the ceremony.

Professor Lavernia, as the foreign expert of "1000 talents plan" for the import of high-level foreign experts of the Organization Department of the Central Committee of the CPC, overseas academic master of Discipline Innovation of the preparation technology and engineering applications the function Filmadvanced materials of Key Talents import Project "111 Program" by the Ministry of Education and Bureau of Foreign Experts Affairs,has had a long-term cooperation with WUT and has achieved fruitful results in scientific research, exchange visits, and personnel training. Lavernia was appointed as our strategic scientist in 2013. In 2014, he was elected as the National Thousand Talents Program (for overseas experts). Since 2015, he has been hired as the Dean of the International Demonstration School of Materials Science and Engineering. He has been honored as the Outstanding Foreign Expert of the Year in Hubei Province in 2016 for his outstanding achievement in cooperating with our university.

"Bell Award" is an award established by the People's Government of Hubei Province in accordance with the relevant provisions of "incentives for foreign experts" by State Bureau of Foreign Experts to reward foreign expertswho have shown selfless dedication, and have a good reputation and greater social impact and have made outstanding contributions to economicconstruction and social development in various fields in Hubei Province. It is thehighest award for foreign expertsfrom People's Government of Hubei Province.

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Contact: waishi@whut.edu.cn Created by webmaster@whut.edu.cn

From: Fei Chen
Sent: Wednesday, May 2, 2018 12:43 AM
To: Yizhang Zhou
CC: Prof. Lavernia
Subject: Re: Re: Candidate Profile Acadamician
Attachments: 20180502 Nomination Form.doc

Dear Yizhang,

Today, President Qingjie Zhang told me that he has discussed with Prof. Lianmeng Zhang about the nomination/referee academicians from Chinese Academy of Engineering for Prof. Lavernia's 2019 CAE foreign member. Currently, we have found 7 CAE members who can vote for Prof. Lavernia, including:

Lianmeng Zhang, Desheng Jiang (Wuhan University of Technology)
Dequn Li (Huazhong University of Science and Technology)
Fusheng Pan (Chongqing University)
Zuoren Nie (Beijing University of Technology)
Pingkai Ouyang (Nanjing Tech University)
Ji Zhou (Tsinghua University)

Please note that every current CAE member only can vote 1 time for foreign CAE members. So the competition to get their vote is fierce. In order that Prof. Lavernia could have the successful election for 2019 CAE foreign member, could you please ask several of your/Prof. Lavernia's or any other old friends who are current CAE members to vote for Prof. Lavernia? After contacting with them for their confirmation, could you please let me know the additional CAE members that could vote for Prof. Lavenria? So that I will also let president Qingjie Zhang and Prof. Lianmeng Zhang know. We have plenty of time to prepare but I hope to make it in the year 2019. Thank you.

Also, please find the attached nomination form, please check it again and modify accordingly and send back to me your edits. We could discuss it in detail this month in UK.

best wishes,

Fei

Recommended by President Qingjie Zhang:
Wuhan University of Technology: Lianmeng Zhang, Desheng Jiang
Huazhong University of Science and Technology: Dequn Li
Chongqing University: Fusheng Pan
Beijing University of Technology: Zuoren Nie
Nanjing Tech University: Pingkai Ouyang
Tsinghua University: Ji Zhou

Recommended by Prof. Lavernia:
Beihang University: Huibin Xu, Huaming Wang
Beijing Institute of Aeronautical Materials (BIAM): Xiangbao Chen
University of Science and Technology Beijing: Jianxin Xie
Shanghai Jiaotong University:
Northwestern Polytechnical University:

Look forward to your reply.
Fei

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Fei Chen, Ph.D.
Professor
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http://www.journals.elsevier.com/materials-science-and-engineering-a/
E-mail: chenfei027@gmail.com
==========
On 2018-04-17 00:29:50, Yizhang Zhou <yizhangz@uci.edu> wrote:

Dear Fei,

Attached please find one document with 15 significant publications, and another one (nomination form) with more suggested changes/updates.

Please let me know if there are any questions.

Thank you,

Yizhang

On Sun, Apr 1, 2018 at 5:37 PM, Fei Chen <chenfei027@whut.edu.cn> wrote:
Dear Prof. Yizhang,

WUT would like to help Prof. Lavernia for the election of Chinese Foreign Academician of Chinese Academy of Engineering next year. Attached please find the nomination forms as requested. I have filled in the forms. Please help modify it and let's work together for this significant nomination. Thank you. I would like to discuss with you in May when we meet in Oxford.

best wishes,

Fei
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==========
Fei Chen, Ph.D.
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http://www.journals.elsevier.com/materials-science-and-engineering-a/
E-mail: chenfei027@gmail.com
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Foreign Academician of Chinese Academy of Engineering

Candidate Nomination Form

(2019 Calendar Year)

Name of Nominee: **Enrique J. Lavernia**

Citizenship: **U.S.A.**

Subject: **Materials Science and Engineering**

Printed by the Chinese Academy of Engineering

Name: Enrique J. Lavernia **Gender:** Male **Date of Birth:** [redacted]

Citizenship: U.S.A. **Professional Title:** Professor

Address: 509 Aldrich Hall, University of California, Irvine, Irvine, CA 92697-1000

Full Name of the Employer: University of California, Irvine

Educational Qualifications:

- 06/1987: Postdoctoral, Materials Science and Engineering, Massachusetts Institute of Technology,
- 02/1986: Ph.D., Materials Science and Engineering, Massachusetts Institute of Technology
- 02/1984: M.S., Metallurgy, Massachusetts Institute of Technology
- 06/1982: B.S., Solid Mechanics, Brown University

Academic Background:

- 2017: Member, National Academy of Inventors, United States
- 2014: Fellow, The Minerals, Metals and Materials Society (TMS), United States
- 2013: Member, National Academy of Engineering, United States
- 2013: Fellow, Materials Research Society, United States
- 2011: Member, Global Engineering Deans Council, United States
- 2006: Fellow, American Society of Mechanical Engineers (ASME), United States
- 2003-2004: Member, National Science Foundation Directorate for Engineering Advisory Committee, United States
- 2002-2004: Member, National Materials Advisory Board, United States
- 2000: Fellow, American Association for the Advancement of Science
- 1998: Fellow, The Materials Information Society International (ASM)
- 1998 – present: Editor-in-Chief, Materials Science & Engineering A
- 1996 – 2002: Co-editor-in-Chief, Journal of Materials Synthesis and Processing

- 1992 – present: U.S. National Natural Science Foundation, U.S. Office of Naval Research special project fund, U.S. Army Research Office special project fund and NASA special project fund
- 1992 – present: Person-in-charge of various projects including U.S. National Natural Science Foundation, U.S. Office of Naval Research special project fund, NASA special project fund, U.S. Department of Energy projects, Military Research Office projects and National Laboratory projects

Fellow of the national academy of engineering and/or academy of sciences in the host country: Yes (Fellow of the National Academy of Engineering and Fellow of the National Academy of Inventors)

Major achievements and awards in engineering science and technology:

Publications

- Published 596 international major journal papers, 230 papers in conference proceedings, and 37 invited papers
- One monograph, 20 co-authored books, and 9 book reviews
- 166 invited international academic lectures (17 different countries)
- 10 U.S. patents granted

Awards

- 2018: Distinguished Engineering Educator Award, U.S. National Engineers' Council
- 2017: Friendship Medal, People's Republic of China
- 2016: Leadership Award, U.S. The Minerals, Metals and Materials Society (TMS)
- 2016: Advance Research Award, Alexander von Humboldt Foundation
- 2016: Chime Bell Award, Hubei Province, People's Republic of China
- 2015: Distinguished Professor, the University of California, Irvine
- 2015: Hispanic Engineer National Achievement Awards (HEENAC), Great Minds in science, technology, engineering and mathematics (STEM)
- 2013: Edward DeMille Campbell Memorial Lectureship, The Materials Information Society International (ASM)
- 2013: ASM Gold Award, The Materials Information Society International (ASM)
- 2011: Hispanic Engineer National Achievement Awards (HEENAC), Great Minds in science, technology, engineering and mathematics (STEM)
- 2011: Distinguished Scientist, Society for Advancement of Chicanos and Native Americans in Science (SACNAS)

- 2011: Top 200 Most Influential Hispanic-Americans in Technology, Hispanic Engineer & Information Technology magazine
- 2010: Miegunyah Honorary Professor, University of Melbourne, Australia
- 2007: Distinguished Professor, UC Davis
- 2006: Honorary Member, The Materials Research Society of India
- 2005: Outstanding Engineering Alumnus Medal, Brown University
- 2002: Highly Cited Researcher, Institute for Scientific Information (ISI), Citation Impact for Research in Materials
- 2002: Chancellor's Professor, the University of California, Irvine
- 1995: Fellowship, Alexander Von Humboldt Foundation

Major contributions to the engineering and technology undertakings of China:

Professor Enrique Lavemia's research interests have ranged across the entire field of materials science and engineering. He has long been engaged in the basic research of synthesis and physical behavior of nanostructures and multiscale materials, thermal spray processing of nanostructured materials, spray atomization and deposition of structural materials, high temperature-high pressure atomization processes, rapid solidification, laser engineered net shaping technology for structural materials (additive manufacturing technology), structural design and formation mechanism of new high-entropy alloys, and simulation of advanced materials and synthetic processes. He has profound academic attainment and significant international influence in nanomaterials, structural materials, and thermal spray technology. Professor Lavernia developed a multiphase, multiscale composite material preparation process to synthesize nanocrystalline (reinforced) and coarse-grained (enhanced plasticity) multiscale nanocomposite new materials with enhanced tensile strength and high ductility for the first time, breaking from the traditional concept of nanomaterials design and preparation technology and opening the way for the application of this new nanomaterial in both military and civilian fields. Professor Lavernia introduced spray deposition technology into the preparation process of metal materials, wrote the first and also the most classic book on spray deposition technology - Spray Atomization and Deposition, and successfully developed a new Al-Si alloy (aluminum-silicon alloy) and related materials. He used simulation and advanced

sensing technology to reveal the latent heat, flow and solidification mechanism during spray deposition, clarified the formation and control mechanism of the primary Si phase with unique morphology, greatly improved the wear resistance and strength of Al-Si alloy (aluminum-silicon alloy), and successfully commercialized this Al-Si alloy (aluminum-silicon alloy) worldwide. So far, he has published more than 800 high-level research papers and 20 books and has been invited to 166 academic lectures internationally.

During the 12 years since his cooperation with the Wuhan University of Technology, Professor Enrique Lavernia has cooperated with the team of Professor Lianmeng Zhang, the chief professor of materials science, regarding major scientific problems and engineering applications in the field of lightweight, high-strength and structural/functional integrated advanced composite materials. They have made significant progress in high-entropy alloys, amorphous co-fusion and thin-film forming, as well as multiphase, multiscale aluminum-based and zirconia-based composites and their preparation techniques. They have established a joint laboratory with the world's first-class equipment and a joint research team, jointly published many high-level papers, and introduced and cultivated a lot of outstanding talents.

I. Lead China to develop new materials and technologies for cutting-edge defense weapons and equipment, such as nanomaterial synthesis, multiscale fine structure control, as well as additive manufacturing technology and continuously narrow the technology gap with more advanced countries.

In recent years, various research and technical levels in China have developed rapidly, and the levels of scientific research in many fields are approaching those of developed countries. The "13th Five-Year" National Science and Technology Innovation Plan provides a guide for China to advance into the ranks of most technologically innovative countries, and the strategic emerging industries and national defense construction have put forward higher demand for new materials. In particular, guided by the strategy of supporting innovation-driven development and serving economic and social development, the construction of "world-class universities and first-class disciplines" aims to rank among the top international leaders and built top universities, placing additional demands on Chinese scientific researchers. China has advanced scientific research equipment and top-class research and development capabilities; however, the practice of independent innovation and development of new materials and the application of high-end materials are difficult challenges faced by the entire material field. In areas such as cutting-edge national defense materials and manufacturing techniques, additive manufacturing, low-temperature rapid densification of structural materials, fine-tuning of multiscale material microstructures, and high-performance coating materials and applications, there exist a large technological gap between

China and developed countries, such as the United States. Therefore, to stimulate the innovation vitality of research in China, we urgently need the guidance of international success models as well as foreign senior scientific research personnel to share their valuable experience in grasping the world's cutting-edge technology, researching and developing new materials, and transforming the applications and achievements.

All countries attach great importance to the key new material technology of national defense, which the United States ranks as first of the key technology in its National Key Technology report. China still has obvious weaknesses in the development of new material technology as the material basis for defense-oriented weapons and equipment, and we still have a lot to learn concerning the structural flexibility and performance stability of new materials with special functions in extreme service environments. The common basic scientific problems such as the dynamic evolution and control mechanism of composite structure and service performance of materials have not been fully understood, and the functional design, synthetic preparation, structural control, and application evaluation supporting the development of new materials and the key technical problems in the process remain to be solved. Additive manufacturing (or 3D printing) originated in the United States, the world's top technology leader. At present, with the world's most advanced additive manufacturing technology, the United States is at the forefront of the world in military, aerospace, medical, industrial, and civilian applications. The industrialization of additive manufacturing in China is still in its infancy, with a considerable gap from the developed countries. A complete industrial system has not yet been formed, and there is still a certain distance from realizing large-scale industrialization and engineering application. Accelerating the development of additive manufacturing technology and building an industrial scale as soon as possible is of great significance for promoting the transformation and upgrading of China's manufacturing industry and realizing a substantive leap of "Made in China 2025". With their unique size effect, multiscale materials have successfully solved the scientific and technical problems of the inverse relationship between material strength and toughness or plasticity. Reducing vehicle weight and fuel consumption depends heavily on the development and application of high-performance multiscale materials. The U.S. Navy and the Boeing Company have made full use of this technology to achieve lightweight structural materials. This key technology has profound practical significance for China's aerospace technology development and modern defense construction. It will effectively help to facilitate industrial breakthroughs in high-end equipment and new materials. Also, compared with more advanced countries, China still has a way to go in terms of aero-engine turbine blade coating

materials and long-term high-temperature creep performance, which is also a key bottleneck problem that has restricted the application of aviation engines in China for a long time.

Professor Enrique Lavemia is a Member of the U.S. National Academy of Engineering and a Member of the U.S. National Academy of Inventors. He has long been engaged in the research of synthesis and physical behavior of novel nanostructures and multiscale materials, thermal spray processing of nanomaterials, spray atomization and deposition of structural materials, and laser engineered net shaping technology (additive manufacturing technology) of structural materials. After decades of hard work, his research team has possessed world-class capabilities of independent innovation and research and development, holding a number of influential patents in material synthesis, multiscale fine structure modification, and performance improvement. Their research results have been successfully applied by the U.S. Navy and the General Electric Company and in various fields, including aero-engine turbine blade coating. Professor Enrique Lavernia is the successor of pulsed electric current sintering (later developed into spark plasma sintering) technology. His research team has several innovative achievements in the sintering densification of multi-component, complex, and volatile materials and spark plasma sintering technology. They also have remarkable cumulative results in the microstructure characterization, analysis, and control of ceramic materials and phase transition process, as well as precise regulation of the valence state of doping elements in a phase transition.

II. Conduct international academic cooperation closely with the Wuhan University of Technology, build a high-level international laboratory, jointly undertake the major projects of international science and technology cooperation of the Ministry of Science and Technology, and guide the research of China's national-level major scientific research projects.

(1) Jointly undertake major national projects in international cooperation with the Wuhan University of Technology

With the continuous efforts of Professor Enrique Lavernia, the two universities have found a point of entry for cooperation and carried out substantive collaboration in the controllable synthesis of nanostructures and multiscale materials, the preparation of ceramic matrix composites, and the physical deposition technology of coating materials. In 2011, as the main person in charge of the foreign party, Professor Enrique Lavernia cooperated with Professor Qiang Shen of the Wuhan University of Technology to jointly undertake the major project of

international science and technology cooperation of the Ministry of Science and Technology (Cooperative Study on Preparation Technology of Tin Oxide Bismuth Ceramic Target Materials and Transparent Conductive Film (2011DFA52650)), and made important progress in the development of new transparent conductive film materials and its advanced preparation technology. During this period, he guided and recommended for publication the academic papers of professors of our university, and the papers were published in reputable foreign journals. The project was approved and accepted by the expert group of the Ministry of Science and Technology in June 2015.

In addition, as a foreign academic master and the responsible person of the foreign party, Professor Enrique Lavemia played a crucial role in the construction and implementation of the approved project of our university in 2013 - Discipline Innovation and Introduction Base of Advanced Preparation Technology and Engineering Application of Functional Film New Materials ("111 Plan", B13035).

(2) Made significant contributions to the establishment of an international partnership for productive academic exchanges

The Wuhan University of Technology aims to build a world-class discipline – material science and engineering (a national key discipline of the first-level discipline). As early as more than ten years ago, Professor Enrique Lavemia established a close cooperative relationship with Professor Lianmeng Zhang and Professor Fu Zhengyi of our university. The Wuhan University of Technology and the University of California, Davis built a joint laboratory for ultra-fine crystal materials in July 2012. In March 2012, the Wuhan University of Technology hired Professor Lavemia as Strategic Scientist (this is the top talent project for our university to implement the development strategy of talented university, aiming at introducing 10 top international scientists to lead and help the university's development), which laid a solid foundation for deeper cooperation between the two parties in the future. He has visited our university many times, gave academic presentation for our teachers and students, and brought key technologies of controllable synthesis of nanostructures and multiscale materials, supersonic oxygen fuel spraying of ultrafine-grained materials, and composite element doped modified ceramic matrix composites to the relevant research team of our university. He took as many opportunities as possible to introduce the latest research results to the researchers of our university, helped solve difficult problems, and guided the national key scientific research projects of the National Key Laboratory of our university. Under his efforts, our university has managed to keep up with the world's latest and most advanced research level in the field of materials science and engineering research, maintain a leading domestic level, and cultivate a group of research backbone teachers for the National Key Laboratory of Materials Composite New Technology. At the same time, Professor Enliek Lavernia recommended Professor Julie Schoenung from the Department of Chemical and Materials Science at UC Irvine

and Professor Zuhair Munir from the Department of Chemical and Materials Science at UC Davis and Professor Subbash Mahajan (Member of U.S. National Academy of Engineering) to visit our university and conduct academic exchanges and communication. Professor Enrique Lavemia actively built a platform for exchanges between different university teams in the two countries. He has hosted many academic exchange teams from China to the United States and made positive contributions to the exchanges between scholars and researchers of the two countries.

In September 2016, President Qingjie Zhang of the Wuhan University of Technology and Professor Enrique Lavernia, Executive Vice President of the University of California, Irvine, signed an agreement on the inter-school cooperation framework and an agreement on building a joint laboratory for international cooperation in materials composite new technology and new materials.

III. Lead the construction of the International Model College of Materials Science and Engineering of the Wuhan University of Technology, effectively assist our university in promoting the reform of cultivating top-notch innovative talents, and significantly improved the international reputation of the materials discipline of our university.

(1) A leader of Materials Science discipline and international engineering education at the Wuhan University of Technology

As Member of the U.S. National Academy of Engineering and Member of the U.S. National Academy of Inventors, Professor Enrique Lavemia is a renowned scientist with an international reputation in the field of advanced composites and nanocrystalline composites. As the Distinguished Professor of “1000 Foreign Experts Introduction Plan” at the Wuhan University of Technology, he pays close attention the material research at our school. Through multiple visits to our university and joint training of young researchers and graduate students, Professor Enrique Lavernia not only introduced the latest achievements and cutting-edge dynamics of international advanced composite materials and their preparation technology to our researchers, but also pointed out the development direction for our scientific researchers considering the current research situation of our university, provided strategic guidance, and guided the research of national key scientific research projects of our National Key Laboratory.

Also, Professor Enrique Lavernia has been the Dean of International Model College of Materials Science and Engineering at Wuhan University of Technology since December 2015. He has been actively involved in the discipline development, future planning, and undergraduate internationalization program construction of the International Model College of Materials Science and Engineering. He also introduced our university’s

International Model College to other universities and outstanding professors in the material field, in order to attract famous foreign professors to join our International Model College. Under his strong recommendation, Professor Subbash Mahajan (University of California, Davis), Member of the U.S. National Academy of Engineering, and Professor Diran Apelian (Wuster Institute of Technology), Member of the U.S. National Academy of Engineering have joined the International Model College, and Professors Donald Sadoway (Massachusetts Institute of Technology), Professor James Shackelford (University of California, Davis), and Dr. Jim Olson (a guest lecturer at Stanford University and the University of California, Davis) came and taught undergraduates at the International Model College.

Under Professor Lavemia's strong recommendation, in October 2016, China's first international Material Advantage Chapter (jointly established by American Ceramic Society, American Iron and Steel Institute, International Metals Society, and The Minerals, Metals and Materials Society) was established at the International Model College of Materials Science and Engineering of the Wuhan University of Technology. Based on the International Model College of Materials Science and Engineering of the Wuhan University of Technology authorized by the national "Higher Education International Model Promotion Plan", the Chapter aims to train the "top-notch innovation and compound talents" and enable the Wuhan University of Technology chapter to be directly connected to the International Material Advantage. Through the cooperation and competition with international materials students, the interest in material studies have been stimulated, the awareness of academic innovation has been raised, the international vision has been significantly expanded, the cultural atmosphere of distinctive technological innovation has been created, and the international reputation of the Materials Science discipline of the Wuhan University of Technology has been further improved.

(2) Trained many high-level scientific talents for the Wuhan University of Technology

Professor Enrique Lavernia has trained and delivered many outstanding management and research talents for China by providing access to the most advanced research facilities in the world. Professor Enrique Lavernia invited Professor Zhengyi Fu and Professor Yucheng Wang of our university in 2005 and 2007 to visit and conduct cooperative research. Based on this, the two universities carried out collaborative research in various aspects such as advanced multiscale composites, physical vapor deposition of thin films, and ceramic thermal/cold spray technology. Upon the recommendation of Professor Enrique Lavernia, Professor Chuanbin Wang, Dr. Fei Chen, and Dr. Meijuan Li and Ph.D. students Jianrong Song, Longjia Wu, Chuantong Wu, and Zhifeng Huang visited the University of California, Davis and University of California, Irvine from 2007 to 2016, mainly engaged in ultra-fine crystals, nanocrystalline high-

entropy alloy, amorphous co-fusion and thin-film forming, multiphase, multiscale aluminum-based and zirconia-based composites and their preparation techniques, and grain boundary simulation calculation based on first principles and molecular dynamics. During their visit, all of them were tirelessly instructed by Professor Enrique Lavernia and achieved excellent results by publishing multiple high-level research papers.

Professor Enrique Lavemia introduced Professor Yaojun Lin (Ph.D. of the University of California, Irvine and Distinguished Professor of the “Hundred Talents Program” of Hebei Province) to the Wuhan University of Technology and recommended Professor Fei Chen to be the Editor of Materials Science and Engineering A, a major international journal of Elsevier.

Under the guidance of Prof. Enrique J. Lavernia, our university has jointly published 37 high-level papers with him in the major international journals of structural materials, including Journal of American Ceramic Society, ScriptaMaterilia, Materials Science and Engineering A, and Journal of Alloys and Compounds, etc.; applied for five patents, and published a number of high-impact academic papers through bilateral cooperation with our researchers.

(3) Facilitated the development of the inter-school partnership between the Wuhan University of Technology and the University of California, Davis and the University of California, Irvine respectively

In July 2012, Professor Lavernia promoted the agreement to establish the WUT-UC Davis Joint Laboratory of Advanced Composite Materials between the Wuhan University of Technology and the University of California, Davis, confirmed the construction site of the joint laboratory, and conducted research and discussion on the materials preparation and processing equipment, structural analysis and characterization equipment, and performance testing equipment to be purchased. In September 2016, President Qingjie Zhang of the Wuhan University of Technology

and Professor Enrique Lavernia, Executive Vice Chancellor of the University of California, Irvine, signed an agreement on the inter-school cooperation framework and an agreement on building a joint laboratory for international cooperation in materials composite new technology and new materials.

At the same time, Professor Enrique Lavernia, together with Academician Lianmeng Zhang, the chief professor of materials science at the Wuhan University of Technology, established a high-level international academic team composed of young scholars, including Professor Qiang Shen (Deputy Director of the National Key Laboratory of Materials Composite New Technology), Professor Chuanbin Wang (Visiting Scholar at Tohoku University, Japan and University of California, Davis), Professor Fei Chen (Visiting Scholar at University of California, Davis and Massachusetts Institute of Technology), Professor Junguo Li (Ph.D. of Tohoku University, Japan), Professor Guoqiang Luo (Visiting Scholar at Tohoku University, Japan), and Associate Professor Meijuan Li (Visiting Scholar at University of California, Davis).

In addition, while serving as Dean of College of Engineering of University of California, Davis and Executive Vice Chancellor of University of California, Irvine, Professor Enrique Lavernia actively promoted the two universities to conduct Chinese-Foreign Cooperation in the field of materials science, provide mutual supports with excellent resources in the undergraduate education, and adopt methods such as mutual recognition of credits and the 2+2 model to jointly cultivate outstanding undergraduates of the Wuhan University of Technology.

Representative research results and monographs, reports and bibliography that reflect major scientific and technological achievements, contributions, and academic level (no more than 15 articles). If there are collaborators in published works, please follow the order of author names at the time of publication):

Representative publications are as follows:

1. D.B. Witkin and E. J. Lavernia, “Synthesis and Mechanical Behavior of Nanostructured Materials via Cryomilling”, Progress in Materials Science, Vol. 51, No. 1, pp. 1-60, January 2006.
2. Y.H. Zhao, T.D. Topping, J.F. Bingert, A.M. Dangelewicz, Y. Li, W. Liu, Y.T. Zhu, Y.Z. Zhou and E.J. Lavernia, “High tensile ductility and strength in bulk nanostructured nickel”, Advanced Materials, Vol. 20, pp. 3028-3033, 2008.
3. Sheng Cheng, Yonghao Zhao, Yazhou Guo, Ying Li, Qiuming Wei, Xun-Li Wang, Yang Ren, Peter K. Liaw, Hahn Choo and Enrique J. Lavernia, “High Plasticity and Substantial Deformation in Nanocrystalline NiFe Alloys under Dynamic Loading”, Advanced Materials, Vol. 21, pp. 5001-5004, 2009.
4. P.V. Liddicoat, X.Z. Liao, Y.H. Zhao, Y.T. Zhu, M.Y. Murashkin, E.J. Lavernia, R.Z. Valiev and S.P. Ringer, “Nanostructure hierarchy increases strength of aluminum alloys”, Nature Communications, pp. 1-7, September 2010.
5. Ying Li, Zhihui Zhang, Rustin G. Vogt, Julie M. Schoenung and Enrique J. Lavernia, “Boundaries and Interfaces in Ultrafine Grain Composites”, Acta Materialia, Vol. 59, pp. 7206-7218, 2011.
6. Haiming Wen, Troy D Topping, Dieter Isheim, David N Seidman, and Enrique J Lavernia, “Strengthening mechanisms in a high-strength bulk nanostructured Cu-Zn-Al alloy processed via cryomilling and spark plasma sintering”, Acta Materialia, Vol. 61, pp. 2769-2782, 2013.
7. T. Hu, K.K. Ma, T. Topping, J. Schoenung and E. Lavernia, “Precipitation phenomena in an ultrafine-grained Al alloy”, Acta Materialia, Vol. 61, pp. 2163-2178, 2013.
8. Baolong Zheng, Dustin Ashford, Yizhang Zhou, Suveen N. Mathaudhu, Jean-Pierre Delplanque and Enrique J. Lavernia, “Influence of Mechanically Milled Powder and High Pressure on Spark Plasma Sintering of Mg-Cu-Gd Metallic Glasses”, Acta Materialia, Vol. 612, pp. 4414-4428, 2013.
9. Y.J. Lin, H.M. Wen, Y. Li, B. Wen, W. Liu and E.J. Lavernia, “An analytical model for stress-induced grain growth in the presence of both second-phase particles and solute segregation at grain boundaries”, Acta Materialia, Accepted August 2014.

10. L. Jiang, T. Hu, H. Yang, D. Zhang, T. Topping, E.J. Lavernia and J.M. Schoenung, “Deformation of a Ceramic/Metal Interface at the Nanoscale”, Nanoscale, Vol. 8, No. 20, pp. 10541-10547, April 2016.
11. Dalong Zhang, Haiming Wen, M. Arul M. Kumar, Fei Chen, Lianmeng Zhang, Irene Beyerlein, Julie M. Schoenung, S. Mahajan, Enrique J. Lavernia, “Yield symmetry and reduced strength differential in Mg-2.5Y alloy”, Acta Materialia, Vol. 120, pp. 75-85, August 2016.
12. Zhiqiang Fu, Weiping Chen, Haiming Wen, Dalong Zhang, Zhen Chen, Zheng, Baolong, Yizhang Zhou, Enrique J. Lavernia, “Microstructure and strengthening mechanisms in an FCC structured single-phase nanocrystalline Co25Ni25Fe25Al7.5Cu17.5 high-entropy alloy”, Acta Materialia, Vol.107, pp. 59-71, February 2016.
13. C.C. Koch, T.G. Langdon, E. J. Lavernia, “Bulk Nanostructured Materials”, Metallurgical and Materials Transactions A, pp. 1-19, September 2017.
14. Chuandong Wu, Kaka Ma, Dalong Zhang, Jialu Wu, Shuya Xiong, Guoqiang Luo, Jian Zhang, Fei Chen, Qiang Shen, Lianmeng Zhang, Enrique J. Lavernia, “Precipitation phenomena in Al-Zn-Mg alloy matrix composites reinforced with B4C particles”, Scientific Reports, Vol. 7, pp. 1-11, August 2017.
15. E.J. Lavernia and Y. Wu, Spray Atomization and Deposition, published by John Wiley and Sons Ltd., 1996, ISBN 0-471-95477-2.

Opinions of the nominator:

Recommended by President Qingjie Zhang:
Wuhan University of Technology: Lianmeng Zhang, Desheng Jiang
Huazhong University of Science and Technology: Dequn Li
Chongqing University: Fusheng Pan
Beijing University of Technology: Zuoren Nie
Nanjing Tech University: Pingkai Ouyang
Tsinghua University: Ji Zhou

Recommended by Professor Lavernia:

Beihang University:	Huibin Xu, Huaming Wang
Beijing Institute of Aeronautical Materials (BIAM):	Xiangbao Chen
University of Science and Technology Beijing:	Jianxin Xie
Shanghai Jiaotong University:	
Northwestern Polytechnical University:	

Signature of the Academician (seal):

Date: ____ (month) ____ (day), _____ (Year)

CONTRACT OF EMPLOYMENT

WUHAN UNIVERSITY OF TECHNOLOGY

(Photocopy not Accepted)

WUHAN UNIVERSITY OF TECHNOLOGY
Contract of Strategic Scientist's Appointment

Employer(Party A)
Name of the Employer: Wuhan University of Technology (WUT)
Legal Representative:ZHANG Qingjie

Employed Strategic Scientist(Party B)
Name: Enrique Jose Lavernia

This contract is hereby made and concluded by and between Party A and Party B in Wuhan, China, on the principle of equality and mutual benefit and through amicable consultation.

Article One Effective duration of the Contract

The appointment period for WUT strategic scientists is generally five years. The period of service will be from 9th January, 2013 to 8th January, 2018. After the expiration of this contract, the renewed appointment or re-appointment can be decided by both parties' mutual consent.

Article Two Employment Objective and Tasks for Party B

1. Make strategic, visionary and creative research proposals to guide the advancement of disciplines or scientific research institutes to become first class disciplines or scientific research institutes in China or the world, especially in frontier areas.

2. Supervise young teachers or researchers, receive them as visiting scholars. Guide or co-guide postgraduate students (including post-doctoral researchers), lead them to the international forefront of related fields, jointly publish academic papers in the world top international journals (in the name of WUT, and WUT faculty or students as the first author) or publish high-level academic monographs and guide

young teachers and researchers to win national awards or influential international academic awards.

3. Build up a Discipline Innovative Team, introducing and cultivating high-level talents to be as qualified as those of China's 1000 Young Talents Plan, Distinguished Professors of Chang Jiang Scholars and winners of National Science Fund for Distinguished Young Scholars.

4. Conduct national level important (key) projects or key international cooperation projects that meet China's national strategic development requirements or stand at the forefront of international science and technology research field.

5. Promote international exchanges and cooperation, and host or jointly host prominent international academic conferences in the name of WUT.

Article Three Rights and Obligations

I. Rights and Obligations for Party A

1. Provide Party B with service management according to the employment objective and tasks mentioned above.

2. Safeguard Party B's legal rights in accordance with Chinese laws.

3. Provide Party B with favorable working and living conditions, including:

① Party A shall provide research funds of 1 million Chinese Yuan per year for constructing laboratory, purchasing special experimental equipments and so on.

② International strategic scientist will be paid 50,000 USD per month. Party B' actual payment will be calculated according to Party B' actual work time in WUT on a weekly basis (pretax, government stipend included).

③Party A shall assist Party B to recruit team members.

④Party A shall create favorable conditions to enable Party B to recruit top-quality postgraduate students, doctoral students and postdoctoral researchers.

⑤Party A shall provide Party B with international round-trip ticket (business-class).

4. Once Party B gains a Chinese national government-sponsored position through successful application for other kind of Chinese talent-related projects, Party A shall adjust its payment terms to ensure that Party B enjoys more benefits on the principle of "prioritizes the higher payment", and the same payment terms will not be implemented twice.

II. Rights and Obligations for Party B

1. Party B shall respect all the rules and regulations made by Party A, and abide by laws, decrees and relevant regulations enacted by the Chinese government.

2. According to the stipulations of "WUT Strategic Scientists Appointment Regulations", Party B shall ensure the working hours in WUT. (The required working hours can be negotiable when significant contributions are made by Party B for the construction and development of Party A), and shall enjoy the remuneration and related benefits provided by Party A.

3. Party B shall fulfill WUT strategic scientists' position responsibilities, complete their work objectives and tasks on time, and accept Party A's evaluation and management.

Article Four Evaluation

The evaluation of Party B made by Party A shall be conducted according to "WUT Strategic Scientists Appointment Regulations".

Article Five Revision and Cancellation of the Contract

1. Party A has the right to terminate the contract if Party B fails to fulfill the obligations specified in the contract during the employment period.

2. If Party B wishes to terminate the contract due to special reasons, notice must be presented to Party A at least three months in advance, and

only with Party A's consent can the contract be terminated.

3. If the contract needs to be revised or cancelled due to unforeseeable or unpreventable circumstances or events, both parties should handle it properly according to relevant regulations.

Article Six Supplementary Articles

1. This contract is executed in triplicate to be held by Party A, Party B and Party B's work place in WUT respectively, which shall become valid from the date of both parties' signature/seal.

2. What is left unmentioned in this contract can be written down as additional regulations based on both parties' consent after consultation. The additional regulations shall have the same legal effect as this contract.

Party A:
(Signature)

Party B:
(Signature)

Date of the signature

Jan 8, 2013

Date of the signature:

January 8th 2013

NAE academician appointed as Honorary Professor of SCUT

June 09,2015 17:09:28 readCount:672

On May 27, the inauguration ceremony of Professor Enrique J. Lacenmia as the Honorary Professor of SCUT was held in the meeting room of Building No. 29, Wushan Campus. President Wang Yingjun attended the ceremony and granted the letter of appointment to Professor Lavernia. After that, Professor Lavernia gave his inaugural lecture titled "Nanostructured Materials: from the nanoscale to the microscale".

President Wang (right) granting the letter of appointment to Professor Lavernia

Professor Lavernia is academician of the National Academy of Engineering of the United states, distinguished professor of University of California, Davis (UC Davis) and the dean of Institute of Technology at UC Davis. He is also the chief editor of the Journal of Materials Science and Engineering: A.

In 2014, he was selected into the list of the Thousand Talent Plan, which is a national recruitment program of global experts initiated by the Chinese government. He is well known for his academic accomplishments and international reputation in the fields of nano materials, metallic material and thermal spray technology.

Professor Lavernia giving his inaugural lecture

The guests of the ceremony also include representatives from School of Mechanical & Automobile Engineering and other schools.

Chinese version written by Wang Fen and Xia Lingling
Translated by Wen Qiang and Xie Ruizhen
Reviewed and edited by Xu Peimu
From the SCUT News Network

CLOSE

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From: Enrique Lavernia
Sent: Tuesday, January 2, 2018 10:19 AM
To: Fei Chen
Subject: Re: Happy 2018

Thank you Fei and yes let it be a super happy and prosperous 2018!

Enrique J. Lavernia, Ph.D
Provost and Executive Vice Chancellor Distinguished Professor, Chemical Engineering and Materials Science
509 Aldrich Hall
University of California, Irvine
Irvine, CA 92697-1000

Phone: (949) 824-6296
Fax; (949) 824-2438

provost@uci.edu

On Jan 2, 2018, at 7:11 AM, Fei Chen <chenfei027@whut.edu.cn> wrote:

> Dear Prof. Lavernia,
>
> Happy new year 2018!!
>
> I just checked your WUT account. Yes, it is there, the payment for 4th quarter ISMSE payment is RMB 63100. I will wire it to you tomorrow.
>
> --
> ==========
> Fei Chen, Ph.D.
> Professor
> State Key Lab of Advanced Technology for Materials Synthesis and Processing
> Wuhan University of Technology, Wuhan 430070, P. R. China
> Tel: +86-13808629168
> Fax: +86-27-87879468
> http://www.journals.elsevier.com/materials-science-and-engineering-a/
> E-mail: chenfei027@gmail.com
> ==========
>
> 在 2018-01-02 23:06:36, Enrique Lavernia <[redacted]> 写道：
>
> Dear Fei, happy 2018 this new year of the Dog will be special for WUT
>
> Fei, can you please check on the WUT international school payments? Per your schedule there was supposed to be a payment in December, but as I checked bank records for the first of the year it has not been received. Thxs

Looking forward to our trip. E

Enrique J. Lavernia, Ph.D.
Distinguished Professor, Chemical
Engineering and Materials Science
509 Aldrich Hall

University of California, Irvine
Irvine, CA 92697-1000

Editor-in-Chief, Materials Science and Engineering A

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EMPLOYMENT CONTRACT of "ONE THOUSAND TALENT" HIGH LEVEL FOREIGN EXPERT

Printed by

Wuhan University of Technology

(Photocopy not Accepted)

EMPLOYMENT CONTRACT of "ONE THOUSAND TALENT" HIGH LEVEL FORTIGN EXPERT

Employer (Party A): Wuhan University of Technology

Leagal Representative: Zhang Qingjie

Address: No. 205, Luoshi Road, Wuhan City, Hubei, 430070 P.R. of China

Employee (Party B): Enrique Jose Lavernia

Gender: Male

Date of birth: July 30th, 1960

Nationality: United States of America

Passport No.: [redacted]

Overseas Address: 1021A Kemper Hall, University of California, Davis, CA 95616

Telephone Number: 001-530-752-4964

Fax Number: 001-530-754-7102

Both parties , in line with the principles of legality, fairness, equality, and mutual agreement, to ensure the implementation of "One Thousand Talent" high level foreign expert plan, and to guarantee the legal rights and obligations of both parties, based on Chinese laws and rules concerned, agree to sign this contract.

I. Duration of the Contract

The term of this contract will be 3 years since the date of signature. Both parties can sign the new contract through consultation and mutual consent after the contract is upon expiration with the permission of superior authorities department.

II. Party B's employment objectives and tasks

1. Party B's employment objectives on the position during the implementation of the contract.

Party B is supposed to grasp the international frontier and developing direction in the field of multiphase and multiscale functional composite materials and coating materials, to raise the scientific conception with forward-looking, strategic and innovative scientific idea. Party B is supposed to make Party A to be the scientific base of scientific research, talents cultivation

and international cooperation with important influence. Party B is supposed to get influencing research achievements, to build a high level innovative research team and to cultivate a group of young and middle-aged academic backbone researchers and excellent Ph. D students.

2 . Party B's work tasks during the implementation of the contract.

(1) Scientific research

Party B shall face to the needs of the national strategy and the frontier of international science and technology, to organize the scientific team members to apply and undertake at least one national major projects, key projects or international cooperation projects, and to publish 10~15 high level articles in the renowned and important international academic journals in the name of Wuhan University of Technology, and to declare 3-5 national or international invention patents, and strive to obtain national or provincial scientific and technological awards.

(2) Scientific Team construction

Party B shall build a scientific team with strong ability of research and innovation in his field and introduce and cultivate Cheung Kong Scholars and high level talents such as National Outstanding young scientific fund winners.

(3) Talents Cultivation

Party B shall guide 1~3 distinguished young scholars and 2~4 doctoral students of Wuhan University of Technology and help them to publish systematic articles in the international renowned journals. And Party B shall guide young teachers to obtain national awards for outstanding scientific research achievements or important international academic awards.

(4) International Exchange and Cooperation

Party B should organize or co-organize 1~2 predominant international conferences in his field in the name of Wuhan University of Technology. Party B shall invite 2~3 international top scientists to work in the lab as visiting scholars or give lectures.

III. Rights and Obligations

1. Party A's rights

(1) Party A shall manage Party B's work according to the employment objectives and tasks on the basis of the working instructions of "One Thousand Talent" high level foreign expert plan.

(2) Party A shall conduct regular evaluation of Party B's work according to the Chinese Laws and regulations of Party A.

2. Party A's Obligations

(1) Party A shall respect Party B's legal rights.

(2) Party A shall provide Party B with necessary working and living conditions.

a. Working and lab conditions: Party A shall provide Party B with working and lab conditions according to Party B's requirement

b. Funding for science research supporting: Party A shall provide Party B eight million Chinese Yuan (8,000,000RMB) including three million from national funding during the term of this contract to the construction of new direction and infrastructure construction, equipments and instruments purchasing. This amount of money shall be managed by Party A, Party B can use it after discussing with the co-professor from Party A.

c. Academic team construction condition: Party A shall construct academic team according to Party B's requirement and provide one million Chinese Yuan (1,000,000RMB) as the funds of academic team construction each year. The funds shall be mainly used as the payment, accommodation, and travel expense of Party B and the team members. This amount of money shall be managed by Party A, Party B can use it.

d. Payment and living conditions: Party A shall provide Party B with fifty thousand U.S. Dollars ($50,000) a month, (pre-tax) paid according to his working time in Wuhan University of Technology. Party A shall provide Party B with one million Chinese Yuan (1,000,000RMB) (after tax) as living allowance which will be paid 1/3 annually for three years.

e. Party A shall provide Party B with necessary conditions to supervise postgraduates, doctor candidates, post-doc researchers and visiting professors. The person shall be recommended by Party A, and then examined and chosen by Party B.

(3) Party A shall provide policy and related support in the university to ensure Party B to fulfill the obligations in the contract.

3. Party B's rights

(1) Party B can use the working and living conditions provided by Party A.

(2) Party B can appeal to the administrative authority if Party A fails to fulfill the obligations as stipulated in this contract.

4. Party B's Obligations

(1) Party B shall observe relevant laws and regulations of

the People's Republic of China and the rules and regulations of the university.

(2) Party B shall work for Party A for **up to** nine months a year. Including the time he works in WUT or the other ways working for Party A, such as apply for international cooperation projects, cultivating young teachers and graduate students, organizing international conference, applying for patents and publishing papers in the name of Party A.

(3) Party B shall fulfill the tasks assigned to him and shall be subject to Party A's inspection, assessment and supervision.

(4) All educational and academic achievements which Party B obtains at the position are assignment outcome. Author's name and his unit should be affixed to all the published papers and works, award applications, patent applications and research project applications (except for international projects). And the first unit has to be Wuhan University of Technology.

IV. Assessment

1. Party A is responsible for the daily management of Party B.

2. Party A is responsible for the assessment of Party B to examine the results of the tasks of Party B.

3. At the end of effective period of this contact, Party A will assess Party B according to this contact and the work commitment. Some overseas experts will be invited to join the assessment. The assessment report will be delivered to the national relevant departments.

V Contract modification and termination

1. Party A has the right to terminate this contract if Party B could not fulfill the stated tasks or could not pass the assessment or is found behaviors violating laws or disciplines during the implementation of the contract.

2. Party B could ask for resignation during the implementation of the contract for special reasons but should notify Party A his wish to terminate the contract at least ninety (90) days in advance. Party A is responsible for reporting to the national related department. Only getting the permission and finishing the handover, could the contract be terminated.

3. During the employment, in case of any reason that both sides can't foresee or unable to prevent, that the contract could not be normally performed. The contract could be modified or terminated in accordance with the relevant regulations of the People’s Republic of China.

VI. Others

1. Party A will help Party B apply for one to three years validity period multiple entry visas.

2. Party B has the right to enjoy the same medical treatment as that of the staff of Party A. Party A shall buy accident injury insurance for Party B.

VII. Supplementary articles

1. This Contract, in triplicate, becomes effective from the date of signature by two parties. Each party holds one copy and another copy will be filed by higher authorities.

2. In addition to the force majeure factors that, both parties should fulfill any articles in this contract. The contract may be amended by mutual consent of the two parties. Any dispute about this contract should be negotiated by two parties.

3. By mutual consensus, supplemental agreements can be signed for any other item not mentioned in this contract and have the same effect as this contract.

Party A	Party B
(signature)	(signature)
Date	Date

“千人计划”高层次外国专家

工作合同书

武汉理工大学印制

（复印无效）

“千人计划”高层次外国专家工作合同书

聘任方（简称甲方）

单位名称： 武汉理工大学

法定代表人：张清杰

地址：湖北省武汉市武昌区珞狮路 205 号

受聘方（简称乙方）

姓名： Enrique Jose Lavernia

性别：男

出生年月：1960 年 7 月 30 日

国籍：美国

证件号码：(护照号码） [redacted]

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Davis, CA 95616

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电话： 001-530-752-4964

传真: 001-530-754-7102

为保证“千人计划”高层次外国专家项目的顺利实施，保障甲乙双方的合法权益，根据中华人民共和国的有关文件精神和政策规定，经双方平等协商，订立本合同。

第一条　聘期

“千人计划”高层次外国专家岗位首次聘期为三年，该合同自签订之日起生效。 聘任期满，经双方协商后，报上级主管部门审批， 可续签下一期合同。

第二条　乙方的岗位工作目标及任务

一、乙方在聘期内应完成的工作目标

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把握多相、多尺度功能复合材料和涂层材料领域的国际前沿和发展方向，在该领域提出具有前瞻性、战略性、创新性的科学研究构想，使我校在本领域成为国际上有重要影响的科学研究基地、人才培养基地和国际合作交流基地，并取得有影响的研究成果，建立一支高水平创新研究团队，培养优秀中青年学术骨干和博士研究生。

二、乙方在聘期内应履行的工作任务

1．科研任务

面向国家重大战略需求和国际科学与技术前沿，积极组织本学科团队申报并承担至少 1 项国家重大、重点项目或国际合作项目。以武汉理工大学为第一署名单位，在材料、工程领域国际知名学术期刊上发表高水平学术论文 10-15 篇，申报国家、国际发明专利 3-5 项，力争获得国家或省部级科技奖励。

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2．团队建设任务

建设本领域科研创新团队，引进和培养长江学者特聘教授、国家杰出青年科学基金获得者等高水平人才。

3．人才培养任务

为武汉理工大学指导 1-3 名优秀青年学者，指导或联合指导 2-4 名博士研究生，指导甲方的优秀青年学者或博士研究生在国际著名杂志上发表系统性论文，指导青年教师获得国家级科技奖励或有重要影响的国际学术奖励。

4．国际交流与合作任务

以武汉理工大学的名义组织或共同组织召开 1-2 次本学科有影响的国际学术会议，邀请 2-3 名国际顶尖的科学家来实验室作访问学者或讲学。

第三条　权利和义务

一、甲方权利

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1．根据国家有关“千人计划”的文件精神和政策规定，结合甲方引进人才的岗位工作目标及任务，对乙方进行管理。

2．依照中华人民共和国的法规及甲方的有关规定，对乙方进行考核。

二、甲方义务

1．依法维护乙方应享有的各项权利。

2．为乙方提供良好的工作和生活条件

（1）办公及实验室条件：甲方按乙方的要求为乙方提供办公及实验条件。

（2）科研配套经费：聘期内，甲方为乙方提供 800 万元科研配套经费（其中包括国家拨款 300 万元），主要用于购置实验仪器设备、新方向和基础设施建设，此经费由甲方管理，乙方与甲方的合作教授共同商量支配。

（3）团队建设条件：甲方按乙方的要求为乙方组建学术

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团队，并每年投入 100 万元团队建设经费，主要用于开支团队成员的工资、安家补贴，团队及乙方本人的差旅等； 此经费由甲方管理，乙方支配。

（4）生活条件：薪酬标准为每月 5 万美元（税前标准），按实际到岗时间支付，另外享受 100 万元人民币的生活补贴（免税），经与专家协商，分三年支付。

（5）为乙方指导博士、硕士研究生及指导博士后工作人员、高级访问学者等创造条件。人员由甲方推荐、乙方考察并最终确定。

3 .为乙方提供完成本合同规定的工作目标及任务所需要的校内相关政策和支持。

三、乙方权利

1．享受中华人民共和国和学校提供的工作和生活条件。

2.甲方如不能按规定履行其应尽义务时，乙方有权向上

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级有关部门进行申诉。

四、乙方义务

1.遵守中华人民共和国的有关法律法规,遵守甲方的各项规章制度。

2.聘期内保证每年为甲方在岗位上工作达到 9 个月。包括在甲方的工作时间和以其他形式为甲方工作，如：联合申报国际合作项目、培养青年教师和研究生、组织或以甲方的名义参加国际学术会议、以甲方名义申请专利、发表论文、出版专著等。

3.全面履行岗位职责，完成本岗位的工作目标及任务；接受甲方的监督、考核及管理。

4.乙方在甲方的岗位上所取得的教学、科研等成果均属职务成果，其在发表有关论文、出版著作、申报有关奖励、专利和科研项目（除国际项目外）等时必须同时署作者及作

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者单位，作者第一单位只能署甲方名。

第四条　考核

1．由甲方对乙方进行日常管理。

2．由甲方负责组织对乙方进行年度工作检查，检查乙方工作目标完成情况。

3．甲方在三年聘期结束后根据聘任合同和工作任务书对乙方进行评估，评估时邀请海外专家参与评价，并报国家相关部门备案。

第五条　合同的变更与解除

1．乙方在聘期内如不能履行本协议所规定的职责，考核不合格或有违法违纪行为，经国家相关部门审核，甲方有权对乙方予以解聘，终止本合同。

2．乙方在聘期内因特殊原因提出辞聘的，需提前三个月向甲方提出申请，经甲方同意，报请国家相关部门审核后，

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方可辞聘，并视具体情况做好交接工作。

3.聘期内如发生双方无法预见、无法防范,致使合同无法正常履行的事由，需要变更或解除合同的，聘任双方应按照中华人民共和国的有关规定和法律妥善处理。

第六条　其它

1．甲方协助乙方办理 1-3 年有效期的多次往返签证；

2．乙方享受与甲方正式工作人员同等医疗待遇.并由甲方为乙方购买意外伤害保险。

第七条　附则

1.本合同一式三份,双方当事人各持一份,另一份交上级主管部门备案;本合同于双方当事人签字盖章之日起生效。

2.除发生不可抗力因素致使合同无法履行外,双方应严格履行合同中的各项条款，如发生争议，双方应协商处理，对合同有关条款的变更，应征得对方同意。

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3 .本合同如有未尽事项 ,应由双方协商 ,做出补充规定。补充规定与本合同具有同等效力。

甲方法定代表人签字：　　乙方签字：

盖　　章：　　盖　　章：

年　月　日　　年　月　日

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