Overview

• Why NSF CAREER proposal?
• My background
• My CAREER roadmap and History with NSF grants
• Lessons learned from failures
• Lessons learned from previous CAREER workshop
• Suggested Timeline
• Some additional tips/suggestions on proposal preparation.

Why NSF CAREER Proposal?

• Increased visibility
  – more collaborations, better students, invited seminars etc.
• Award/recognition
  – respect of your "peers"
• Makes administrators "happy"
  – increases your chances of tenure, promotion and salary raise etc.
• Stable funding for 5 years:
  – one or two PhD students and travel
• Possibility of PECASE
• No citizenship or green car needed!

CAREER Roadmap and History with NSF grants

• First NSF proposal as PI: With-in one month as assistant professor
• First CAREER submission: 1st year as assistant professor
  – Funded as one year EPSCoR proposal (NSF-First Award)
• Second CAREER submission: 2nd year as assistant professor
• Continued submission to other agencies and regular proposals
• First NSF proposal funded: 4th year as assistant professor
• Third CAREER submission: 5th year as assistant professor

NSF CAREER: 1st Attempt

First CAREER submission: 1st year as assistant professor
• Submitted to the Division of Materials Research

• Ratings:
  - Overall Ratings: Excellent/Very good/ Very good. NOT FUNDED
  
Summary Statement
The intellectual merit of the proposal depends strongly on a successful synthesis of experimental plan to fulfill the requirements for the other research objectives. It is crucial to demonstrate the advantage for using SiN/SiO2/SiN and its comparison to the present work with SiO2. The subsequent objectives of the proposal are very interesting. The research work has a significant impact during high temperature treatment of silicon and to use the special value of SiN/SiO2/SiN materials for new opportunities.

Summary Statement
My overall rating of this proposal is excellent. The PI has already published high impact papers in the area of the proposal section. The proposal plan is clear, logical and comprehensive. The researchers indicated that they have already been working with the PI and have indicated their desire to continue the interaction. The research plan is well integrated with the education and outreach activities. There is also a plan to provide first hand research experience to students and new researchers. Indeed, there is strong endorsement and support for the research from the institution.
NSF CAREER: 2nd Attempt
Second CAREER submission: 2nd year as assistant professor
• Submitted to the Division of Materials Research
• Ratings:
  – Overall Ratings: Excellent/Very good/ Very good/Fair. NOT FUNDED

NSF CAREER: 3rd Attempt
Third CAREER submission: 5th year as assistant professor
• Between 2nd and 5th year
  – Ventured into a "new" and "risky" areas: 2-D materials (beyond graphene) for energy devices. Met with Dr. Bruce Kramer and discussed my new strategy.
  – Published a couple of high impact papers
  – Graduated two M.S. thesis and one PhD student
  – Introduced new courses and lab modules
  – Attended CAREER workshops: 1. College-level and 2. NSF CAREER workshop
• Submitted to the CMMI
• Result
  – Received phone call in December that my proposal was reviewed favorably and it is being considered. However, nothing is certain and it can additional take 2 to 4 weeks.
  – Early January I got another call saying that the proposal is funded.

Lessons Learned From Failures
• Don't rush into writing a CAREER proposal. Instead spend time building your "brand-name":
  – Publish good papers, attend conferences, organize symposiums, develop courses, perform outreach activities.
  – Make good use of your start-up funds and just do what you have been hired to do.
• Be open-minded and pursue other funding avenues:
  – Eventually my declined CAREER proposal was funded as EPSCoR proposal and then as regular proposal.
• Networking/collaboration:
  – Interact with leaders in your field.
• Attend panels and CAREER workshop to understand the process

Lessons Learned From CAREER Workshop
• CAREER is not like a regular NSF proposal. Long-term goals are funded not specific project.
• It is important to find a 'home' at NSF.
• Confidence is good but over-confidence can hurt! Don’t be too ‘secretive’ about your research ideas/proposal.
• Well-written/ convincing proposals (almost) always get funded.
  – Good connection between ‘science’ and broader impacts is important.
  – Broader impacts does not mean educational activities alone.
  – No point in getting arbitrary letters of support i.e., make sure the person providing letter of support has read the proposal and understands what you are proposing.
• Help is available (just need to ask!) and Don’t be afraid of criticism
  – Show your proposal to colleagues in the department and friends at other universities
  – Listen to program managers

Suggested Timeline: CAREER Proposal
One year prior to writing a CAREER proposal
• Ask these questions
  – What is your motivation for writing a CAREER proposal? (to get tenure someday? to get some funding? or just because you are eligible)
  – What (fundamental research) is that you want to do in the next 5 or 10 years to become a leader in your field? (do you really want to be a leader?)
• Read some successful proposals from 'peer-institutions' and get a general idea as to what is expected from a CAREER proposal
• Check NSF website and read abstracts of successful proposals (in your research area). Also check awardees research website.
• You are encouraged to read "NSF CAREER Proposal Writing Tips By Z.J. Pei"
If you have attended the CAREER workshop you would know the answers to above questions.

Suggested Timeline: CAREER Proposal
Four to Five months before submission
• By this time you have got pretty good idea on what you want to propose and where you want to be in 5 to 10 years.
• Read the solicitation—it generally becomes available in March/April
• Prepare a one page summary and discuss it with the program director (to make sure that it falls with-in the purview of the program)
• Once you have confirmed with the PD, discuss with department head and collaborators:
  – Email the summary to your collaborators or those who are going to provide support letters (to make sure that they are comfortable with what you are proposing). Also share/include some exciting new data or a recently published article in the email
• Start writing (My advice: select Times Roman/size 12 and, not Palatino/size 10
Suggested Timeline: CAREER Proposal

Three months before submission

• First full-draft should be ready 3 months before submission.
  – Think of Dr. George Hazelrigg time-to-time (“convincing proposal”, “hypothesis driven”, “avoid terms like develop”, “no weather reporting” etc). Watch slides from his presentation!
• Inform the office of sponsored programs that you are submitting a CAREER proposal.
• Be your own reviewer and make changes to the draft accordingly. Print and read.
• Share the first draft (hard copy) with colleagues in your college and friends (previous CAREER awardees) at other institutions for mock review/feedback.

Two months before submission

• You are going to get ‘a lot’ of feedback. Fix the proposal based on feedback. You will notice that some concerns are common to all reviewers (those need to be fixed first). If multiple people are asking you to remove some text/figure then remove it!!
• Share the second draft with those who are writing letters of collaboration for you. Make changes based on any suggestions that they may have. You should have the letters approximately 1 month before submission. Having no letter is better than a lousy/lame/non-sense letter.
• Print/read, print/read. Send it to English language editor in your department/collage.
• Upload all documents on NSF website, convert into PDF and print/read.

Submit the proposal one week before the deadline

Suggested Timeline: CAREER Proposal

Some Additional Tips/Suggestions

• NSF is National ‘Science’ Foundation. Therefore, the focus should be on “generation of new knowledge”—new processes, new measurements, new model, new methods/tools, theory etc. Knowledge that can be applied in general to other systems or materials as well.

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• High risk/high reward/’exciting’ proposals are preferred.
  – Include preliminary data on proposed research to eliminate doubts in the minds of reviewers.
  – Mention all assumption clearly.
  – Provide evidence of facilities, resources (special equipments etc.) needed for timely completion of various tasks etc.

• Highlight the knowledge gaps—what’s known, what’s not known. Thorough literature review is suggested.

There are currently no published reports on the synthesis and mechanical property assessment of large-area TMDC freestanding films or papers. This absence is primarily due to the challenges associated with the manufacture of large-area paper or films that require highly stable, high concentration dispersions of sheets with large lateral dimensions. Even graphene and graphite oxide papers (lengths up to 18 inches) have been demonstrated only recently. 3, 75

3.4 Challenges associated with Na-ion battery negative electrode materials

One main obstacle to the commercialization of Na-ion batteries is the limited solubility of anode materials that can offer stable capacity with high cycling efficiency at moderate to high current densities. No host materials involving either carbon or group IV-A and V-A elements that form intermetallic compounds with Na have been investigated. Allowing anodes: The alloying compounds exhibit high first-cycle Na-storage capacities. However, this comes at the cost of very high voltage change upon Na-insertion, resulting in the formation of internal cracks, loss of electrical contact, and eventual failure of the electrode (particularly for thin electrodes). Nanostructural designs that can accommodate large

3.4.2 Mechanical properties. Mechanical properties such as tensile strength and strain to failure are important design parameters for battery electrodes. Static uniaxial-strain tests will be conducted in a simple custom-built test setup, as illustrated in Fig. 3. The samples are pre-covered on one end by a computer-controlled movable stage, while the other end is fixed to a 1.4-N load cell, which in turn is fixed to an immovable stage. All the tensile tests were conducted in controlled strain rate mode with a variable

propagation monitored using high-resolution, high-speed videography. The assumption is that cracks will initiate in a brittle manner and propagation effects can be ignored for the tensile analysis (see Fig. 3b). Recently, large-area few-layer-graphene has been shown to fail in a brittle manner. 15 These data

4.1 Liquid Phase Exfoliation of TMDC Nanosheets

Hypothesis To be Tested: (i) Group IV TMDCs may be exfoliated in strong acids without interaction.

Exfoliation in strong acids may cause the problems of tube damage and low yield common in other methods. If successful, this method would allow production of gram-level volumes with order-of-magnitude higher yield than existing techniques. Preliminary results are promising.

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Some Additional Tips/Suggestions

- Why you are uniquely positioned to perform this research?
  - Discuss your capabilities (little bragging is OKAY). That's why building your credentials is so important.

- Educational/outreach activities: Show results from prior activities.

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