AIChE NSEF Newsletter

Fall 2019

Message from the Chair

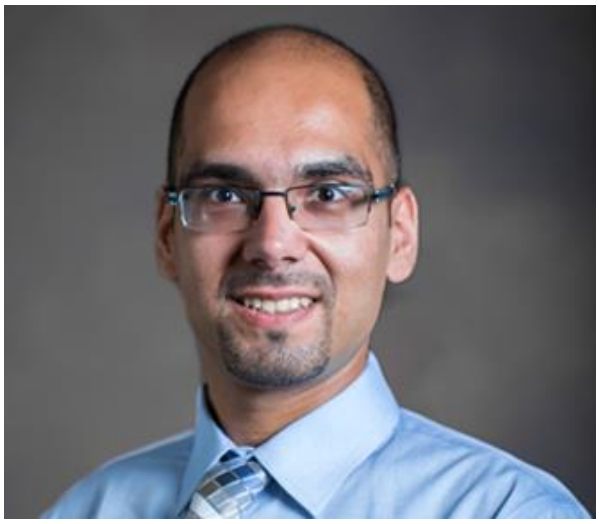
With the AIChE Annual Meeting only a few weeks away, I encourage you to check out the many exciting activities hosted by NSEF in Orlando this November. NSEF will be hosting over 20 exciting scientific sessions, including the NSEF, Bionanotechnology, and Carbon Nanomaterials plenaries, NSEF poster session, and graduate student award sessions. A big congratulations goes out to Dr. Christopher Jewell and Dr. Sharon Glotzer for being the 2018 Young Investigator Award and Forum Award Winners, respectively. We will be honoring the 2019 NSEF award winners during the NSEF Plenary Session and reception at the annual meeting. NSEF is excited once again to incorporate Nanomaterials for Energy Applications in the forum, and invite you to attend these sessions in Orlando. Lastly, I would like to invite you all to attend the NSEF Reception & Awards presentation on Tuesday, November 12th at 6:00pm during the annual meeting. Here's to an exciting and fruitful meeting!

- Dr. Samantha A. Meenach, NSEF Chair

News and Announcements

NSEF Programming for 2019 AIChE Annual Meeting:
NSEF is pleased to announce many exciting scientific sessions at the 2019 Annual Meeting in Orlando, Florida from November 10 to 15. The session topics are listed below. Also we are pleased to announce the following forum award winners.

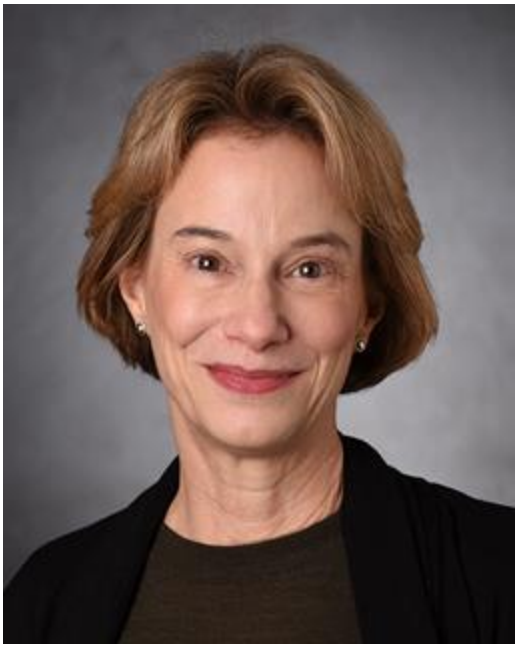
2019 Young Investigator Award Winner:
Amir Farnoud, Assistant Professor, Department of Chemical and Biomolecular Engineering, Ohio University; his talk, "Interactions of Engineered Nanomaterials with the Cell Plasma Membrane," will be presented Monday, November 11, 2019 from 8:30-9:30 am in Hyatt Regency Orlando - Discovery 45 and has the following abstract:



"Most biomedical applications of nanotechnology require that engineered nanomaterials come into direct contact with mammalian cells. The cell plasma membrane, a lipid bilayer surrounding all cells, is the first cellular entity that interacts with incoming nanomaterials. Depending on dose, and nanoparticle and membrane properties, engineered nanomaterials are capable of disrupting the cell membrane, thereby causing cell toxicity. Due to the complex structure of the cell membrane, mechanistic research on nanoparticle-membrane interactions has primarily relied on membrane models. However, while a variety of nanoparticle properties have been examined, the structural complexities of the plasma membrane such as the compositional asymmetry of membrane leaflets and the presence of membrane domains have been overlooked. This has led to a lack of understanding on the mechanisms of nanoparticle-induced cell membrane damage. In this talk, I will discuss efforts in my group to develop membrane models that capture the complexities of the cell membrane and use these models to uncover the mechanisms by which nanomaterials disrupt membrane structure and integrity. These efforts demonstrate the important role of nanoparticle physicochemical properties and biomolecular corona, as well as membrane composition and biophysical properties in regulating nanoparticle-induced membrane damage. I will also provide an overview on our work on going beyond simple membrane models and utilizing live cells as the "model" to probe nanoparticle-membrane interactions."

Please join us at this division plenary to hear his invited talk and congratulate him on this award!

2019 NSEF Forum Award Winner:



Kristen Fichthorn, Merrell Fenske Professor of Chemical Engineering and Professor of Physics, The Pennsylvania State University; her talk entitled, "Shape-Selective Growth of Nanoscale Materials: Insights from Multi-Scale Theory and Simulation," will be presented Monday Nov. 11 from 9:30 to 10:30 in Hyatt Regency Orlando - Discovery 45; her presentation has the following abstract:

"A significant challenge in the development of functional nanomaterials is understanding the growth and transformations of colloidal metal nanocrystals. From a practical perspective, a knowledge of how to selectively synthesize desired metal nanocrystal sizes and shapes would benefit numerous applications. For example, nanocrystal synthesis science is playing an increasingly prominent role in electrocatalysis for fuel-cell applications, photocatalysis for the production of solar fuels, and the catalytic production of biofuels from biomass. Metal nanocrystals figure prominently in solar-cell technologies, for example as nanometallic plasmonic structures to enhance the light absorption and efficiency of photovoltaics, as non-plasmonic photosensitizers for light-energy conversion, and as nanowire-based transparent conducting films. Metal nanocrystals are also featured in emerging applications targeting energy efficiency, such as photothermic desalination based on plasmonic nanocrystals, wearable triboelectric generators, flexible energy storage devices, electrochromic smart windows, and life-inspired nanosystems. For these and many other applications, the science of shape-selective nanocrystal synthesis has been advancing at an increasingly rapid pace, with numerous recent reports on the synthesis of various beneficial nanocrystal morphologies.

Despite ample demonstrations that it can be highly beneficial to tune nanocrystal morphologies for specific applications and despite the tremendous strides made in nanocrystal synthesis science, it is still difficult to achieve high, selective yields in most synthesis protocols. Many fundamental aspects of these complex syntheses remain poorly understood and empiricism still runs rampant. Our research has focused on understanding shape-selective nanocrystal growth via multi-scale theory and simulations.

I will discuss our efforts to understand the thermodynamics and kinetics of shape evolution for Ag and Cu nanocrystal growth in solution. Our multi-scale theoretical studies based in quantum density-functional theory (DFT) highlight how various nanocrystal shapes can be governed by either thermodynamics or kinetics. We use a variety of classical molecular-dynamics (MD) simulation techniques based on our many-body force field to show that the growth of sufficiently large Ag nanocubes with PVP capping molecules is induced by the facet-selective deposition kinetics of solution-phase Ag atoms/ions. When chloride is introduced to the synthesis, Ag nanocubes grow with a thermodynamic driving force. Fivefold-twinned Ag nanowires grow by surface diffusion induced by the unique, strained structure of these fascinating objects. I will also discuss the growth of fivefold-twinned Cu nanowires in the presence of chloride and HDA, where DFT calculations indicate that growth is dominated by deposition kinetics. These scenarios indicate the various "knobs" that can be turned to achieve shape-selective syntheses in the future."

2018 NSEF Graduate Student Awards
Congratulations to the excellent students awarded at the 2018 conference!

Oral Carbon Nanomaterials
1st Place - Ananth Govind Rajan
2nd Place - Gozde Sultan Demirer
3rd Place - Tianxiang Liu

Oral Bionanotechnology
1st Place - Khalid Hajj
2nd Place - Mythreyi Unni
3rd Place - Darwin Yang

Poster Session

1st Place - Elisa Torrico Guzmán
2nd Place - Karthik Pushpavanam

We look forward to seeing the graduate presentations this year!

NSEF Reception 2019:
NSEF invites all current members to attend the NSEF Reception at the AIChE Annual Meeting on Tuesday, November 12th 2019, from 6-7:30pm. Location is Hyatt Regency Orlando - Bayhill 24. In addition to some wonderful food and beverages, announcements will be made for the NSEF Award winners, graduate student awards, and poster session awards. We hope to see you there!

2019 AIChE Annual Meeting Graduate Student Award Sessions:
NSEF is sponsoring two award sessions at the 2019 AIChE Annual Meeting in the areas of Bionanotechnology and Carbon Nanomaterials. These sessions honor graduate students whose research achievements are in these areas and who demonstrate a high level of excellence in their work. At the end of each session, a panel of judges will determine 1st - 3rd place awards. The two sessions will be held at different times (TBD).

- Carbon Nanomaterials
- Bionanotechnology

2019 AIChE Annual Meeting NSEF Poster Session:
The NSEF poster session is scheduled for 3:30 PM - 5:00 PM Monday, November 11, 2019 in Hyatt Regency Orlando - Regency Ballroom R/S. Scores of high quality posters addressing fundamental science and engineering issues associated with nanoscale science, engineering and technology will be presented. The poster session will be judged, and student awards will be given to the best three posters.

Summary of 2019 Programming Activities

Nanoscale Science and Engineering Forum (22)
- 22000 Division Plenary: Chemical Engineering Principles for Nanotechnology (Invited Talks)
- 22001 Poster Session: Nanoscale Science and Engineering
- 22002 Nanofabrication and Nanoscale Processing I
- 22003 Self and Directed Assembly at the Nanoscale I

Carbon Nanomaterials(22A)
- 22A00 Area Plenary: Carbon Nanomaterials (Invited Talks)
- 22A01 Carbon Nanomaterials Graduate Student Award Session
- 22A02 Carbon Nanofibers and Related Structures from Renewable and/or Cheap Feedstock
- 22A03 Graphene 2-D Materials: Synthesis, Functions and Applications I
- 22A04 Graphene and Carbon Nanotubes: Absorption, Separations, and Transport Processes
- 22A05 Graphene and Carbon Nanotubes: Characterization, Functionalization, and Dispersion I

Bionanotechnology(22B)
- 22B00 Area Plenary: Bionanotechnology
- 22B01 Bionanotechnology Graduate Student Award Session
- 22B02 Bionanotechnology for Gene and Drug Delivery I
- 22B03 Nanobiotechnology for Sensors and Imaging I
- 22B04 Nanomaterials for Biological Applications
- 22B05 Nanostructured Biomimetic and Biohybrid Materials and Devices
- 22B06 Nanotechnology and 3D Printing: The Intertwined Technologies
- 22B07 Nanotechnology for Biotechnology and Pharmaceuticals I
- 22B08 Self-Assembled Biomaterials

Nanomaterials for Energy Applications(22C)
- 22C00 Nanomaterials for Energy Storage Applications
- 22C01 Nanomaterials for Hydrogen Production and Fuel Cells
- 22C02 Nanomaterials for Light Harvesting and Novel Photophysical Phenomenon

Full details can be found here - https://www.aiche.org/conferences/aiche-annual-meeting/2019

Member Awards & Highlights

If you have a recent high impact publication, honor, or award that you would like to have highlighted in the next NSEF Newsletter please submit these to the NSEF Treasurer/Secretary, Nigel Reuel, at reuel@iastate.edu.

Upcoming Events

For an up to date list of nano related workshops, symposia, and conferences we recommend looking at the Nano.gov event calendar:

https://www.nano.gov/events/meetings-workshops

Membership Column

Not a member of AIChE or NSEF? In order to guarantee that you are included in our current email list so that you will have updated access to NSEF materials and award eligibility make sure you are a current NSEF and AIChE member. NSEF membership is an additional $10/year to the AIChE membership. You can follow the steps of one of the following options below to join:

1. Visit AIChE's membership website to sign up online: http://www.aiche.org/membership
2. Download the following file from the AIChE website: Membership Application PDF and send your application and payment directly to AIChE.

2018-19 NSEF Leadership

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