



AICHE NSEF Newsletter - Spring 2016

American Institute of Chemical Engineers

April 2016

Message from the Chair

As we approach spring, I encourage you to begin planning for the Annual Meeting. The NSEF sponsors over 20 sessions covering topics ranging from synthesis to applications in energy and biology. Additionally, I want to call your attention to our award opportunities. **Applications for the Forum and Young Investigator awards are due soon, please nominate deserving colleagues.** However, NSEF also has several awards for graduate students, including graduate student awards in carbon nanomaterials and bionanotechnology. Awards are also presented at the poster sessions. These are excellent opportunities to recognize young talent, please encourage your graduate students to apply. I look forward to seeing you all in San Francisco!

- Dr. Jessica Winter, NSEF Chair

News and Announcements

2015 NSEF Award Winners:

During the 2015 Annual Meeting, NSEF was honored to present **Alan Weimer** with the 2015 NSEF Forum Award for pioneering research and inventions related to particle atomic layer deposition (ALD) processes) and **Jordan Green** with the 2015 NSEF Young Investigator award for significant advances in biodegradable nanoparticles for both tumor treatment and controlled release. The award winners were highlighted in the NSEF Plenary Session at the AICHE Annual Meeting. Their short bios are included below:

Alan W. Weimer, H. T. Sears Memorial Professor of Chemical and Biological Engineering, joined the faculty of the University of Colorado in 1996 after a 16-year career with the Dow Chemical Company. He was named Dow Research Inventor of the Year in 1993, and received Dow's "Excellence in Science Award" in 1995 for commercializing high-temperature "Rapid Carbothermal Reduction" processing to produce fine non-oxide ceramic powders, a process believed to be widely practiced today for the manufacture of tungsten carbide powders. He was named University of Colorado Inventor of the Year in 2004, received both the campus-wide and the College of Engineering and Applied Science Faculty Research Awards in 2005 and a 2004 R&D 100 Award for his inventions related to Particle ALD. He co-founded ALD NanoSolutions, Inc. (www.ALDNanoSolutions.com) in 2001 to commercialize Particle ALD technologies and has helped to grow and navigate the company through major economic downturns since its inception. He has directed the research of 29 Ph.D. students; and 27 of the almost 100 undergraduates that he has mentored have either received Ph.D.s, or, are currently enrolled in Ph.D. programs elsewhere in the United States. He received a B.S. in chemical engineering from the University of Cincinnati in 1976 and a Ph.D. in chemical engineering from the University of Colorado in 1980.

Dr. Jordan J. Green is an Associate Professor of Biomedical Engineering, Ophthalmology, Oncology, Neurosurgery, and Materials Science & Engineering at the Johns Hopkins University School of Medicine. He is also an executive committee member of the Institute for NanoBioTechnology and a co-founder of the

Translational Tissue Engineering Center at JHU. Dr. Green received his B.S. in chemical engineering and biomedical engineering from Carnegie Mellon University in 2003 and completed his Ph.D. in biological engineering from the Massachusetts Institute of Technology in 2007. Subsequently, Dr. Green was a postdoctoral associate at MIT in chemical engineering from 2007-2008. Dr. Green serves as the Chair of the Drug Delivery Special Interest Group of the Society For Biomaterials. He is also the CEO and co-founder of the Baltimore biotech startup company, AsclepiX Therapeutics. His work has resulted in the publication of over 60 papers and he has received numerous awards including the Maryland Outstanding Young Engineer Award, the Carnegie Mellon University Recent Alumni Award, the Biomedical Engineering Society Rita Schaffer Award, and was named by Popular Science as one of the 2014 "Brilliant Ten." Dr. Green's main research interests are applying chemical engineering principles to develop biomaterials and nanobiotechnology to meet challenges in human health.

2015 NSEF Graduate Student Award and Poster Session Winners

At the 2015 Annual AIChE Meeting, NSEF was pleased to award several graduate students and poster presenters for their contributions to the nanoscale science and engineering fields. The graduate students were initially selected from a number of applicants and then gave presentations in special sessions dedicating to highlighting their work. Congratulations to the following awardees:

Carbon Nanomaterials Graduate Student Award Session

1st Place: Francesca Mirri, "Lightweight, Flexible, High-Performance Carbon Nanotube Cables By Scalable Flow Coating"

2nd Place: Alex Pak, "Disorder Engineering to Enhance the Limited Quantum Capacitance of Graphene-Based Electrochemical Capacitors"

3rd Place: Lin Ma, "Enhanced Lithium-Sulfur Battery By Amine-Functionalized Carbon Nanotube Cathode"

Bionanotechnology Graduate Student Award Session

1st Place: Ben Geilich, "Silver Nanoparticle-Embedded Polymersome Nanocarriers for the Treatment of Antibiotic-Resistant Infections"

2nd Place: Reem Eldawud, "Electronic Platform for Real-Time Multi-Parametric Analysis of Cellular Behavior Post Exposure to Single-Walled Carbon Nanotubes"

3rd Place: Jacob Lilly, "Award Submission: Nanoscale Hydrogel Coatings for Rapid Sorting of Circulating Tumor Cells: Relating Marker Expression to Isolation Yield"

NSEF Poster Session

1st Place: Alex Aboagye, "Graphene-Embedded Carbon Nanofibers with High-Loading Surface-Attached Platinum Nanoparticles for Super Efficiency Dye-Sensitized Solar Cells"

2nd Place: Elisa Torrico-Guzman, "Evaluation of the Cancer-Preventive Effect of Resveratrol-Loaded Nanoparticles on the Formation of Tumor Spheroids"

3rd Place: Rui Wang, "Imprinted Enzyme Nanogel for Catalysis in Organic Solvents"

Call for Abstract - 2016 AIChE Annual Meeting:

The 2016 AIChE Annual Meeting will be held from November 13 - 18, 2016 in San Francisco, California. More information is available at: <http://www.aiche.org/conferences/aiche-annual-meeting/2016>. The call for abstracts is currently open and new submissions may be entered until **May 9, 2016**. NSEF is looking for submissions in the following areas:

- • Nanofabrication and Nanoscale Processing
- • Nanomaterials Manufacturing
- • Self and Directly Assembly at the Nanoscale
- • Graphene and Carbon Nanotubes: Absorption, Separations, and Transport Processes
- • Graphene and Carbon Nanotubes: Characterization, Functionalization, an Dispersion
- • Synthesis of Graphene and Carbon Nanotubes: Kinetics Mechanisms and Reactor Design
- • Bionanotechnology for Gene and Drug Delivery
- • Magnetic Nanoparticles in Biotechnology and Medicine
- • Nanoscale Science and Engineering in Biomolecular Catalysis
- • Nanostructured Biomimetic and Biohybrid Materials and Devices

- • Nanostructure Scaffolds for Tissue Engineering
- • Nanotechnology and Nanobiotechnology for Sensors and Imaging
- • Nanotechnology for Biotechnology and Pharmaceuticals
- • Self-Assembled Biomaterials

2016 Graduate Student Award Sessions:

NSEF will sponsor two award sessions at the 2016 AIChE Annual Meeting in the areas of Bionanotechnology and Carbon Nanomaterials where some of the most promising young chemical engineering researchers will present their work. Finalists will be selected from the abstract submissions to present in these award sessions. A panel of judges will determine 1st-3rd place awards. (Awards are available for 1st, 2nd, and 3rd place in the form of \$150, \$100, and \$50 checks). More information on submission guidelines is available online in the abstract submission process.

2016 NSEF Award Nominations

The NSEF is soliciting nominations for two awards: The Forum Award and The Young Investigator Award. The Forum Award recognizes outstanding contributions to the advancement of nanoscale science and engineering in the field of Chemical Engineering through scholarship, education or service. The Young Investigator Award recognizes outstanding interdisciplinary research in nanoscience and nanotechnology by engineers or scientists in the early stages of their professional careers (within 10 years of completion of highest degree). More information can be found at <http://www.aiche.org/community/sites/divisions-forums/nanoscale-science-engineering-forum/awards>. Applications are due May 1, 2016.

New Programming Chair

We are pleased to report the appointment of a new programming chair: Reginald Rogers from the Rochester Institute of Technology. Reg will be responsible for organizing all of the NSEF programming, taking over this responsibility from Micah Green. Thank you to Micah for his service.

Nominations for NSEF Leadership Positions

The NSEF will conduct its biennial elections this year. Nominations, including self-nominations, will be accepted for positions of vice chair, secretary/treasurer, and 2 members at large. Note that the vice chair becomes the chair after 2 years, and then serves as chair for 2 years, and past chair for 2 additional years. Thus, this is a 6 year commitment. Please forward nominations to current chair, Jessica Winter at winter.63@osu.edu. Nominations should include biographical information and a short statement.

Soliciting Contributions for Springer Handbook of Nanotechnology

A fourth edition of The Springer Handbook of Nanotechnology, a best seller among Nanotechnology Handbooks, development is in development. Up to half of the chapters are expected to be revised with new additions as well. Chapters are particularly needed in the area of bioMEMS and biosensing. If you wish to contribute, please submit a tentative title, list of authors (including names, addresses, phone/email) and the outline in a bullet form to Bharat Bhushan at bhushan.2@osu.edu. All revised and new chapters should be received by July 15, 2016.

Chemical Engineering Nanoscale Metrology - Fiat Lux!

By: Marc Kelemen

And from Genesis forward, humanity has been measuring...comparison measuring, measuring against standards, measuring nonetheless.

And so it was as our species emerged from the dark ages into the age of enlightenment, Isaac Newton (17th century) showed that what everyone thought of as "white" light is actually composed of different "colors" (frequencies) of light. Now, as proud members of AIChE's Nanoscale Science and Engineering Forum (NSEF), we cannot help but marvel at the improvements in process control and optical data storage / manipulation replaced the traditional copper conductor chassis. We recall the words of Peter Drucker,

"What gets measured gets managed" and the wisdom of Tom Peters, **"What gets measured gets done."**

FIAT LUX – **"What gets measured gets done."**– World Metrology Day --- May 20, 2016

World Metrology Day is an annual celebration of the signature by representatives of seventeen nations of the Metre Convention that started on 20 May 1875. The Convention set the framework for global collaboration in the science of measurement and in its industrial, commercial and societal applications. The original aim of the Metre Convention - the world-wide uniformity of measurement - remains as important today as it was in 1875. The theme for World Metrology Day 2015 was **'Measurements and Light'**. The World Metrology Day web site (<http://www.worldmetrologyday.org/>) reports their theme was chosen to align with the UNESCO International Year of Light and Light-based technologies 2015, a global initiative designed to highlight the key role light and optical technologies play in our lives and their importance for our future and for the sustainable development of society. The world metrology day web site further explains how Metrology plays a central role in enabling light-based technologies. The international year of light website (<http://www.light2015.org/Home/WhyLightMatters/What-is-Photonics.html>) reports Max Planck and Albert Einstein (early in the 20th century) proposed that light was a wave as well as a particle. We may ask, "how can light be two completely different things at the same time?" Decades of statistics and experimentation later confirmed this duality in the nature of light and that a single particle can pass through two different slits at the same time. (Is anyone buying their cats from Schrödinger?)

The word *Photonics* appeared in 1960, when Theodore Maiman invented the laser (<http://www.laserinventor.com/bio.html>). Photonics is the science of generating, controlling, and detecting light waves and photons, which are particles of light. The characteristics of the waves and photons can be used to explore and manipulate the universe, cure diseases, and forensically solve crimes. The electromagnetic spectrum extends well beyond the visible spectrum wavelengths in both directions, from gamma rays to radio waves. It includes X-rays, ultraviolet, and infrared light. The fast-evolving lighting industry needs reliable standards and authoritative calibrations to produce energy-saving lamps based on light-emitting diodes. In many areas of science, medicine and commerce NIST (<http://www.nist.gov/pml/commercial-lighting.cfm>) is meeting the need for more sensitive and precise ways to characterize advanced materials, provide new techniques for medical and environmental imaging, improve light-based radioactivity detection, intelligently design nano-catalysis systems and more.... We are learning to tease (or torture) the most information out of the light - almost like "industrial light and magic" (with apologies to George Lucas circa 1975).

So, on May 20, 2015 the National Economic Council and the Office of Science and Technology Policy held a forum at the White House to discuss opportunities to accelerate the commercialization of nanotechnology. Let's focus a bit more on photonics. The international year of light website reminds us that photonics ("light and magic") is integral to telecommunications (internet), consumer electronics (scanners, DVD's), health (surgical & medical instruments), manufacturing (additive and subtractive), defense / security (infrared camera, remote sensing) and entertainment (holography, laser shows). Beyond "our little corner of the world", Cosmic Microwave Background (discovered circa 1965 at Bell-labs) is an electromagnetic echo of the origin of the universe. This 'fossil' radiation, which was released soon after the 'Big Bang' is an echo or 'shockwave' of the Big Bang currently detected in the microwave domain.

FIAT LUX.

Maiman's laser followed quickly after Richard Feynman's 1959 CalTech talk, "There's Plenty of Room at the Bottom," the genesis of nanotechnology (at least the genesis of the terminology). <http://www.its.caltech.edu/~feynman/plenty.html>. Feynman got us thinking about the problem of manipulating and controlling things on a small scale – a very small scale. The most enduring definition remains "at least one dimension being 0.1 – 300 nanometers," where one nanometer is one-millionth of a millimeter. For comparison, the wavelength of green light (the center of the human visible range) is 550 nanometers. Thus, the natural inhabitants of the nano world include DNA (small), proteins (typical) and viruses (large).

In 2015, NIST researchers (<http://www.nist.gov/pml/quantum-light.cfm>) continued to develop techniques to characterize and control single photons – the smallest units of light – for quantum information exchange

as well as investigate the properties of atoms, ions, and various subatomic particles using precision-regulated beams of light. And so, Nanotechnology has indeed become our final frontier. And our time-honored measurement standard – light – may be stretched beyond its limits (certainly in the visible spectrum). Ultra high-energy gamma rays may be the key to measuring in the nanoscales. These photons will have energy levels exceeding 1 million electron volts! FIAT LUX!

Shining the spotlight once more on metrology, we recall a common form of acceptance and rejection used in industry is the epic "four-to-one rule" given in MIL-STD 45662A. http://www.aspe.net/publications/Summer_2004/04su%20extended%20abstracts/phillips-1622.pdf. Another seminal document on measurement uncertainty is **The GUM**: International Organization for Standardization, "Guide to the Expression of Uncertainty in Measurement," Geneva, Switzerland, 1993. (This document is also available as a U.S. National Standard: NCSL Z540-2-1997). Can we do this at over a million electron volts? The large hadron collider at CERN (Switzerland) can generate Tera electron volts, or a million million electron volts – clearly capable of measuring deep into the nanoscale, and well beyond the measurement uncertainty rules. The observer's paradox of quantum physics notwithstanding (http://lhc-machine-outreach.web.cern.ch/lhc-machine-outreach/lhc_glossary.htm). Talk about expensive certified reference materials!

Measurement Uncertainty meets Heisenberg Uncertainty. I can't wait for ISO/IEC 17025 accredited labs to work in these realms. **"What gets measured gets done."** FIAT LUX!

Marc Kelemen is an ASQ Fellow and Director-at-Large of the Chemical Engineers (AIChE) Nanoscale Engineering and Science Forum. He is a voting member of several ASTM Technical Committees and sub-committees including E-56 Nanotechnology, F-04 Medical & Surgical and E-60 Sustainability. Kelemen is President of NanoSynopsis Consulting and Director of Quality Systems, Engineering and Regulatory Affairs at ROE Dental Laboratories. After three decades in alternative energy and consumer electronics, he joined the Business / Management Faculty of South University and remains active on three nonprofit boards. Kelemen is a named inventor on eight patents and holds ASQ certifications as CMQ/OE, CSSGB, and CQA. He earned his Chemical Engineering Degree from Case Western Reserve University and his MBA from Baldwin-Wallace University. Kelemen is also an ISO Lead Assessor for A2LA, a Problem Solving / Decision Making LDI Validated Trainer for Kepner-Tregoe and Secretary of the ASQ Electronics and Communication Division.

Member Awards & Highlights

If you have a recent high impact publication, honor, or award that you would like to have highlighted in the NSEF Newsletter please submit these to the Newsletter Editor at smeenach@uri.edu.

Upcoming Events

2016 Spring Meeting and 12th Global Congress on Process Safety

April 10 - 14, 2016 in Houston, TX

<http://www.aiche.org/conferences/aiche-spring-meeting-and-global-congress-on-process-safety/2016>

2016 Synthetic Biology Meeting: Engineering, Evolution, and Design (SEED)

July 18 - 21, 2016 in Chicago, Illinois

<http://synbioconference.org/2016>

2016 Spring Regional Student Meetings

Various dates and locations

<http://www.aiche.org/conferences/student>

Nanotechnology News Highlights

'SINGLE' imaging technique allows for viewing or atomic-scale 3-D structures

Researchers at the U.S. Department of Energy's Lawrence Berkeley National Laboratory have developed a new imaging technique termed 'SINGLE' that allows for the first atomic-scale images of colloidal nanoparticles. SINGLE stands for 3D Structure Identification of Nanoparticles by Graphene Liquid Cell Electron Microscopy and this technology has been used to provide images of individual platinum nanoparticles in solution. [Science Daily](#)(8/12)

Laser processing of graphene results in more robust scale-up electronics technology There is currently no large-scale technology that allows for the control of graphene properties and the current technology adapted from silicon-based processors is not suitable for this application. Researchers from Technological Center AIMEN have utilized ultrafast lasers as tools for graphene processing. This technology allows for the precise tailoring of the properties of graphene films in specific areas to produce distinct behaviors of the systems. [phys.org](#)(8/12)

Drugs are released into the body through stretching

Drug delivery technology has been developed by researchers from North Carolina State University and University of Carolina at Chapel Hill that allow for the release of drugs into the body when the elastic patch developed is stretched. This technology could be used for on-demand release of drugs such as painkillers in a non-invasive fashion. [phys.org](#)(8/12)

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.

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