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SNO letter

NEWSLETTER OF SUSTAINABLE NANOTECHNOLOGY ORGANIZATION

Sustainable Nanotechnology Organization
Research | Education | Responsibility

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Edited by Joel Andersen

SNO Newsletter Submissions

Please send news, conference announcements, job postings, letters to the editor, and other contributions to the newsletter to the Dr. Sadik or Dr. Karn (osadik@binghamton.edu or bkarn@nsf.gov)
The next newsletter will appear in May 2013.

Conference Review

A successful conference reaffirms the demand for SNO and signals a productive future

Inaugural SNO conference Nov 3-5

Despite cloudless skies, SNO descended upon the Hilton Arlington Hotel from Nov 3-5. Our inaugural conference was a very successful one. From the highly-interactive poster session to the plenary presentations to the dinners and awards, the conference continually presented opportunities for fostering the growth of SNO's mission of supporting, promoting, and providing SNO-oriented research. Feedback from attendees was exceptionally positive. Comments such as "Very focused, very on track, very productive," emphasized the high-quality, productive interaction possible at the conference. More feedback and event statistics are provided on page 3.

Conference Highlights

Highlights of the conference include the presentation of the SNO Award to recipient Dr. Mihail Roco, the award-winning posters, the development of new education and graduate student committees, as well as a summary of some of the conferences statistics.

SNO Award

The SNO Award is intended to recognize individuals that have demonstrated a commitment to impactful research and service that deepens the scientific community's understanding of issues related to sustainable nanotechnology. This cardinal year for SNO it has been clear that Dr. Mihail C Roco has exemplified these qualities in his work.

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"Very focused, very on-track, very productive"
- Galya Orr on the 1st Annual SNO Conference

Continued from page 1

Dr. Roco is the National Science Foundation's Senior Advisor for Nanotechnology. His leadership and foresight has been recognized in magazines such as Forbes and Scientific American. His work has been at the heart of what we consider our organization to be about. We congratulate Mihail Roco on receiving the SNO award, and thank him for his contributions to our growing field.

Student Poster Awards

In addition to recognizing Mike Roco with the SNO award, SNO also recognized six student poster presenters with 1st, 2nd, and 3rd place awards, as well as three honorable mention awards. The recipients of these awards include **Joel Cohen** (1st Place, "Tracking translocation of industrially relevant engineered nanomaterials (ENMs) across alveolar epithelial monolayers: The effect of particle properties on Size and surface chemistry affect particle"), **Janet Dowding** (2nd Place, "Synthesis matters: Phosphatase activity of CeO_2 nanoparticles may underlie their toxicity."), **Nicholas Geitner** (3rd Place, "Oil spill remediation using biocompatible dendritic polymers"), **Kyle Doudrick** (Honorable Mention, "Photocatalytic reduction of nitrate using water as a hole scavenger"), **David Goodwin** (Honorable Mention, "Sustainability of carbon nanotube polymer composites in the presence of microbial populations"), and **Navid Saleh** (Honorable Mention, "mechanistic hetero-aggregation of gold nanoparticles for a Wide Range of Solution chemistries"), respectively. The complete abstracts of these posters are available at Susnano.org in the conference abstracts pdf.

Dr. Sadik congratulates several of the student poster winners (left-to-right, top-to-bottom: Joel Cohen, Nicholas Geitner, Kyle Doudrick, and David Goodwin)

New Committees

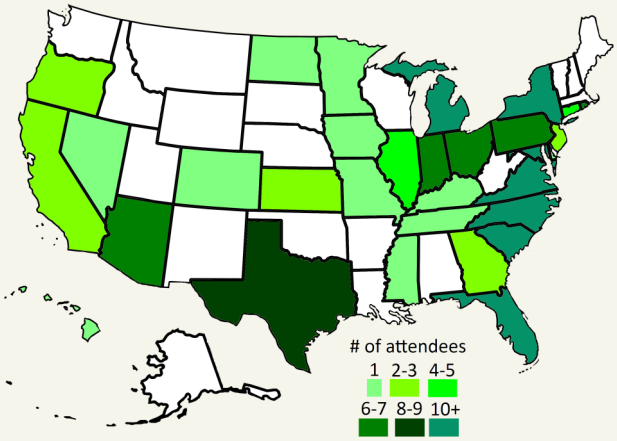
Two new committees were formed during the conference, the education committee and the graduate student committee. These two committees will serve important roles in the future of SNO and our mission. The graduate committee will have goals including managing an upcoming SNO blog, helping to motivate graduate student interest in the organization,

CONFERENCE REVIEW & MOVING FORWARD

committee will serve as a resource to those interested in designing and developing an effective sustainable nanotechnology-based curriculum. Such developments will be very consequential in producing future generations of scientists that have sustainability in mind while performing nanotechnology-based research. The education committee will develop a database of existing courses and curricula on sustainable nanotechnology. For more information regarding these committees or to express interest in assisting, please e-mail Joel Andersen (graduate committee, ander2jL@mail.uc.edu) or Deb Newberry (education committee, Deb.Newberry@dctc.edu).

Conference statistics and feedback

In total, 200 scientists and engineers attended the SNO conference. Of the attendees, 55 were female, and 145 were male. Within the U.S., 31 of 50 states were represented; other represented areas around the globe include Singapore, UK, Germany, Switzerland, France, and Australia. The success of the event echoes in the positive feedback from attendees. Dr. Clayton Teague, former director of the US National Nanotechnology Coordination Office, found the conference to be "very well done and a good mix of application, environment, and medicine." Dr. Teague also agreed with many other attendees that the poster session fostered significant interaction. Graduate student Clare Mahoney was excited to find that SNO had organized "a good combination of fields discussing what we need to do moving forward."



Geographic distribution of attendees within the United States. We also had attendees from areas outside of the United States: Singapore, UK, Germany, Switzerland, France, and Australia

Moving forward

After reviewing the success of the past, it is important to look to the future. The future of SNO will be a busy and productive one. Especially noteworthy is the growing partnership between SNO and the new ACS Sustainable Chemistry and Engineering Journal. This summer, the journal will have a special issue, edited by SNO leaders Barbara Karn, Wunmi Sadik, and Mamadou Diallo. The journal invited 40-50 papers focused on sustainable nanotechnology research. As such, presenters of research at the SNO conference were asked to submit their paper to this special issue. Partnerships like these will help SNO create a more streamlined process for both publishing and finding literature regarding sustainable nanotechnology research.

Additionally, SNO is considering the possibility for foreign SNO chapters. This potential allows SNO to expand its network and spread its mission worldwide. As such growth occurs, the ability of SNO to follow its mission is exponentially increased, and we are very excited at this possibility. The excitement will carry us to the second conference, which is scheduled for Nov. 3-5 2013 in Southern California. More precise details will follow in a future newsletter.

SNO Forum

In order to be an effective organization that speaks for its membership, SNO has developed a members-only forum on its web page. The initial purpose of this discussion forum is to develop a consensus on the definition of sustainability and sustainable nanotechnology. This consensus will form the basis of a developing strategy for future SNO activities. In addition, the forum will provide a place for feedback and new ideas for the conference.

INTERVIEWS WITH DR. ANDRE NEL AND DR. PHILIP DEMOKRITOU

Dr. Andre Nel delivers his plenary presentation in Washington D.C. for the 1st Annual SNO Conference.

Dr. Philip Demokritou in his Harvard laboratory.

SNO continues its interview series with interviews of Dr. Andre Nel and Dr. Philip Demokritou. These two highly-regarded researchers provided oral presentations to help set the tone for the SNO conference. Although they provided much food for thought in their papers, we caught up with them outside of the conference to get another look at their thoughts on sustainable nanotechnology as well as their reactions to the first conference.

Dr. Nel's high productivity begins at the University of California, Las Angeles (UCLA). At UCLA he is a tenured professor while also being Director of the UC Center for the Environmental Impact of Nanotechnology, Director of Asthma and Immunology Disease Center, Co-Director of the Southern California Particle Center, and also Co-Director of the UCLA Nanomachine-Center. His publications have been accepted in journals such as *Environmental Science and Technology* to *ACS*

Harvard professor Dr. Demokritou supervises Harvard's Aerosol Technology Laboratory. In addition to his journal publications and book chapters, he holds a patent for sensing air pollution. Dr. Demokritou's research interests currently revolve around developing techniques that would allow for measurement of human exposure to airborne nanoparticles. He has been instrumental in the formation of SNO, in particular working with industrial partners.

Andersen. Given the demand for emerging nanotechnologies, what concerns do you have regarding the potential for a growing nanotechnology market to outpace our knowledge of the long-term impacts of the new technology?

Nel. With the emergence of a game changing technology such as nano, there are always a lot of questions about long-term implications, particularly whether the technology will be safe and sustainable. Key among these concerns is the issue about whether we have enough knowledge to go forward with what we know and whether we should consider turning the brakes on before it is too late and unknown or unintended consequences emerge from something as powerful as nanotechnology. This concern is exemplified by the Smalley-Drexler debates on self-replicating nano factories taking over the world. While such a scenario is highly implausible, the successful development of nanotechnology means that we are producing a lot of novel materials with brand-new properties that could lead to hazardous

NEL/DEMOKRITOU INTERVIEWS CONTINUED

outcomes when they make contact with the nanoscale biological structures and functions in natural systems. Thus, there is a chance that the pace of nanotechnology development may outstrip our ability to gather knowledge about hidden dangers for humans and the environment. This is exactly the reason we need to engage in knowledge gathering at a rate commensurate with the growth of the technology, including information gathering and decision-making tools that can keep up with the development and build a green and sustainable technology. Since nanotechnology is emerging in an era of intense global awareness about the negative impact of the Industrial Revolution (e.g., fossil fuel combustion and a large number of industrial chemicals) a proportionally correct percentage of effort needs to be incorporated into the overall nanotechnology enterprise to ensure that this becomes the first truly sustainable wave of innovation. Not only is important that nanotechnology be inherently safe, but that we could also draw on its awesome power to remediate some of the errors of the past. This vision constitutes one of the reasons for the establishment of SNO.

Demokritou. Without a doubt, the rapid expansion of nanotechnology is a powerful scientific and economic force. However, we need to match this progress with careful evaluation of the environmental health and safety issues of nanomaterials and technologies. We have a unique opportunity here: For the first time in the history of new technology, we can develop it in a sustainable way, rather than follow the 20th century model, which was based on "clean the mess 20 years later." We all know the results from many promising new chemicals/materials introduced in the past century that resulted in environmental and public health disasters. Typical examples are asbestos and PCBs, with both industries completely eradicated as a result of the remediation efforts. We need to study environmental health implications in parallel with the development of new materials and nanotechnologies. How do we bring all stakeholders together, academia, industry, regulators, lay public in order to maximize the societal benefits from this emerging technology and at the same time safeguard the environment and public health, remains the biggest challenge in my humble opinion.
At the research level, we need to study nano-EHS matters in a more efficient way by searching for fundamental principles that govern biological responses to nanomaterials, rather than assessing the toxicity of specific nanomaterials one at a time, which has been the approach so far. This current risk assessment paradigm is very costly and time consuming, and with the gazillion new nanomaterials and technologies introduced every year, that paradigm will be impossible to sustain.

Andersen. What are some concerns regarding sustainability that researchers may overlook while developing novel nanotechnologies and nanomaterials?

Nel. Given the wonderful and exciting toolbox that nanotechnology has introduced, researchers may be so interested in new product and applications development that they overlook the fact that all materials have a lifecycle during in which we have to account for the potential circumstances where nanomaterials may come into contact with industry workers, consumers and the environment. Since much of biology is based on the nanoscale properties and function, we need to focus on the possibility that engineered nanomaterials may introduce new biological hazards to humans and the environment. We should regard nano safety as an integral component of technology development. Another potential major oversight would be failure to inform the public about the benefits and risks of this new technology, creating the possibility that nanotechnology could lose

NEL/DEMOKRITOU INTERVIEWS CONTINUED

public support it major safety problems emerge. Finally, it is important to consider the energy footprint, availability of raw materials and the scalability of the nano-manufacturing processes so that we cannot overlook the basic principles of sustainability.

Demokritou. Usually, researchers pay attention only to the applications and physical properties of nanomaterials while neglecting nano-EHS matters. Sustainability has a very broad meaning and starts with a change in the way we conduct research. We need to view things in a multidisciplinary way. For example, not only do we need to develop the new generation of nanomaterials to enhance our ability to capture energy, but we need to make sure that we synthesize them in a sustainable way, utilizing green chemistry concepts. At the same time, we must assess possible environmental health implications during production and across a material's life cycle. We also need to work more in the years ahead on "developing safer by design" nanomaterials.

Andersen. What roles do you see nanotechnology taking to create a more sustainable future?

Nel. I see two major roles. The first is the inherent sustainability of the technology by making sure that it is safe and adheres to the principles of a green and sustainable technology. The second major contribution is the use of nanotechnology as a new sustainability science that can be used for environmental remediation, clean water, renewable energy, increased food production and protection of crops and produce, production of more energy efficient materials, and the development of new therapeutics for human ailments that have no cure or cause unnecessary suffering.

Demokritou. Nanotechnology will play a pivotal role in addressing some of our biggest societal problems in the 21st century (e.g., energy, clean water, environmental remediation, diseases, etc.). From the application prospective, the possibilities are endless. From new materials that will enable us to capture and convert energy in a more efficient way, to new materials for automotive, airspace and construction applications, to remediation technologies for environmental applications, etc. Without a doubt, nanotechnology will be a great asset in our quest towards a sustainable planet.

Andersen. The Sustainable Nanotechnology Organization seeks to allow for a more concerted approach to analyzing nanotechnology and sustainability. What did you think of the first meeting held in Washington, D.C.?

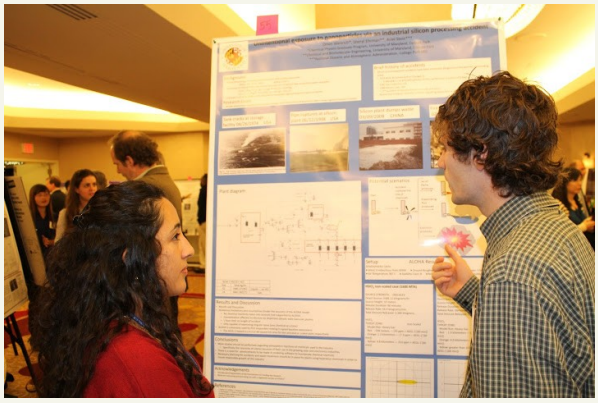
Nel. The inaugural meeting was a great success, both on the level of raising awareness as well as the level of scientific discourse and debate among a wide variety of interdisciplinary stakeholders.

Demokritou. I think the meeting was a great success, and please allow me to congratulate and thank the Chair, Drs. Barbara Karn and Wunmi Sadik, for the endless efforts in organizing it. I was impressed not only with the high caliber of scientific presentations but also with the multi-disciplinary nature of the audience. All stakeholders were there: industry, academia, policy makers, and lay public. SNO showed that it has the convening power to bring all nanotechnology people together, and that is very important at this point in time.

Andersen. What words would you like to leave with SusNano members?

Nel. Among the waves of innovation that humankind has fostered, nanotechnology is emerging at a stage of awareness that we are only caretakers but not the owners of planet

PHOTOS FROM THE FIRST SNO CONFERENCE



Graduate Students Receive Awards

The previous newsletter (Vol. 1, Issue 2) recognized 20 recipients of Graduate Student Travel Awards for the 2012 SNO conference. Pictured below are many of those recipients at the SNO conference.

SNO would like to extend our gratitude to Dr. Antonietta Quigg for capturing the events of the 1st Annual SNO Conference and providing photos for this newsletter.

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