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# MATERIALS by DESIGN

The IMS Associates Program Newsletter

VOLUME 18, ISSUE 1

JANUARY 2013

## University Unveils Master Plan for Technology Park

By Tom Breen, from UConn Today. For the complete article visit: <http://today.uconn.edu/blog/2012/12/university-unveils-master-plan-for-technology-park/>

Members of the UConn community and the town of Mansfield recently got their first look at the plans for UConn's ambitious new technology park, which is envisioned as an important driver of both research and economic growth in the region.

In presentations at the Student Union and at Mansfield Town Hall on Dec. 6, University officials and a team from the architectural firm Skidmore, Owings & Merrill unveiled the master plan for the long-sought University of Connecticut Technology Park.

"This has been a hope for some time, and it will soon become a reality," said Mary Holz-Clause, the University's vice president for economic development. "The Tech Park will be another way to use the

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Doug Adamson  
IMS Polymer Program/  
Chemistry

## Focus on Research: Doug Adamson

With this issue of the newsletter we are pleased to bring back an old favorite, Focus on Research. This recurring feature will profile one of the active research areas at IMS. In this issue we focus on the research program led by Doug Adamson, Associate Professor of Chemistry and Director of the Polymer Program.

Doug Adamson is an Associate Professor in the Polymer Program at IMS with Chemistry as his home department. He has been the director of the Polymer Program since July of 2011, and has been at UConn since August of 2008. His background is in organic and polymer chemistry. The research interests of his group include the synthesis of well-defined polymers, composites of graphene and boron nitride, self-assembled polymer structures, and polymer synthetic methods.

**Polymer Synthesis:** Several synthetic techniques are employed, including controlled radical polymerization and high vacuum anionic polymerization. The choice of the method depends on the application. Projects ongoing include developing a new method for the polymerization of ethylene oxide to form PEO or PEG homopolymers and block copolymers, synthesizing well-defined triblock grafted copolymers for single chain collapse, and for the first time forming block copolymers of poly(vinyl imidazole).

**Bio-inspired Materials:** The ability to synthesize well-defined polymers also enables the group's efforts to make bio-inspired materials. An

*(Continued on page 5)*

## Growing Momentum: UConn to Hire 290 New Faculty

From the School of Engineering News and Events. For the complete article visit: <http://news.engr.uconn.edu/growing-momentum-uconn-to-hire-290-new-faculty.php>

In June, UConn President Susan Herbst announced one of the most ambitious faculty hiring plans in U.S. higher education. Over the next four years, across the spectrum of disciplines and campuses, UConn will hire 290 new faculty members. During the first year of this important initiative, the School of Engineering will recruit and hire 18 new tenure track and tenured faculty for a fall 2013 start date. This first phase of hiring will focus on individuals with expertise in one of three interdisciplinary areas of knowledge, enabling UConn Engineering to achieve critical mass in areas of national importance:

- Advanced Manufacturing & Materials Genomics
- Genomics and Biomedical Sciences & Engineering
- Human Sustainability & Physical and Cyber Infrastructure Resilience

## Three New Faculty Members Join IMS

### Avinash Dongare

<http://www.mse.engr.uconn.edu/materials-modeling-expert-avinash-dongare-joins-uconn-faculty.php>



Avinash Dongare  
IMS/CMBE

Dr. Avinash Dongare joins IMS in January of 2013 as an assistant professor in the Chemical, Materials & Biomolecular Engineering Department. Dr. Dongare earned his Ph.D. in materials science and engineering at the University of Virginia, Charlottesville in 2008. In 2007, he obtained a prestigious three-year National Research Council fellowship at the U.S. Army Research Office, where he helped develop material models for advanced ballistics and the next generation of military hardware.

Dr. Dongare uses his skills in computational materials science to delve deep into the atomic microstructure of materials to find the optimal mix of components experimental scientists need to build stronger, faster, lighter, and more resilient steels, plastics, ceramics, and other materials. Dr. Dongare is particularly adept at developing computational tools for hybrid materials, which are widely used in materials science today.

Using advanced algorithms, Dr. Dongare's computer simulations screen out weaker or more problematic structures in a fraction of the time and at a fraction of the cost of traditional methods. "To run an experiment and do analysis costs a lot of money and a lot of time," says Dr. Dongare, "And it's very difficult to identify individual processes at the atomic level, because researchers often don't have that kind of equipment. "By running simulations on a computer, we can try all the different possible combinations of a material and test them in different environments at the atomic scale in order to predict their behavior and weed out the good and the bad," says Dr. Dongare, an assistant professor in the Department of Chemical, Materials, & Biomolecular Engineering, who also will be associated with UConn's Institute of Materials Science. "That way, we can go back to the experimenter and say, 'You want to develop your material this way because this way will work.'"

Dr. Dongare's research interest include the development and application of advanced computational methods (molecular dynamics, Monte Carlo, density functional theory, coarse-grained methods, etc.) to investigate the behavior and properties of novel materials across multiple scales.

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## Three New Faculty Members Join IMS

(Continued from page 2)

### Serge Nakhmanson

This winter Dr. Serge Nakhmanson is joining the CMBE department as an Associate Professor and member of IMS. He received his Ph.D. in 2001 from Ohio University, where he studied the properties of amorphous materials with first-principles and empirical simulation techniques with Dr. David A. Drabold. He then joined Dr. Jerry Bernholc at North Carolina State University as a junior postdoctoral fellow to investigate the polar and piezoelectric properties of BN nanotubes and electroactive polymers. His research was based on the polyvinylidene fluoride (PVDF) "design template" and utilized the methods of Modern Theory of Polarization, developed by David Vanderbilt and coworkers in the late 90s. In 2004, Dr. Nakhmanson joined Dr. Vanderbilt and Dr. Karin Rabe at Rutgers as a senior postdoctoral researcher working on prediction and enhancement of polar properties of functional complex oxide heterostructures. Since the summer of 2006 Dr. Nakhmanson has been a staff member in the Interfacial Materials group of the Materials Science Division at Argonne National Laboratory, where his work focused on designing and evaluating new electroactive materials, both hard and soft, with a variety of computational approaches continued.

Dr. Nakhmanson's research interests include developing approaches for rational design of multifunctional ferroic materials—including complex oxide, polymer and molecular crystal compounds—exploring phase transformations in these materials with the help of quantum mechanical computations to optimize their properties, and mesoscale simulations to study their behavior at long time and extended length scales.

### Elena Dormidontova

Dr. Elena Dormidontova joins the Physics Department as an Associate Professor and member of the Polymer Program of the IMS. Dr. Dormidontova received her Ph.D. degree in physics and mathematics at Moscow State University under the supervision of Dr. A. R. Khokhlov and carried out postdoctoral research at the Department of Polymer Chemistry, University of Groningen, working with Dr. Ten Brinke and Dr. G. Hadziioannou, and in the Department of Chemical Engineering and Materials Science at the University of Minnesota, collaborating with the group of Dr. T. Lodge.

From 2002 until joining UConn, Dr. Dormidontova was on the faculty of the Department of Macromolecular Science & Engineering at Case Western Reserve University, where she was named to the Climo Professorship for untenured faculty and received an NSF CAREER grant for computer modeling of associating and supramolecular polymers.

Her research expertise is in computer simulations and analytical theory applied to the thermodynamics and kinetics of self-assembly, biomedical applications of polymers and nanoparticles, ligand-receptor and donor-acceptor interactions, adsorption and phase behavior, micellization and network formation. One of her recent areas of interest is the use of computer simulations to explore how nanoparticle architecture can be modified to achieve optimization of targeting affinity and specificity for biomedical therapeutic and imaging applications. This use of computer simulations to guide future materials development is closely aligned with the Materials Genome Initiative.

Dr. Dormidontova has presented 30 invited lectures at academic institutions or national/international meetings and serves as reviewer for more than 20 journals. She was co-organizer of Symposium on *Biofunctional Architectures - Reversible Interactions and Surface Recognition* as a part of Colloids and Surfaces Division, at



Elena Dormidontova  
IMS/Physics



Serge Nakhmanson  
IMS/CMBE

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# University Unveils Master Plan for Technology Park

(Continued from page 1)

strength of the University of Connecticut as a research institution to feed innovation and create jobs both in the region and throughout the state in the years ahead.”

The plan calls for the park to be built on a portion of the University known as North Campus, which is bounded by Route 44, Route 195, and North Eagleville Road. An initial facility of 125,000 square feet, the Innovation Partnership Building, is expected to be completed in 2015, and will feature research equipment, flexible-use laboratories, and business incubator space.

The ultimate goal is to design about 900,000 square feet of building space divided into three “nodes” of several buildings each, connected by footpaths and by the extension of North Hillside Road to Route 44, which will create a new entrance to campus. The plan is to leave much of the area’s existing green space intact, while designing a technology park that’s in harmony with its environment, said Mark Regulinski, managing director of Skidmore, Owings & Merrill. A feasibility analysis by a tech park consulting firm estimated that the park will create between 1,000 and 1,300 jobs in its first decade. The average salary at similar technology parks around the country is roughly \$75,000.

The technology park is the logical next step for a university that’s rapidly cementing its reputation as a top research institution, said Mun Choi, interim provost, noting that UConn faculty members won more than \$220 million in research awards in 2012.

“We’re already a great research university,” Choi said, “but we want to expand our opportunities to work even more closely with in-



**Mun Choi, interim provost, said the kind of work envisioned for the tech park includes additive manufacturing, nanotechnology, genomics, and digital innovation. (Peter Morenus/UConn Photo)**

creasing numbers of industry partners.”

About 8,000 companies are within two hours’ drive from UConn that are doing the kind of work envisioned for the tech park, including additive manufacturing, nanotechnology, genomics, and digital innovation, he added.

Ultimately, Choi said, the goal is for the project not just to attract partnerships and faculty from the region, but to draw innovative companies and researchers from around the globe to Storrs.

“We want to bring in partners who want to come to this University because of the resources we have and the skills of our faculty and students,” he said.

## Three New Faculty Members Join IMS

(Continued from page 3)

Spring 2010 ACS meeting. Her undergraduate and graduate students have won several awards for their research presentations at local and national meetings and conferences.

Representative recent publications:

1. S. Wang; E. E. Dormidontova "Selective targeting by polymer nanoparticles: computer modeling" *Phys. Rev. Letters* 109, 238102, 2012
2. Z. Li, E. E. Dormidontova "Equilibrium Chain Exchange Kinetics in Block Copolymer Micelle Solutions by Dissipative Particle Dynamics Simulations" *Soft Matter*, 7, 4179-4188, 2011
3. S. Wang; E. E. Dormidontova "Nanoparticle Targeting using Multivalent Ligands: Computer Modeling" *Soft Matter*, 2011, 7, 4435-4445, 2011
4. Z. Li, H. Djohari E.E. Dormidontova "Molecular Dynamics Simulations of Supramolecular Polymer Rheology" *J. Chem. Phys.* 133, 184904, 2010 - selected for the November 15, 2010 issue of Virtual Journal of Biological Physics Research and November 22, 2010 issue of Virtual Journal of Nanoscale Science & Technology.
5. Wang, E. E. Dormidontova "Nanoparticle Design Optimization for Enhanced Targeting: Monte Carlo Simulations" *Biomacromolecules* 11, 1785-1795, 2010

## Focus on Research: Doug Adamson

(Continued from page 1)

example of such a material is synthetic block copolymer that templates and catalyzes the formation of ceramics such as silica and titania. These processes occur in ambient conditions and result in ceramic/polymer composites with unique chemical and morphological characteristics. Applications in coatings and catalysis are currently being explored.

**Graphene:** Starting in 2005 while at Princeton, the functionalization, exfoliation, and composites of graphite have been topics of investigation. With graphite oxide (GO) materials, this has included developing methods to thermally exfoliate GO, functionalizing GO sheets with amine and nitro groups, investigating the fundamentals of GO formation, and exploring methods to characterize GO samples.

For pristine natural flake graphite, work has focused on creating high concentration graphene suspensions in low boiling solvents, creating highly porous graphene assemblies, and forming transparent conductive films. The properties of pristine graphite are significantly superior to GO, yet the insolubility of graphite makes processing a challenge. Methods developed in the Adamson lab (in collaboration with Andrey Dobrynin) have overcome this challenge to allow for the direct processing of graphite without chemical modification.

**Polymer Spheres:** The formation of small polymer spheres containing gas or liquid is an area of active investigation. The spheres are formed either by a self-assembly technique or by interfacial polymerization. These spheres have applications in composite materials, separations, drug delivery, and actives storage. The spheres are formed by several methods, including a microfluidic device developed by the Adamson group.

**Boron Nitride:** The group has developed a method to functionalize and exfoliate boron nitride for use as a nanofiller in polymer composites. Boron nitride is an inert, non-flammable material used in applications such as high temperature lubricants and cosmetics. The patent pending method for utilizing it in composites is currently being explored for its use as a low load, transparent flame retardant.

For more information please contact Dr. Adamson at [adamson@ims.uconn.edu](mailto:adamson@ims.uconn.edu).

## Work of Friction

The work of Andrey Dobrynin, Professor of Physics and member of IMS, and his group was recently featured in the November 2012 issue of International Innovation. For the complete article visit [researchmedia.eu](http://researchmedia.eu). (Registration is necessary)

The importance of friction and lubrication can be seen in our everyday lives, ranging from industry to biology. For example, many biological surfaces such as cartilage, airway surface layers in the lungs, and mucin layers in the eyes and the gastrointestinal tract are covered with a brush-like layer of large chain-like molecules that have electrical charges. This polyelectrolyte layer consists of glycoproteins and has excellent lubrication and wear characteristics. In mammalian joints two brush-like layers covering the opposing cartilage surfaces face each other and prevent two bone surfaces from coming in physical contact during sliding motion.



**Andrey Dobrynin**  
IMS/Physics

The National Science Foundation-funded research group at the Institute of Materials Science at the University of Connecticut has set out to understand the complex interactions between brush layers and how it leads to the

lubricating properties of biological and synthetic systems. Led by Professor Andrey Dobrynin, the group is using computer simulations and theoretical methods to explain the low friction between the sliding surfaces of cartilage. In particular they apply a combination of molecular dynamics simulations and theoretical techniques to develop a model of the lubrication of charged and neutral glycoprotein layers.

The main goal of the research is to understand how the structure of the brush layer and layer interactions depend on the solution properties

and molecular architecture of the bottle-brush macromolecules. By varying the compression and shear stresses on the confined brush layers, Dobrynin's research group has been able to elucidate the effect of external stimuli on deformation of the bottle-brush macromolecules and their correlations with friction between brush coated surfaces. The computer model they are developing will then be used to simulate lubrication in different polyelectrolyte base coatings.

The Dobrynin research group's findings have shown that the friction coefficient in charged brush coatings is significantly reduced in comparison with neutral brush layers. Computer simulations have demonstrated that in charged bottle-brush systems under shear, there exists a layer with an excess of counterions located in the middle between brush-bearing surfaces. This protective layer of counterions prevents two brush layers from overlap, reducing inter-layer interactions. One can think of this layer of small ions as lubricant ('oil') which lowers the friction between brush covered surfaces. The main deformation mode of the charged bottle-brush macromolecules is associated with elongation of their backbone. This molecular deformation mode results in reduced shear viscosity being a universal function of the reduced shear rate in the wide interval of the compression loads.

The group is now carrying out computer simulations trying to establish what can be done on the molecular level to improve system lubricating properties. This may lead to the computer simulation aided design of molecules with optimal chemical structures for lowering interfacial friction. They are also performing large-scale detailed molecular dynamics simulations to elucidate the role of the solvent on the energy dissipation in sliding brush-like coatings. This research helps to advance our understanding of the lubrication properties of cartilage as well as other biological and synthetic surfaces where brush-like molecules form protective interfacial layers. In the future the study seeks to develop new polymeric coatings with excellent lubricating properties for biomedical applications such as joint replacements, the effectiveness of which are currently limited by wear to the artificial joint surfaces caused by friction generated during daily use.

*Editor's Note:* Beginning January 2013, Dr. Dobrynin will spend two years as an NSF program manager in theoretical physics.

## Engineer has NSF EAGER Award to Study Nanoparticle Flow in Bloodstream

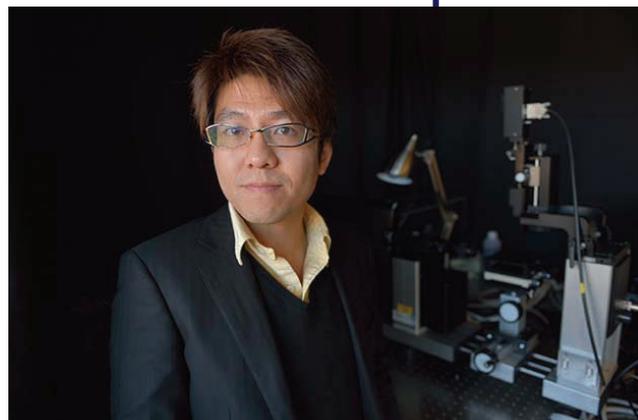
By Nan Cooper. From UConn Today. For the complete article visit: [http://today.uconn.edu/blog/2012/12/engineer-has-nsf-eager-award-to-study-nanoparticle-flow-in-bloodstream/?utm\\_source=DailyDigest](http://today.uconn.edu/blog/2012/12/engineer-has-nsf-eager-award-to-study-nanoparticle-flow-in-bloodstream/?utm_source=DailyDigest)

Anson Ma, an assistant professor of chemical engineering with a dual appointment in the Institute of Materials Science Polymer Program, has received a National Science Foundation Early Concept Grant for Exploratory Research (EAGER) award. The two-year grant supports his research aimed at understanding how nanoparticles flow in the bloodstream, with the goal of determining whether nanoparticles can be employed to improve the delivery of cancer-fighting drugs to tumors while reducing the toxic side effects to normal tissues.

Ma, who earned his Ph.D. from the University of Cambridge in the UK, joined UConn in August 2011 following a two-year appointment as the J. Evans Attwell-Welch Postdoctoral Fellow at Rice University. He believes nanoparticles offer significant promise as a vehicle for delivering chemotherapy drugs more directly to the site of the diseased tissues than conventional methods. The focus of his EAGER award will be to test the use of nanoparticles for drug delivery, and to understand, from the time of the injection of nanoparticles into the bloodstream, how these nanoparticles can really get into the tumor.

In seeking to unveil the processes at work in delivering drug-carrying nanoparticles to a tumor, the research team will first build novel microfluidic devices that simulate the bloodstream. They will then study the flow dynamics of nanoparticles within these simulated blood flows, with the aim of better understanding the enhanced permeability and retention (EPR) effect. Another facet of the research centers on the roles of particle shape and size, and blood constituents in delivering drugs to the tumor site.

For the EAGER project, Ma and his team will inject dye-tagged nanoparticles into the microfluidic bloodstream simulator and study how the blood and nanoparticles flow dynamically. They will also see how certain factors like particle shape and surface chemistry influence the hydrodynamics of the nanoparticles. From these observations, they hope to understand the EPR and margination effects, tailor the design of drug-delivering nanoparticles, and ultimately help the pharmaceutical community develop better cancer-fighting drugs with few negative side effects on patients.



Anson Ma  
IMS Polymer Program/Chemical Engineering

## IMS Faculty Organize MRS Symposiums

From the School of Engineering News and Events. For the complete article visit: <http://news.egr.uconn.edu/faculty-grad-student-news.php>

Dr. Ramamurthy "Rampi" Ramprasad (Chemical, Materials & Biomolecular Engineering (CMBE), and member of IMS, ed.) was a co-organizer of a symposium held during the 2012 Materials Research Society's Fall Meeting in Boston from November 25-30. The Symposium QQ theme was "Materials Informatics" and focuses on the concept of rationally designing materials with novel properties through the use of computational methods, which forms the core of the recent U. S. Whitehouse Materials Genome Initiative. His colleague, Dr. Pu-Xian Gao (CMBE, and member of IMS, ed.) was a co-organizer of Symposium K: "Hierarchically Structured Materials for Energy Conversion and Storage" which focused on assembly and fabrication strategies for the creation of hierarchically structured inorganic and organic materials.

## Department Seminars: Spring 2013

All Spring seminar schedules have not been finalized at the time of this writing. Final seminar schedules will be available near the beginning of the semester and can be found on the department web sites (<http://www.ims.uconn.edu/polymer/seminars.html> and <http://www.mse.engr.uconn.edu/seminars>). This information will be updated as additional seminars and information are added. Abstracts of seminars are usually available about a week in advance. We can also put you in touch with the faculty member sponsoring the seminar to learn more about the specific seminar of interest. We suggest you call before attending to be sure the seminar has not been canceled due to illness or weather.

Here are the preliminary schedules for the Polymer Program spring seminar series and the CMBE.

### POLYMER SEMINAR SERIES

<b>February 1</b>	<b>Nanomaterials from the Self-Assembly of Globular Proteins</b> Prof. Bradley D. Olsen, MIT
<b>March 1</b>	<b>Polymer-based Materials Research at the DOE's Office of Basic Energy Sciences</b> Dr. P. Thiyagarajan, U.S. Dept. of Energy
<b>March 8</b>	<b>Graphene Polymer Nanocomposites</b> Prof. Christopher W. Macosko, University of Minnesota
<b>March 15</b>	<b>Complex Polymer Systems: From Thin Films to RNA</b> Prof. Robert M. Briber, University of Maryland
<b>March 29</b>	<b>Carbon Nanotube and Graphene: From Fluid Phases to Multifunctional Materials</b> Prof. Matteo Pasquali, Rice University
<b>April 5</b>	<b>Nanofluidics—Wetting and Spreading Phenomena</b> Prof. Darsh Vasan, IIT Chicago
<b>April 19</b>	<b>Polymer Analytical at Boston Scientific</b> Dr. Peter G. Edelman, Boston Scientific

Additional seminars may be added. Please check the [Polymer Program website](#) for details.

All Polymer Program seminars are held on Fridays at 1:30 PM in IMS Room 20, unless noted otherwise. Coffee will be served at 1:00 PM outside the seminar room. For more information, please contact YH Chudy at [yhchudy@ims.uconn.edu](mailto:yhchudy@ims.uconn.edu) (860-486-3582) or visit [www.ims.uconn.edu/polymer](http://www.ims.uconn.edu/polymer).

## MSE SEMINAR SERIES

### MSE Spring 2013 Seminar Series

- January 25                    **Nanoarchitectures for Oxygen Reduction PEM Fuel Cell Electrodes and for Electrochemical Supercapacitors**  
Dave Mitlin, Professor, University of Alberta
- February 8                    **TBD**  
Rosario A. Gerhardt, Executive Director for Research and Institute Collaboration, Office of the Vice President for Institute Diversity, Professor of Materials Science and Engineering, Georgia Institute of Technology
- February 15                    **Modeling The Mechanical Response Of Metallic Materials At The Nano-Scale**  
Diana Farkas, NSF and Virginia Tech
- March 8                        **The Role of Interfaces in Devices for Energy Harvesting and Energy Generation**  
Dawn Bonnel, Trustees Chair Professor, Materials Science and Engineering; 2012 American Ceramic Society Sosman Award Winner, University of Pennsylvania
- March 29                      **TBD**  
Ian Robertson, Donald B. Willett Professor of Engineering, Professor of Materials Science and Engineering, UIUC
- April 12                        **An Atom-by-Atom View of Nanotube Nucleation and Growth**  
Eric Stach, Brookhaven National Lab
- April 26                        **NOx Catalysis from the Bottom Up**  
William F. Schneider, Professor, Department of Chemical and Biomolecular Engineering, University of Notre Dame

### MSE Spring 2013 Distinguished Lectureship

- February 21 (4:00pm)        **Diving into the World of Atoms—Picometre Electron Microscopy**  
Knut Urban, Director, Institute of Microstructure Research Forschungszentrum Jülich
- February 22                    **Pushing the Frontiers—Insight into Transmission Electron Microscopy**  
Knut Urban, Director, Institute of Microstructure Research Forschungszentrum Jülich

All MSE seminars are held on Fridays at 11AM in IMS Room 20, unless noted otherwise. Coffee will be served before the seminar outside the seminar room. For more information, please contact Cathy McCrackan ([cmccrackan@ims.uconn.edu](mailto:cmccrackan@ims.uconn.edu)) or visit <http://www.mse.engr.uconn.edu/seminars>.

## Alumnus Nick Polomoff: YouTube Star

By Heike Brueckner. From the School of Engineering News and Events. For the complete article visit: <http://news.engr.uconn.edu/alumnus-nick-polomoff-youtube-star.php>

Since receiving his Ph.D. in Materials Science & Engineering in 2011, (*Huey group*, <http://www.ims.uconn.edu/~bhuey/>, ed.) alumnus Nick Polomoff has been working as a Senior Material Scientist at Material ConneXion, an international company that employs the materials expertise of its multidisciplinary specialists to aid companies in problem-solving and innovation. Material ConneXion utilizes several forms of social media, including Facebook, Twitter, and YouTube, to keep interested parties apprised of the latest breakthroughs.

Dr. Polomoff is featured in the company's weekly video series, broadcast on YouTube, "Material Mondays." The videos introduce the viewer to a different innovative and unique material each week and are accessible to even the least scientifically minded, as they feature materials that solve real-world problems. Burglary, for example, can be combatted by conductive wallpaper that acts as an alarm system without expensive installation or cumbersome wires, and the ubiquitous holiday worry of dry, highly flammable Christmas trees is can be appeased by a household-safe, omni-surface fire-retardant spray.

The complete series of videos can be accessed on YouTube at <http://www.youtube.com/user/MaterialConneXionNY?feature=watch>. For additional details of the company's materials, visit the Material ConneXion website at <http://www.materialconnexion.com/>.

## A Handy Way to Sort Carbon Nanotubes

By Samantha Cheung in the August 16, 2012 issue of Chemistry World. For the complete article visit: <http://www.rsc.org/chemistryworld/2012/08/handy-way-sort-carbon-nanotubes>.

The work of the nanomaterials group led by Fotios Papadimitrakopoulos (Professor of Chemistry, Associate Director, Institute of Materials Science) was recently featured in Chemistry World.

Single walled carbon nanotubes (SWNT) are hollow cylindrical structures composed of a single atomic layer of graphene which, conceptually, have been rolled up in one of three ways. The hexagons of the honeycomb-like sheet can match perfectly which bestows metallic properties or the SWNTs have off center match to give rise to two enantiomers, right and left handed which display semiconducting properties. The potential of SWNTs can only be unlocked if the SWNTs can be separated by type, chirality, handedness and length.

The Papadimitrakopoulos team has recently shown that the naturally occurring chiral flavin mononucleotide (FMN) can selectively choose left handed SWNTs. "FMN uses its directional hydrogen bonds to form helical ribbons that use SWNTs to wrap around, similar to the way a vine wraps around a stick," explains Papadimitrakopoulos. "What is amazing is that the right-handed FMN helix naturally selects left handed SWNTs."

The next step is to gather more evidence. "We need solid proof and quantification of the amount of twist that the FMN imparts on various kinds of SWNTs. Moreover we need to develop applications to utilize these twists," says Papadimitrakopoulos.

## Leon Shaw

Professor Leon Shaw has moved to the IIT Armour College of Engineering as the Rowe Family Endowed Chair Professor in Sustainable Energy, Director, Center of Energy Storage and Conversion. We wish Leon and his family well in their new endeavor.

## Employment Web Page

The Institute of Materials Science has a web page to help match students with potential employers. The IMS Employment Center can be accessed from the IMS home page <http://www.ims.uconn.edu/> and clicking on Outreach then Employment Center.

The open positions page has brief information concerning each position and a link for more details. Please forward any open position announcements you wish to post to Rhonda Ward ([rhonda.ward@ims.uconn.edu](mailto:rhonda.ward@ims.uconn.edu)).

We have several positions on the website now, with your help we can continue to build this database of information, which benefits both students and employers.

## Toxic and Bio-Contaminated Samples

On a small number of occasions member companies have sent us toxic samples for examination. IMS is not set up to handle such materials. We operate in a very open environment with multiple users and shared laboratory facilities. We cannot accept toxic materials, materials that present biological hazards or similar materials such as drugs that require very specialized handling. If we do receive such a sample we must return them (and may need your assistance to do so as shipping these materials can be time consuming and expensive). We cannot dispose of these types of material at UConn when they are created by external sources.

## Mid-Length Projects (MLP) Program

The Institute of Materials Science (IMS) announces the continuation of a program that addresses seed research/development projects of an intermediate length. This program is designed to encourage university/industry collaboration on projects that are too extensive for the existing Associates Program yet smaller than full-blown university research projects. Typical student/post-doc supporting research projects at IMS (and most of UConn and other institutions) last for some number of years. Industry often has exploratory projects of intermediate length between these extremes, projects that may require several months to a year of full time effort. Through the Mid-Length Projects (MLP) Program IMS will assist industry in matching the available resources of IMS to those required for the project of interest.

For more information or to discuss specific projects please contact Ed Kurz (860-486-4186, [ekurz@mail.ims.uconn.edu](mailto:ekurz@mail.ims.uconn.edu)) or Harris Marcus (860-486-4623, [hmarcus@mail.ims.uconn.edu](mailto:hmarcus@mail.ims.uconn.edu))

## Large Sample Quantities

It is rare that the Associates Program needs more than 100gr of material for our investigations – actually we rarely need more than a few grams. When we receive unnecessarily large sample quantities we must return or dispose of the unneeded material. This can incur significant expense that we must pass along to the requestor. If you are unsure of the quantity of sample required for various projects please feel free to discuss that with us before sending samples.

## Sample Preparation

In many projects that the Associates Program deals with, such as adhesion and coatings, surface analysis techniques are extremely important. The techniques used for such analysis, particularly GC/MS, Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS) and contact angle are extremely sensitive to small amounts of material on the surface. It is important to make efforts not to contaminate these surfaces during sample preparation, collection and shipment. **Shipment in common plastic bags should be avoided!** Common plastic bags typically contain significant amounts of additives used to prevent the plastics from adhering to themselves and other materials. These additives will migrate to the sample during shipment and at best make interpretation difficult and sometimes impossible. It is much better to ship such samples in common kitchen aluminum foil (not industrial aluminum foil which is often coated with an oil or other release agent). Samples can also be shipped in glass containers with aluminum foil over the opening under the cap.

Alternatively special polyester bags that do not contain such additives can be purchased. One source of such bags is the Kapak Corporation (now Ampac) Typical price is about \$200 per thousand depending on the exact size. Be sure to specify non-contaminating/non-plasticized material.



### IMS Associates Program

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## Gant Complex Construction

The northwest and southwest stair towers and a portion of the roof of the Gant Building are in serious disrepair. Protective scaffolding has been in place for some time to ensure the safety of pedestrians and visitors entering and exiting the Gant building via these stair towers.

The University retained the engineering firm of Simpson, Gumpertz and Heger to design corrective repairs. NER Construction Management (NER), an experienced Masonry Contractor, will remove and replace the deteriorated masonry. The glass curtain wall system surrounding the stair towers and the roof of the Physics wing will also be removed and replaced.

Construction fencing was erected during the week of Thanksgiving to prepare the site for construction operations. The restoration work requires the alternate closure of the stair towers for periods of 4 to 6 months each. The project is scheduled to be completed at the end of 2013. The UConn Fire Marshal and Building Inspector's Office has approved emergency exit routes and signage will be placed to direct occupants to safe exits.



Photo: E. Kurz

## Spring Semester Starts

Spring semester classes start January 22, 2013. Some courses that may be of interest include the following:

CHEG 5352	Polymer Properties	E. Dormidontova
CHEM 5341	Advanced Organic Chemistry	D. Adamson
CHEM 5345	Organic Structure Determination	G. Sotzing
CHEM 5384	Polymer Characterization II	A. Asandei
CHEM 5394-2	Special Topics in Chemistry: Carbon Nanotubes and Graphene Nanomaterials	F. Papadimitrakopoulos
MCB 5003	Biophysical Chemistry I	P. Burkhard
MCB 5015	X-Ray Structure Analysis	P. Burkhard
MSE 5309	Transport Phenomena	R. Maric
MSE 5310	Modeling Materials	R. Ramprasad
MSE 5311	Mechanical Properties of Materials	G. Ojard
MSE 5366	Alloy Casting Processes	H. Brody
MSE 6401	Graduate Seminar	B. Carter

