University of Connecticut
Institute of Materials Science
IMS Associates Program Newsletter

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Nanotechnology: A Key to Industrial Growth in Connecticut

Harris Marcus, Director of the Institute of Materials Science
University of Connecticut

The Connecticut General Assembly recently considered bills which proposed the creation of partnerships between Connecticut universities and industry. Funding of this program would allow the purchase of the state-of-art equipment, which is necessary for our industries and universities to remain competitive in this important and quickly evolving field, where a single highly advanced microscope can cost an astonishing $3-6 million, as well as support for other collaborative research and development initiatives. Unfortunately, the rapid slowdown in the economy and the disappearance of the anticipated budget surplus has put the state's nanotechnology initiatives on hold. Active industry involvement is urgently needed to send a clear message to the state legislature regarding the importance of reviving this initiative.

Why is nanotechnology important?

Ensuring that Connecticut remains competitive in the emerging field of nanotechnology is essential to growing our high-tech economy, creating a vital pipeline of highly-skilled workers and advancing innovation. Nanotechnology is at the forefront of research and development in many areas including chemistry, manufacturing, medicine, pharmacy and engineering. Nanotechnology is impacting sensors,

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Polymer Expert's Lifetime Work Garners International Acclaim

(From the UConn Advance, Nan Cooper, June 23, 2008, see http://advance.uconn.edu/2008/08062304.htm for the complete article.)

Polymers are found everywhere in the natural world, and engineering professor Robert Weiss has devoted his career to manipulating polymers to produce an array of useful products, from better golf balls to improved proton exchange membranes for fuel cells.

In May, he was honored by the Society of Plastics Engineers with the society's International Award in recognition of his lifetime achievements in polymer research.

Weiss is the UTC Professor of Advanced Materials & Processing and a Board of Trustees Distinguished Professor in the Department of Chemical, Materials & Biomolecular Engineering *and a member of IMS (ed.).*

Robert Weiss, Professor Of Chemical, Materials, And Biomolecular Engineering, in his lab. Photo by Peter Morenus

During his 33-year career, he has contributed substantively to the field of polymer science and engineering. His research focuses primarily on ionomers, a type of polymer containing bonded salt or acid groups. (Cont. Page 8)

Inside this issue:

Chemistry Professor Achieves Nanotechnology Breakthrough

(From the UConn Advance, Cindy Weiss, June 23, 2008, see http://advance.uconn.edu/2008/080623/08062307.htm for the complete article.)

A chemistry professor in the College of Liberal Arts and Sciences and his graduate students have published new results in *Nature Nanotechnology* showing how they isolated a particular type of carbon nanotube from a sample and manipulated it in a way that could have broad applicability in drug and gene delivery, electronic devices, and nanotechnology research.

Fotios Papadimitrakopoulos *(Professor of Chemistry, Associate Director of the IMS and Member of the Polymer Program, ed.)* and his graduate students found a way for a biological molecule, a form of vitamin B2, to wrap around a single-walled carbon nanotube – a tube so small that it has the highest curvature on earth.

Wrapping a carbon nanotube was a difficult achievement and instrumental to their research, since it was a step that eventually enabled them to isolate a particular type of nanotube from a sample that contained 50 different kinds.

Papadimitrakopoulos has spent seven years investigating how to efficiently separate the various nanotubes in a sample into like types. Nanotubes that are alike can be interlocked to create a material that is extremely strong, even if each nanotube is as small as one micron. The research opens the possibility of wrapping nanotubes with proteins or other molecules, which would be useful in a variety of applications.

The lead author of the Nature Nanotechnology paper is Sang-Yong Ju, a polymer science Ph.D. candidate in his fifth year of study. Other authors are Jonathan Doll, a fourth-year polymer science Ph.D. student, and Ity Sharma, a second-year chemistry Ph.D. candidate.

The researchers worked with single-walled carbon nanotubes formed from graphene. If you drag a pencil across paper, Papadimitrakopoulos says, you leave thousands of graphene "seeds" behind, a deposit from the friction of the graphite pencil tip against the paper. At the molecular level, graphene seeds look like a honeycomb. If you form these graphene sheets into a tube, they can become the basis of single-walled carbon nanotubes.

Fotios Papadimitrakopoulos, Professor of Chemistry. Photo by Daniel Buttrey

Getting another material to wrap around them was the next challenge. The researchers discovered that the vitamin B2 molecule stitches itself into a ribbon, using soft hydrogen bonds, and seamlessly wraps itself around the carbon nanotube. The ribbon, in a sense, acted as a detergent, dispersing the oil-loving nanotube in water. "Nobody has shown this before," says Papadimitrakopoulos.

By introducing a second detergent, they managed to destabilize the ribbon, breaking its hydrogen bonds and leaving the second detergent in its place. Varying the concentration of the second detergent allowed them to separate nanotubes that had a given chirality, or pitch. Identifying carbon nanotubes of like chirality, or pitch, has important implications. If the chirality is the same, the nanotubes have the potential to interlock themselves in a hexagonal pattern and create an extremely strong material, even if the nanotubes are not very long.

- To hear Papadimitrakopoulos describe this research, go to www.clas.uconn.edu/facultysnapshots/view.php?id=papadimitrakopoulos
- To read the Nature Nanotechnology paper online, go to: www.nature.com/nnano/journal/v3/n6/full/

UConn Materials Research Society Chapter

The University of Connecticut Materials Research Society (MRS) University Chapter received its charter on Monday, November 26, 2007 at the plenary session at the MRS Fall Meeting. It's exciting to see that the group's membership extends beyond the Materials Science and Engineering Department to include a number of individuals from Physics, Chemistry, Electrical and Computer Engineering and the UConn Health Center.

Investigating a Small World with Big Potential

(From the UConn Magazine, Spring 2008, Stefanie Dion Jones & David McKay Wilson, see http://uconnmagazine.uconn.edu/sprg2008/feature1.html for the complete article.)

What if harmful carbon dioxide emissions — the primary cause of global warming — could be stripped from the atmosphere and harnessed to create useful products, such as pharmaceuticals or renewable fuels?

Suppose newly developed chemotherapy drugs could target cancer cells with unparalleled precision, sparing healthy cells from damage and, consequently, patients from unpleasant side effects.

Although still generations away, such scientific breakthroughs are not as far-fetched as they might have once seemed. Faculty members and graduate students at the University of Connecticut are among those leading the way in this emerging area called nanotechnology.

A burgeoning field of promise viewed by some as the next technological frontier, nanotechnology is expected to bring about widespread changes in the world similar to the transformations that followed development of the computer in the 20th century. Although still in its infancy, many researchers predict that nanotechnology will change everything from how we store information and treat illness to how we power our cars and heat our homes. In short, scientists are looking for ways to use little things — so small they are unseen by the naked eye and observable only through the most advanced of microscopes — to change the world in a big way.

In recent years, UConn has emerged as a leader in nanotechnology research in Connecticut, and "the state is starting to pay attention," says Mehdi Anwar, Associate Dean for Research and Graduate Education at the School of Engineering. UConn's investment in this cutting-edge technology is extensive, with more than 60 faculty plus dozens of graduate students and postdoctoral fellows involved in a myriad of research projects backed by more than $20 million in research grants and contracts.

"There's a real buzz now about nanotechnology," says Harris Marcus, Professor of Materials Science and Engineering and director of the University's Institute of Materials Science, an interdisciplinary research center housing state-of-the-art equipment and laboratories where much of UConn's nanotechnology studies are concentrated. "And while the buzz may fade away, the research is going to be profound."

The number of potential nanotechnology-based applications — in fields as diverse as manufacturing and military defense to medicine and renewable energy — is astounding. UConn faculty in engineering, physics, chemistry and other sciences are coming together to carry out work that could someday lead to the development of cleaner energy sources, earlier diagnoses of disease and many other innovations that are only beginning to take shape.

Take, for instance, the potentially life-saving research performed by scientists at the UConn Health Center. At the R.D. Berlin Center for Cell Analysis, Liisa Kuhn, Assistant Professor of Oral Rehabilitation, Biomaterials and Skeletal Development, *and member of IMS (ed.)* is exploring the possibility of using nanoparticles to deliver anti-cancer drugs directly — and more accurately than ever before — to tumors and lymph nodes.

Equally as promising are the multi-disciplinary endeavors explored by UConn chemists such as Robert Birge, the Harold S. Schwenk Distinguished Chair of Chemistry in the College of Liberal Arts and Sciences *and member of IMS (ed.)*. Heavily dependent on nanotechnology and biomolecular electronics, Birge's research includes a long-standing project dedicated to producing an artificial retina that could restore vision for people who have lost their sense of sight.

At the same time, Fotios Papadimitrakopoulos, Chemistry Professor and the Associate Director of the Institute of Materials Science, has spent the past decade teamed up on a mission to construct special nano-sized sensors that could greatly improve quality of life for people with diabetes. Working with fellow scientists in the Schools of Engineering and Pharmacy, Papadimitrakopoulos envisions these sensors — wireless and implanted in humans—capable of continuously monitoring metabolic processes, such as blood glucose levels. For the more than 20 million Americans currently suffering from diabetes, such a sensor would prove to be indispensable.

"Nanotechnology will make a fundamental change in the way we live and work," says UConn chemistry professor *and member of IMS (ed.)* Challa Vijaya Kumar, who compares the advent of nanotechnology to the dawn of the Stone Age, when humans first learned to make and use tools. In considering the developments that could emerge as nanotechnology research efforts intensify, Kumar is optimistic about the next "leap in our civilization." He envisions nanorobots that flow through the bloodstream, repairing damaged cells, and nanomaterials 100 times stronger than steel. His own research involves removing carbon dioxide from the atmosphere and converting it into practical products using nanocatalysts.

Still other studies, even in the early stages of development, offer a glimpse into a wealth of possible future benefits. Bahram Javidi, Board of Trustees Distinguished Professor in the Department of Electrical and Computer Engineering, and his team have developed a novel way to view and recognize different bacteria species using a special imaging system that measures how nanoorganisms interact with light.

"What is good is that the devices, such as lasers and detectors, needed to make these instruments and these discoveries are all moving in the right direction," Javidi says.

"They are all becoming more available in the domains where we need them." UConn's Institute of Materials Science is the place where sophisticated microscopes and other advanced lab equipment make it possible today for scientists to probe, evaluate and manipulate materials on the nano level. This high-tech instrumentation is accessible to University faculty and graduate students engaged in cutting-edge studies of materials science and engineering, including nanotechnology. "Smaller and smaller is where everything is going," says Marcus, the Institute's longtime director. "This instrumentation is absolutely necessary to doing nanotechnology research."(Continued Page 9)

UConn Developing Implantable Chip For Soldiers

(From The Day, New London, Audrey M. Marks, Jan 1, 2008, copies of the full article are available by request from Shari Masinda smasinda@ims.uconn.edu. A similar article was published in the Daily Campus, see http://media.www.dailycampus.com/media/storage/paper340/news/2008/01/29/NewsResearchers.Developing.Implantable.Microchip-3174000.shtml)

By 2014 the Army may issue more than combat gear to deploying soldiers. University of Connecticut researchers are developing an implantable chip that would be injected under soldiers' skin to help monitor vital health information while they are out in the field.

"It sounds like science fiction but it's not," said Fotios Papadimitrakopoulos, professor of chemistry and associate director of the Institute of Materials Science at UConn. "We're taking components from traditional biology and nanotechnology and trying to marry them."

Six UConn faculty members have been working to create a nanosensor, just millimeters in length and width, that will be used to monitor soldiers' glucose and lactose to make sure the soldiers are not exhausted and are receiving proper nutrition.

The silicone nanosensor will be small enough to pass through the tip of a standard hypodermic needle, which will be used to implant the device in the wrist. The soldier will wear a watch-like transmitter that will receive readings of the soldier's glucose and lactose levels.

Researchers hope that the blossoming technology could also be used in people with diabetes. UConn scientists are looking at ways to use the technology to help change the way diabetics monitor their blood sugar and live their lives. "Right now (diabetics) prick their fingers five times a day and we don't have a picture of what happens in between," Diane Burgess, *Professor of Pharmaceutical Science and member of IMS (ed.)* said. This sensor would be "completely revolutionary."

She said the nanosensor could be used by diabetics to help understand how their bodies respond to eating and exercise and in turn produce an individualized medication and care plan. Burgess said microelectronics will continue to change the future of medicine in how information is gathered and how people are treated. Nanosensors are "not only part of treating medicine, but they have an enormous future in preventative medicine," Burgess said.

School Holds Nanotechnology Forum

(From the School of Engineering News and Events http://www.engr.uconn.edu/nanotechforum.php)

The School of Engineering held its first Nanotechnology Research Forum on Wednesday, March 5th. Nearly 30 faculty members from the School's five departments presented five-minute overviews of their ongoing research activities in nanotechnology and related areas. The objective of the forum was to highlight current research underway at UConn and to foster collaborations among different parties who are actively engaged in explorations involving this transformative technological frontier.

Dean of Engineering Dr. Mun Y. Choi welcomed over 80 attendees and framed the School's objectives in staging the forum. He was followed by Drs. Greg Anderson, Vice Provost for Research & Graduate Education, and Harris Marcus, Director of the Institute of Materials Science, who also offered brief remarks.

Three guest speakers who play important roles in Connecticut's emerging nanotechnology industry and curriculum development opened the forum. They were Stephen Andrade, Program Manager of Battelle's Technology Partnership Practice, who spoke as a representative of the State's Office for Workplace Competitiveness; Brig. Gen. (ret.) Robert Mansfield, Director of the National Center for Aerospace Leadership at the Connecticut Center for Advanced Technology (CCAT); and Louis Manzione, Dean of the College of Engineering, Technology & Architecture at the University of Hartford and founding executive director of Bell Laboratories' research center in Ireland.

In addition to the engineering faculty presentations, the forum featured research summaries by two invited researchers, Drs. Kenneth Noll of Molecular & Cell Biology and Steven Suib of Chemistry, who discussed their work involving - respectively - development of energy and sensor technologies from microbes, and nano-sized catalysts. Both researchers collaborate with engineering faculty members on a variety of fuel cell, coatings, materials and other applications-oriented investigations.

The event attracted faculty, graduate and undergraduate students, university administrators as well as industry collaborators. Throughout the three-hour forum, the slate of primarily engineering faculty members discussed facets of their nanotechnology research spanning a spectrum of applications, from sensors, actuators and transistors to nano-scale surface mapping and defect detection, memory devices, novel fuel cells and intra-cellular injection. Other research areas centered on devices, medical therapeutical delivery devices and photonics.

The complete proceedings can be found at http://www.engr.uconn.edu/pdf/Proceedings-Complete-3-14-2008.pdf

New Faculty

George Rossetti Jr.

This fall IMS welcomes four new faculty members. **Dr. George A. Rossetti, Jr.** will join the CMBE department in August 2008 as an Associate Professor and member of IMS. Dr. Rossetti has worked as a Research Professor in the Institute of Materials Science at UConn since 2006. He previously was a Research Associate Professor at Rutgers University.

Dr. Rossetti's experience spans more than a decade in industry, during which he served as Director of Functional Materials at Continuum Photonics Inc. in Billerica, MA and a Senior Research Engineer at Norton Company Central Research Laboratories, Saint-Gobain Corporation, Worcester, MA. He was also a Senior Research Scientist at the NASA Center for Advanced Microgravity Materials Processing at Northeastern University, Boston.

Dr. Rossetti earned his B.S. in Chemical Engineering and M.S. in Materials Engineering from Worcester Polytechnic Institute and his Ph.D. in Solid State Science from The Pennsylvania State University. He conducted post-doctoral work at the Princeton Materials Institute. His research interests focus on structure-processing-property relations in electroceramic materials and their applications in dielectric, electromechanical and energy conversion devices and systems.

Some recent publications include:

G. A. Rossetti, Jr., et al, "A distributed step-like switching model of the continuous field-driven phase transformations observed in PMN-*x*PT relaxor ferroelectric single crystals," *Acta Materialia* **56**, 2744-2749 (2008).

G. A. Rossetti, Jr., et al. "Ferroelectric solid solutions with morphotropic boundaries: Vanishing polarization anisotropy, adaptive, polar glass, and two-phase states," *Journal of Applied Physics*, **103**, 114113 (2008).

G. A. Rossetti, Jr., et al. "Influence of mechanical boundary conditions on the electrocaloric properties of ferroelectric thin films," *Journal of Applied Physics,* **103**, 024104 (2008).

Dr. Menka Jain joins the Physics Department in August 2008 as an Assistant Professor and member of IMS. Dr. Jain received a B.S. from Christ Church College in Kanpor, India, an M.S. in Physics also from Christ Church College and a Ph.D. in Physics from the University of Puerto Rico. Her thesis work focused on perovskite ferroelectric thin films for tunable microwave applications. Most recently she was a post-doctoral fellow at the Superconductivity Technology Center, Materials Physics and Applications Division of Los Alamos National Laboratory. Her research interests include ferroics, a family of materials exhibiting one or more multifunctional characteristics such as ferroelectric, ferromagnetic or ferroelastic properties. In order to insure long-term device reliability specific structural, microstructural, interfacial and surface morphological requirements must be met. Optimization of these properties is possible only when processing routes lead to the desired nano- and microstructures.

Menka Jain

Some recent publications include:

M. Jain et al., "Manipulating Magnetoresistance Near Room Temperature in $La_{0.67}Sr_{0.33}MnO_3/La_{0.67}Ca_{0.33}MnO_3$ Films Prepared by Polymer Assisted Deposition", *Advanced Materials,* 18, 2695 (2006)

M. Jain et al, " Effect of Conductive LiNiO3 Electrode on the Structural and Ferroelectric Properties of Bi3.25La0.75Ti3O12 Films'" *Applied Physics Letters,* **89**, 242903 (2006)

M. Jain et al., " Magnetoresistance in Polymer-Assisted Depsoted Sr- and Ca- Doped Lanthanum Manganite Films", *Applied Physics Letters,* **88**, 232510 (2006)

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Yao Lin

Dr. Yao Lin joins the Chemistry department in August 2008 as an Associate Professor and member of IMS. Dr. Lin received a B.S in Macromolecular Science from Fudan University in Shanghai, China, A M.A. in Chemistry from the College of William and Mary and a Ph.D. in Polymer Science and Engineering from the University of Massachusetts. His thesis research focused on directed self-assembly of nanoparticles at liquid-liquid interfaces. Most recently he was the George W. Beadle Postdoctoral Fellow at Argonne National Laboratory. His current research interests focus on understanding the principles of designing protein building blocks that can form complex structures with novel functions. This work is expected to result in the development of protein-based artificial systems that mimic the properties exhibited by biological systems.

Some recent publications include:

Y. Lin, et al., "Self-Directed Assembly of Nanoparticles/Copolymer Mixtures", *Nature,* **434**, 55-59 (2005)

Y. Lin, et al., "Structure and Dynamics of Nanoparticle Assembly at Liquid-Liquid Interfaces", *Langmuir,* **21**, 191-194 (2005)

Y. Lin, et.al., " Self- Assembly and Cross-Linkingof Bionanoparticles at Liquid-Liquid Interfaces", *Angew. Chem.-Int Edit*, **44**, 2420-2426 (2005)

Dr. Douglas Adamson also joins the Chemistry Department in August 2008 as an Associate Professor and member of IMS. Dr. Adamson received a B.S in Chemistry with a minor in Biology from the University of Evansville in Indiana and a Ph.D. in Chemistry from the University of Southern California. He did post-doctoral work at the Max Planck Institute in Germany and at the Exxon Corporate Research Facility in New Jersey. Most recently he was associated with Princeton University at the Institute for the Science and Technology of Materials and the Textile Research Institute. Central to his research interests is the synthesis of model polymeric materials with controlled chemistry and architecture. Living anionic polymerization is the method of choice, often combined with post-polymerization functionalization. From this central theme four general fields of research will be pursued: bio-materials, bio-inspired materials, complex fluids, and nanotechnology.

Douglas Adamson

Some recent publications include:

D. H. Adamson et. al., " Non-Peptide Polymeric Silicatein α Mimic for Neutral pH Catalysis in the Formation of Silica'" *Macromolecules*, **40**,5710, (2007)

D. H. Adamson et. al., " Enhanced Order of Block Copolymer Cylinders in Single-Layer Films Using a Sweeping Solidification Front", *Advanced Materials*, **19**, 2687, (2007)

D. H. Adamson et. al., " Novel Laboratory Cell for Fundamental Studies of the Effect of Polymer Additives on Wax Deposition from Model Crude Oils", *Energy and Fuels*, **21(3)**, 1301, (2007)

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Parnas Receives High Merit Award

Richard Parnas

From the School of Engineering News and Events (http://www.engr.uconn.edu/enotesnewsparnas.php)

Dr. Richard Parnas received the High Merit Award in the 2007 Pioneering Nanotechnology Competition sponsored by Masscal Scientific Instruments of Orlando, FL, for technical innovation in bio-based polymers. He was selected by an independent panel of scientists in recognition of his scholarly work to reduce the amount of synthetic plastic in landfills by developing toughened wheat protein restructured with polythiols. These can be combined with nano-clay, carbon fiber or other materials for a wide variety of plastic and composite material applications

We're on the Web!
www.ims.uconn.edu/associate/associates.html

Prototype Program Helps Bridge Gap Between Lab, Marketplace

(From the UConn Advance, David Bauman, June 2, 2008, see http://advance.uconn.edu/2008/080602/08060202.htm for the complete article.)

Scientists at the UConn Health Center are using polymers to produce a new generation of orthodontic appliances that are making their way out of the lab and into the marketplace. In Storrs, a protein is being used to create an artificial retina, and new compounds are being developed to combat the effects of Alzheimer's disease.

Entrepreneurially-minded faculty with good ideas have been able to secure funding from a program created by the University's Center for Science and Technology Commercialization and the state Department of Economic and Community Development. The program, called the Connecticut Prototype Fund, makes funds available to turn what has been discovered in the lab into a commercial version, or prototype, of the invention or technology, enabling faculty to demonstrate the commercial potential of their inventions. The fund, which focuses primarily on bioscience, has generated significant new patented technologies and has created a strong pipeline of promising opportunities. The goal is for these technologies to become a new source of revenue for university research and companies in the state.

A UConn R&D company, New Ortho Polymers Inc., used $36,900 in funds to successfully conduct preliminary testing to assure the suitability and strength of materials for development of more aesthetically pleasing brackets and arch wires used in orthodontics. Together with the work of the Health Center's Jon Goldberg, professor and director of the Center for Biomaterials in the Department of Reconstructive Services *and member of IMS (ed.)*, and emeritus professor Charles Burstone, a team with prior commercial success in the orthodontics market, the prototype funds supported the firm's ability to win a Phase I STTR grant, and a seed investment of $250,000 from Connecticut Innovations.

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drug design, electronics, photonics, and materials for energy related areas including solar and fuel cells.

R & D giant Battelle produced three major reports for the State of Connecticut in the last few years, all of which recommended that the state – and UConn – invest heavily in nanotechnology research in order to build and maintain a scientific and economic competitive edge. The overall message is: invest now! UConn and Yale are working together to respond to the State's challenge. Industrial involvement is key in meeting the goals of building the nanotechnology expertise necessary to grow the State's economy for the future.

How is Connecticut a nanotechnology Leader?
Currently, UConn is conducting approximately $20 million in funded nanotech research. About 60 faculty members, in a wide variety of scientific disciplines, are working on nanotech-related projects. Ten additional faculty members were recently hired at a cost of over $5 million. The Institute of Materials Science at UConn is partnering with about 40 Connecticut small and large manufacturers including Pfizer, UTC, General Dynamics/Electric Boat and Northeast Utilities, to improve industrial materials. Many of our projects involve nanotechnology. We provide access to instrumentation and faculty expertise so that our partners can address materials problems that are not easily addressed commercially.

For example, a chemist at UConn is working to restore vision by creating an artificial human retina, by manipulating proteins and nerve cells on a nanoscale. Another researcher is working on wireless sensors, which are so small that they could be implanted in humans in order to monitor indicators of health in real time. An engineering professor is researching nanotechnology techniques for quickly recognizing microorganisms, these methods will allow scientists to more easily identify, detect and track pandemics such as avian flu. A colleague in engineering employed nanotechnologies to invent a revolutionary micro-injector for the fields of stem cell research and invitro fertilization. Another medical application is ongoing research on implantable glucose sensing devices.

As UConn and Yale continue to push the frontiers of nanotechnology, the new and creative discoveries emanating from their university labs are presented in a competitive forum before industrial leaders and investors. Here the discoveries are considered for further financing and potential commercial development. This university-industry collaboration is designed, from the start, to result in the building of new profitable businesses, the training of highly skilled workers and job creation.

What is the next Step?
Having the best faculty, staff and state-of-the-art equipment is essential to conducting cutting-edge research, working with industry to fuel the economy and ensuring that Connecticut will remain competitive in nanotech. Now is the time for industry to stand up and be counted. Industrial leaders must be part of the effort to educate elected officials about the importance of nanotechnology for future growth in the state and the importance of funding the State nanotechnology initiatives and the joint instrumentation centers of excellence at UConn and Yale.

Mid-Length Projects (MLP) Program

The Institute of Materials Science (IMS) is continuing a program that facilitates 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 university research projects. Typical student/post-doc supporting research projects at IMS (and for most of UConn departments and other academic institutions) last for several years. Industry often requires exploratory projects of an intermediate length. These projects 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 a company's needs.

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

Lifetime Work
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His interests also span proton exchange membranes – used in fuel cells – along with polymer blends, thin polymer films, electrically conductive polymers, and hydrogels.

Prior recipients of the award include Alan MacDiarmid, a 2000 Nobel Laureate in chemistry, Weiss's UConn colleague, Montgomery Shaw, and his doctoral thesis advisor and frequent collaborator, William MacKnight, now professor emeritus at the University of Massachusetts.

Commenting on Weiss's award, MacKnight says "Bob has made very significant contributions to ionomers. … [He] has had an exemplary career, and this is a fitting reflection of his accomplishments. SPE strongly emphasizes applications, and this honor distinguishes Bob's work as having merit not only on a fundamental basis but also for its improvements to the plastics industry."

Investigating a Small World Continued from Page 3

So in demand are the Institute's research facilities that about 40 companies located across the Northeast — from the manufacturing, pharmaceutical, chemical and even sporting goods industries — have signed up as members of the Institute in order to attain the right to use its coveted technolology. "They have problems, and they come to us to leverage our expertise," explains Brian Huey, Assistant Professor of Chemical Materials and Biomolecular Engineering *and member of IMS (ed.)*, who came to UConn in 2003 from the National Institute of Standards Technology in Washington, D.C., to bolster UConn's nanotechnology efforts.

By the year 2014, Connecticut's Office of Workforce Competitiveness estimates more than 25,000 workers in the state of Connecticut will produce nanotechnology-enabled applications and manufactured goods and worldwide sales of products incorporating nanotechnology are predicted to amount to $2.9 trillion in revenue. Among UConn faculty involved in nanotechnology, all believe collaboration is necessary to make such predictions a reality. "It is all about partnership, partnership, partnership," says Associate Dean Anwar. "This is a University-wide effort. It is not concentrated in one department. We need to involve each and every discipline to get something done. When we bring partners together, it will all start to make sense."

In addition, scientists and state policymakers are looking to establish a Connecticut Center for Nanoscale Sciences, backed by a partnership between UConn, Yale University, and the state and federal governments.

New Scanning Transmission Electron Microscope

As detailed in the last IMS Associates Program Newsletter (January 2008) Professors Mark Aindow, C. Barry Carter and Lei Zhu, from Chemical, Materials, and Biomolecular Engineering and IMS, were successful in obtaining funds for a new scanning transmission electron microscope (STEM) through the Provost's Research Equipment Competition. A new Tecnai G^2 STEM has since been purchased, installed and is now in operation in the IMS microscopy laboratory.

This new scanning transmission electron microscope enables engineers and scientists to look at the size, shape, and features of a variety of materials at a very fine scale. The FEI Tecnai instrument is a fully capable TEM/STEM with EDAX EDS system. Computer controlled, with many automated functions, it is equipped with digital and plate film cameras. In addition to conventional TEM and EDS, STEM allows for elemental mapping and EDS line-scanning. Supplemented with a wide assortment of specimen holders including tilt, rotate, in-situ heating and cooling, the T12 is a complete instrument ready to serve the research needs of the wider community. Its mechanical stage allows researchers to strain materials and see how they deform in realtime. It will also allow researchers to look at soft materials, using frozen samples, without damaging them. The new equipment replaces a 25-year-old TEM housed at the Institute of Materials Science.

Toxic and Bio-Contaminated Samples

On a small number of occasions over the past several months, 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 can not accept toxic materials, materials that present biological hazards or similar materials such as drugs that require specialized handling. Such samples must be returned immediately. Given the extensive paperwork required for shipping such material this can be expensive and time consuming. We can not dispose of such materials at UConn when they are created by external sources.

Fall Semester Starts

Fall semester classes start August 25, 2008. Some courses that may be of interest include;

MSE 5301	Thermodynamics of Materials	Brody
MSE 5320	Investigation of Special Topic: Welding	Kattamis
MSE 5322	Materials Characterization	Huey
MSE 5334	Structure & Defects in Materials	Carter
CHEM5380	Polymer Synthesis	Kasi
CHEM5381	Polymer Physical Chemistry	Seery
CHEM5382	Polymer Characterization I	Sung
CHEG5351	Polymer Physics	Dobrynin
CHEM5394-1	Conducting Polymers	Sotzing
CHEM5394-2	Organic and Nanostructured Optoelectronic Materials	Papadimitrakopoulos

Some courses require pre-approval of the instructor

Polymer Seminars Fall Semester 2008

September 12	**"Cation and Anion Transport in Functionalized Polymers"** Prof. Michael Hickner, *Pennsylvania State University*
September 19	**"Ionic Membranes and Gels"** Prof. M. Olvera de La Cruz**,** *Northwestern University*
September 26	**"Tailoring Bio-inspired Macromolecules"** Prof. Jin Montclare**,** *Polytechnic University*
October 3	**"Polymer Brushes as Responsive Materials for the Biology-Material Interface"** Prof. Christopher Ober, *Cornell University*
October 10	**"Nanoscale Semiconductor Assemblies for Photovoltaics"** Prof. D. Venkataraman, *University of Massachusetts at Amherst*
October 17	**"Instabilities of Polymers at Interfaces: Creasing of Hydrogel Surfaces and Spontaneous Generation of Amphiphilic Assemblies"** Prof. Ryan Hayward, *University of Massachusetts at Amherst*
November 7	**"Polymer Chemistry as Applied to the Emerging Field of Nanotechnology: *With an Emphasis on Devices for Nanomedicine*"** Prof. Karen L. Wooley, *Washington University in St. Louis*
November 14	**"Biodegradable Nanocomposites for Medical Applications"** Prof. Patrick T. Mather**,** *Syracuse University*
November 21	**"Morphological Dependence of Conjugated Polymer Photophysics"** Dr. Lewis Rothberg**,** *University of Rochester*

All seminars are held on Fridays at 11:00 AM in IMS Room 20, unless noted otherwise.

Coffee will be served at 10:45 AM outside the seminar room.

For more information, please contact YH Chudy at ychudy@ims.uconn.edu, (860) 486-3582 or visit www.ims.uconn.edu.

We suggest you call before attending to be sure the seminar has not been cancelled due to illness or weather.

UConn Sustainable Energy Symposium

(From The UConn Biofuel Consortium Web page http://biodiesel.engr.uconn.edu/symposia.html)

Sustainable alternative energy was the focus of a symposium at UConn held March 31 to April 1. The event featured talks by top federal and state lawmakers, as well as in-depth policy workshops on topics ranging from new technology to business development and public policy issues in the field.

"Our main goal is to show the broadest group of people how multi-faceted the energy issues are, and the intensity of effort being put forth by a very broad group of scientists, engineers, business people, and political leaders right here in Connecticut," said conference organizer Richard Parnas, Director of the Chemical Engineering Program, Head of the UConn Biofuels Consortium *and member of IMS (ed.)*

The first day of this symposium featured remarks from U.S. Reps. Joseph Courtney and Rosa DeLauro, as well as State Senate President Donald Williams, House Speaker James Amman, and House Minority Leader Lawrence Cafero.

The second day included workshops for smaller groups and provided a more hands-on experience in biofuels, fuel cells, investment, and business development.

Scenes from the Annual IMS Picnic on the Patio held Friday, July 18







Photos Courtesy of Jack Gromek



IMS Associates Program

Edward Kurz, Ph.D., Director
Phone: 860-486-4186
Fax: 860-486-4745
ekurz@ims.uconn.edu

Fiona Leek, Ph.D., Associate Director
Phone: 860-486-1040
Fax: 860-486-4745
fiona.leek@uconn.edu

Shari Masinda, Administrative Assistant
Phone: 860-486-3242
Fax: 860-486-4745
smasinda@ims.uconn.edu

University of Connecticut
Institute of Materials Science
97 N. Eagleville Road • Unit 3136
Storrs, CT 06269-3136

Our website has changed
Find us on the web at:

http://www.ims.uconn.edu/associate/associates.html

Department Seminars

The fall semester Polymer Program seminar schedule is on page 10. Other seminar schedules have not been finalized at the time of this writing. 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/polymer.html) and http://www.engr.uconn.edu/cmbe/). This information is updated as additional seminars are scheduled. Abstracts of seminars are usually available about a week in advance. We can put you in touch with the faculty member sponsoring the seminar to learn more about any seminar of interest. We also suggest you call before attending to be sure the seminar has not been canceled due to illness or weather.

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. The site consists of two sections: 1) postings of open positions from industry/academia; and 2) postings of student resumes. Both graduate and undergraduate students can participate.

We post announcements of open positions from industry/academia for full-time or part-time employment as they are received. Please forward any open position announcements you wish to post to Shari Masinda (smasinda@ims.uconn.edu).

We have a few positions on the website now, but with your help we can build this database of information, which will benefit both students and employers.

Sample Preparation

In many Associates Program projects, such as those involving adhesion and coatings, surface analysis techniques are extremely important. The techniques used for such analysis, particularly GC/MS, Auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS) are extremely sensitive to small amounts of material on the surface. It is important to protect these surfaces from contamination during sample preparation, collection and shipment. **Shipment in common plastic bags should be avoided**! These bags typically contain significant amounts of additives used to prevent the plastics from adhering to themselves and other materials. These additives migrate to the sample during shipment and 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.