University of Connecticut
Institute of Materials Science
IMS Associates Program Newsletter

Vol. #12, No. #1 — January 2008

Weiss Named UTC Professor of Advanced Materials and Processing

(From Interim Dean Erling Smith, August 1, 2007)

Bob Weiss, Board of Trustees Distinguished Professor (2003) of CMBE and Professor in the IMS Polymer Science Program, has been named the UTC Professor of Advanced Materials and Processing at the University of Connecticut.

Bob was previously honored as the Anthony T. DiBenedetto Distinguished Professor of Engineering (1998) and a Distinguished Professor of Engineering (2002). Within his profession, Bob has garnered the Society of Plastics Engineers' International Research Award (2002), International Education Award (2000), and Fred O. Conley Award for Plastics Engineering/Technology (2003). Bob is a former Associate Director of the Institute of Materials Science and former Director of the Polymer Program.

He earned his Ph.D. in chemical engineering at UMass-Amherst in 1976, worked in the Corporate Research Labs of Exxon Research and Engineering Company, and joined UConn in 1981.

Bob's research focuses primarily on ionomers, a type of polymer containing bonded salt or acid groups. His interests also span proton exchange membranes - used in fuel cells, polymer blends, wetting of thin polymer films, electrically conductive polymers, and hydrophobically modified hydrogels. He is a Fellow of the American Physical Society, the Society of Plastics Engineers, the American Thermal Analysis Society and the Polymeric Materials: Science and Engineering Division of the American Chemical Society.

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Six Projects to Benefit from Provost's Research Equipment Grants

(Originally published in the UConn Advance, Cindy Weiss, December 10, 2007, see http://advance.uconn.edu/2007/071210/07121010.htm for the complete article.)

Six proposals from researchers in the sciences and engineering won a total of $2 million of equipment funding in the recent Provost's Research Equipment Competition. The six, chosen from 31 proposals submitted, include a total of 62 researchers who are on the teams that will use the equipment. The winning principal investigators (PIs) say their new equipment will be available to other researchers at UConn, too.

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Raytheon Partners with UConn for Advanced Materials

(Originally published in *FrontierNews*, Issue 13, Nan Cooper, http://www.engr.uconn.edu/soe.php?pId=jordan0807)

A team of engineering faculty members received a $1.47 million subcontract from defense giant Raytheon Company to assist in the development of engineered nanocomposites for optical applications. The project is being funded by the Defense Advanced Research Projects Agency (DARPA) and managed by the Office of Naval Research (ONR).

The project team includes principal investigator Eric Jordan, Professor of Mechanical Engineering (ME) *and IMS* (ed.) and deputy manager Maurice Gell, a research scientist affiliated with the Chemical, Materials & Biomolecular Engineering department (CMBE) *and IMS (ed.)*. Critical tasks will be overseen by Baki Cetegen, professor and department Head of ME, and Mark Aindow, *IMS Professor of MS&E Program/CMBE* (ed.). Partnering with the UConn-led, multi-institutional team are Inframat Corporation of Farmington, CT and researchers from MIT and the University of Michigan. Raytheon has subcontracted other portions of its larger DARPA contract to Rutgers University and the University of California - Davis.

The UConn team will seek to develop a new ceramic material that has the necessary optical properties as well as excellent mechanical and physical properties. These requirements greatly limit the choice of potential materials systems, according to Dr. Jordan. “To achieve optical transparency, it is necessary for the material to be fully dense and free of light-scattering defects such as micro-pores and cracks. Accordingly, the materials to be made are at or beyond the cutting edge of ceramics processing,” said Dr. Jordan.

The UConn team was chosen for the project in large measure because of a unique new ceramic processing method it pioneered in partnership with Inframat Corporation. In this process, called Solution Precursor Plasma Spray (SPPS), chemical precursor droplets are injected into a plasma jet to form the ceramic in its brief flight to the substrate. The SPPS process offers significant advantages that are favorable for the DARPA project. It involves molecular-level mixing of multi-component ceramic materials, the ability to control chemical purity, and the flexibility to rapidly explore new compositions.

Dr. Eric Jordan

A project goal is to achieve transparency in the infrared optical range. To do so, the team must produce a nano-grained material that is stable at elevated temperatures. Dr. Jordan explained that thanks to its high cooling rates, the SPPS process commonly produces oxide ceramic microstructures with grain/crystal sizes of less than 100 nanometers. A nanometer is 10^{-9} meters, a size so minute that it would take 80,000 nanometers to equal the width of a human hair. The SPPS process can effectively produce multi-component microstructures at the nanometer scale, called nanocomposites, that are high-strength as well as resistant to erosion and thermal shock. For this first phase of the DARPA contract, the UConn-led team will screen potential optical materials and optimize the SPPS process.

“To guide the experimentation, considerable effort will be devoted to gaining an understanding of – and modeling – the materials and processing characteristics, including the study of the behavior of droplets in the high-temperature, high-velocity plasma jet,” said Dr. Jordan. The modeling of useful optical properties is also important and will be carried out by Raytheon and locally in an effort led by Dr. Paul Klemens, professor emeritus of physics.

Dr. Jordan commented that the project’s greatest challenge is to fabricate defect-free, bulk ceramics, a task that will require innovative approaches and an advancement of the ceramic processing state of the art.

State Nanotechnology Effort

Several State Legislators working with the Office of Workforce Competitiveness are putting forth a plan for the 2008 legislative session. A primary intent of the plan is to establish a laboratory capability that would support nanotechnology efforts throughout the state. IMS will play a major role in this laboratory capability building on its present capabilities and outreach efforts. We will keep you informed as the plan moves forward.

UConn Team to Develop Electronic Explosives Sniffer

(Originally published in eFrontierNews, October 11, 2007 edition, Nan Cooper, see http://www.engr.uconn.edu/eesniffer.php)

Dogs, pigs - even dolphins - have been trained to sniff out different agents, from illicit drugs and rare truffles to explosives. The exquisite sensitivity of their olfactory glands allows these mammals to distinguish unique aromas associated with the targeted agent. Many bombs use nitrated compounds - such as TNT or dynamite, which contain volatile components - as explosives. These compounds emit scent molecules that may be detected by trained animals. The challenge of developing an electronic nose system for explosive detection lies at the heart of a newly funded project that will involve a multidisciplinary team of primarily UConn researchers. With nearly $800,000 in funding awarded by the National Science Foundation, over the course of three years, assistant professor Yu Lei and his colleagues hope to develop real-time, ultra-sensitive sensor arrays capable of sniffing out even trace quantities of explosives. Dr. Lei, who joined the Chemical, Materials & Biomolecular Engineering Department *and IMS* (ed.) in 2006, will lead the investigation. He is joined by University of Connecticut (UConn) colleagues Christian Brückner, an associate professor of Chemistry, and Ali Gokirmak, an assistant professor of Electrical & Computer Engineering, along with University of California - Riverside professor Yushan Yan. UConn's Krishna Pattipati, professor of Electrical & Computer Engineering, will assist the team on pattern recognition facets of the research.

The team will focus on the development of the science behind a miniaturized sensing device capable of detecting potential explosives with greater speed, selectivity and accuracy than ever before using simple instrumentation. Thus, Dr. Lei and his colleagues plan to lay the groundwork for a hand-held unit that inspectors could use, say, to inspect luggage of passengers boarding a plane. Dr. Lei explained that, as the team envisions it, the unit will combine a number of features: the ability to capture and concentrate airborne explosive molecules, and the real-time capacity to distinguish and identify compounds commonly found in explosives.

To understand the challenge of building an accurate, real-time electronic sensor, it's helpful to review how animal noses - including our human noses - detect and process scents. Animal noses do not contain one sensor for, say, pineapple scent, another for mint, others for oranges or Chanel No. 5. Rather, animal noses contain an array of sensors that respond to all gaseous components of a scent, though each sensor type responds to a differing degree. The brain then collects the output from these sensors and memorizes the pattern of responses for roses, cinnamon, or carrion, for example. The next time the animal brain detects this pattern, the animal recognizes the scent as corresponding to a rose or apple - even if the apple aroma comes mingled with all the other scents of a supermarket, or even if it is another type of apple than you smelled before. The complexity of the animal scent detection/recognition "system" illustrates the difficulty of designing an electronic sensor.

With the electronic sensor, a security employee might wave the device near a package or piece of luggage. In an open space such as a luggage handling room, volatile explosive vapors are found at such low concentrations - in the range of parts per billion or even parts per trillion - that detection is hampered. To overcome this problem, the unit will employ an ultra-thin molecular sieving membrane that will sample ambient air and concentrate any explosives vapors encountered. Concentration is possible because the membrane's pores are about half the size of a single nanometer (a typical human hair is about 100,000 nanometers wide), through which small molecules of nitrogen and oxygen found in air pass easily but which are too small for the passage of larger explosive molecules. The unit is, thus, expected to concentrate these explosive molecules by many orders of magnitude within a short period of time.

Having concentrated the molecules on the membrane surface, the unit's next task is detection. Dr. Lei said the device will incorporate an array of single-walled carbon nanotube (SWNT)-porphyrin conjugates as sensors. Planted onto microelectronic circuitry, these are capable of signaling the presence of explosives (or many other volatile compounds) by a change of their conductivity. Using a variety of different porphyrins, large organic molecules that are particularly suited to interactions with nitroaromatic compounds, different sensor elements will respond differently to particular explosives vapors. This generates a distinct electric response pattern that, properly processed using pattern recognition software, will identify the explosive. Once this electronic nose 'smells' an explosive, the software can trigger an alarm, alerting the user to the presence of explosives vapors.

Preliminary proof of concept data have been most encouraging. The team now will focus on building a solid-state 32-sensor array to generate the signature for common explosives such as TNT. They will expand the device's recognition capacity to include other explosives over time. The sensor device then will be combined with the molecular sieving membrane to complete the unit.

The project is of significance in helping the nation attain a greater level of security in various venues, from airports and bus terminals to post offices.

For more information Dr. Lei can be reached at yu.lei@uconn.edu .

Phonon Featured in UConn Frontiers Magazine

(For the complete article see *FrontierNews*, Issue 13, Nan Cooper, http://www.engr.uconn.edu/soe.php?pId=phonon0907)

Phonon Corporation, a long-time member of the IMS Associates Program, was recently featured in the UConn Frontiers Magazine. Excerpts of the article follow:

A small high-tech company co-founded by two UConn engineering alumni, Phonon Corporation of Simsbury, has carved out a niche as one of the leading military surface acoustic wave - or SAW - device designers and manufacturers in the world. Led by Tom A. Martin (M.S., Ph.D., '71, '74), President and Chairman of the Board, and Clement Valerio, Jr. (B.S., M.S., Ph.D. '70, '76, '84) Vice President of Research & Development, Phonon develops high tech analog microcircuits used in defense and space applications.

Phonon is a 65-employee company founded in 1982 by Drs. Martin and Valerio, along with Dick Fraley, former Vice President of Sales & Operations who retired recently, and Pierre Dufilie (B.S., M.S. '70, '71) a fourth partner who left in 1989. Within its 15,000 sq. ft. dedicated facility - located on pastoral farmlands where tobacco once dominated the agricultural economy - Phonon employees design, build and test novel surface acoustic wave, or SAW, units for customers that include Raytheon, Northrop Grumman, Lockheed Martin, and some government agencies.

Phonon's products deploy acoustic waves across the surface of special solid-state materials to achieve their unique signal processing capabilities. An input transducer converts electrical impulses into tiny acoustic waves that then travel through the solid propagation medium to the output transducer, where the waves are then reconverted to electrical signals. Phonon's SAW devices and subsystems are used in radars, electronic warfare programs, communications systems and even deep space.

Because SAW technology is a "very niche business," Dr. Martin said, only one academic program in the nation trains its students in SAW technology, a Florida institution. "We made the decision years ago to seek out bright engineers and train them ourselves. UConn is our main source for engineers. We are very pleased with the relationship." Phonon hires UConn engineering graduates, provides on-site training, and encourages its engineers to return to school for their graduate degrees, offering fee reimbursements, flex-time scheduling and other incentives. Many of the Phonon's 14 engineers are enrolled in, or have completed, graduate studies at UConn.

Besides Drs. Martin and Valerio, the company's 14 engineers includes UConn electrical engineering alumni Dan Porga (B.S. '93), David Miller (M.S. '96), Scott Kraft (B.S. '03), Tom Reinwald (B.S. '03), Jonathan Kahl (B.S. '04), Steve LaBarre (B.S. '06), and Johanna Raphael (B.S. '06). In addition, Dr. Jerry Heines is a UConn physics alumnus.

The U.S. military uses SAW technology to improve the speed and accuracy of small target detection by radars, which are increasingly subjected to sophisticated, powerful jamming and deception techniques. In electronic warfare, SAW technology is used to disable hostile electronics and to protect against electronically controlled threats. SAW devices are used in military communications as well, to handle voice, video, or digital data signals at high rates while providing signal security and jam resistance.

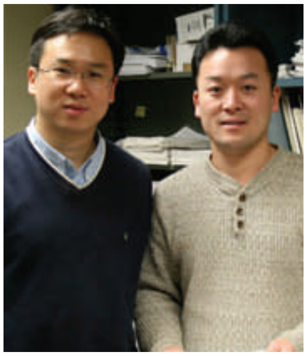
In hiring engineers for its unique operation, Phonon takes advantage of one particularly effective hiring portal, the senior design program in the School of Engineering. Phonon has sponsored a senior design team in the Electrical & Computer Engineering department for several years. Senior engineering students take this capstone class during their last year as a culmination of their preceding years' classroom studies. Corporate sponsors, who provide financial support, present an undergraduate team with a genuine design challenge and appoint a corporate mentor to advise the team throughout the year. Phonon engineer Tom Reinwald (B.S. '03), who is pursuing a master's degree at UConn, is the Phonon mentor to the senior design team. He spends between two and four hours weekly with the students throughout the school year, helping them understand the design challenge within the context of Phonon's needs. The students also visit Phonon several times and deliver a final presentation before a phalanx of the company's engineers, who grill them with questions. "They do a very good job," said Dr. Martin.

The 2006-07 Phonon-sponsored senior design team was charged with development of a programmable logic controller to update the increasingly obsolete Solitec track system Phonon uses at the start of its photolithography process. Dr. Martin explained that the company purchases older (20-30 year old) semiconductor wafer fabrication units and adapts them to their needs, since new units can cost millions of dollars. While older equipment carries a reasonable price tag, the units suffer from increasingly obsolete or unavailable replacement parts. The student design team of Michael Kelley, Benjamin Romeo and Jeffrey Travis, with oversight from Mr. Reinwald, designed and developed a cost-effective programmatic controller to replace an aging system. The project is ongoing, and a new team of electrical engineering seniors will examine a different aspect of the device during the 2007-08 school year.

Phonon's success originates in the company's unique, high quality products, unapologetic quest for excellence, and commitment to providing continuing education for its employees. Its deep roots and ongoing alliance with UConn's School of Engineering help the company sustain its high level of flexibility and innovation. Please visit Phonon's company website at www.phonon.com for more details.

Chemical Engineering Professors to Study Artificial Antibodies

(For the complete article see eFrontierNews, December 13, 2007 edition, Nan Cooper, http://www.engr.uconn.edu/chemprofessorsaa.php)



Drs. Lei Zhu and Yong Wang

Two faculty members in the Department of Chemical, Materials & Biomolecular Engineering *and IMS (ed.),* Yong Wang and Lei Zhu, landed a $450,000 grant to develop artificial antibodies capable of locating and destroying tumors. Antibodies are proteins produced in the white blood cells of humans and other vertebrates, and they move freely through blood and fluids, where they identify and attack "foreign objects" such as viruses, bacteria and other so-called antigens. This ability to fight off potentially dangerous invaders lies at the heart of vaccines, which function by increasing the production of antibodies.

Dr. Wang explained that natural antibodies sometimes don't function as well as we may want them to, for various reasons. For example, many antibodies are simply too large to penetrate the target, such as a tumor, that they are programmed to attack. Other antibodies are ineffective due to poor immunogenicity - the ability to excite a strong response against perceived foreign objects - and owing to the fragility of their cell structures.

Drs. Wang and Zhu seek to improve upon antibody effectiveness, first by gaining a better understanding of the characteristics and functions of natural antibodies, then by developing artificial versions that offer greater stability and functional properties. They have chosen to approach this challenge via two parallel pathways, with biomolecules the focus of one path and artificial polymers at the heart of the second path. Drs. Wang and Zhu contend that natural biomolecules and synthetic polymers may be paired to obtain a more lethal tumor-fighting weapon.

The two researchers aim to demonstrate that humans can produce superior-functioning antibodies. Dr. Zhu's group will focus on polymer synthesis, while Dr. Wang's group will focus on other aspects, such as looking for biomolecules that can target tumor antigens, conjugate them with synthetic polymers, test their functionalities, etc.

The societal benefits that Drs. Wang and Zhu hope to realize include helping scientists to design future nanobiomaterials with superior functionality, and expanded use of these synthetic antibodies in the biomedical arena for drug delivery, bioimaging and tissue engineering. They could be used, for example, in the delivery of cancer-fighting drugs, or as nanoprobes capable of moving through tissue and blood to sense underlying health problems even before symptoms emerge.

The three-year project began in July and is funded by the National Science Foundation.

Bhardwaj Wins Diabetes Technology Peterson Student Research Gold Prize

Upkar Bhardwaj, a graduate student in Pharmacy, won the Diabetes Technology Peterson Student Research Gold Prize. The Planning Committee for the Seventh Annual Diabetes Technology Meeting voted his abstract the best abstract first-authored by a student from over 190 total abstracts submitted to the meeting.

He received transportation, hotel accommodations at the San Francisco Airport Hyatt Regency Hotel, registration for the meeting and pre-meeting workshops, a one-year subscription to "Journal of Diabetes Science and Technology" and was awarded a check for $1000.00 during the Seventh Annual Diabetes Technology Meeting at the San Francisco Airport Hyatt Regency Hotel on October 25-27, 2007.

His research abstract was entitled, "PLGA/PVA Hydrogel Composites for Long-term Inflammation Control on Subcutaneous Implantation of Biosensor."

Bhardwaj's work is based on a joint effort of Diane Burgess, Professor of Pharmaceutical Sciences, and Fotios Papadimitrakopoulos, IMS Professor, Chemistry Department and Associate Director of the Institute of Materials Science, on smart hydrogels that suppress inflammation and immune response to implantable glucose sensors.

Engineering Launches Eminent Faculty Initiative in Sustainable Energy

(For the complete article see *FrontierNews*, Issue 13, Nan Cooperhttp://www.engr.uconn.edu/soe.php?pId=eminentfac)

During a joint press conference on September 18th, held at the Legislative Office Building in Hartford, the University of Connecticut formally unveiled an ambitious new research campaign, the Eminent Faculty Initiative in Sustainable Energy, which will reside in the School of Engineering. The University of Connecticut's new president, Dr. Michael Hogan - joined by Connecticut State Senator and President Pro Tempore Don Williams, UConn Provost Peter Nicholls, industry partners FuelCell Energy, the Northeast Utilities Foundation and UTC Power, and members of Connecticut's General Assembly discussed the public-private initiative enthusiastically.

The Eminent Faculty Initiative represents a unique partnership between UConn, the Connecticut General Assembly, and the industrial partners who are committed to propelling Connecticut onto the international stage in the development of sustainable "green" energy. The initiative is rooted in the July 2006 passage of a senate bill entitled "An Act Concerning Jobs for the Twenty-First Century," which was championed by Senator Williams and enacted by both houses in the Connecticut General Assembly. A provision of the bill charged UConn's Board of Trustees to develop a program to attract world-renowned faculty members to the University in a research area deemed strategically important. Provost Nicholls invited competitive proposals from across campus and awarded the first eminent faculty position to the School of Engineering to address the critical area of sustainable energy - an area of keen importance to Connecticut Governor M. Jodi Rell, who has set a goal to reduce state fossil fuel consumption by 20% and replace it with clean/renewable energy by 2020.

A permanent State appropriation of $2 million yearly was budgeted for the initiative, contingent upon the University's securing a one-time funding commitment of $2 million from industry. Interim Engineering Dean Erling Smith, Associate Dean Mehdi Anwar and Director of Development Joe Hanrahan secured the necessary $2 million in matching industry pledges from corporate partners FuelCell Energy of Danbury, the Northeast Utilities Foundation, and UTC Power of South Windsor. Dr. Smith said the School will immediately launch a national search for a scholar of international stature and reputation who will effectively leverage and expand the School's research and development activities in sustainable energies, including fuel cells, biofuels and photovoltaics. The School expects to hire several additional senior faculty members and support staff to complement ongoing activities in the area of alternative energy. The School's resources include the Connecticut Global Fuel Cell Fuel Cell Center (CGFCC), the Biofuel Consortium, and research involving photovoltaics and other green energy technologies.

The six-year old CGFCC is among the largest academic fuel cell centers in the nation. The Center's interdisciplinary faculty research, develop and deploy innovative fuel cell technologies, focusing on proton exchange membrane fuel cells (PEMFCs), solid oxide fuel cells (SOFCs), direct methanol fuel cells (DMFCs), molten carbonate and other fuel cell types, and efforts in micro- and micro-miniature fuel cell systems. The Center began as a partnership between the School of Engineering, Connecticut Innovations and Connecticut industry and serves as a research, demonstration and testing nexus. The center enjoys over $10 million in federal funding and partners with United Technologies, FuelCell Energy, Distributed Energy Systems, General Dynamic Electric Boat and Henkel Loctite; and with federal agencies such as the Pacific Northwest National Laboratory.

The Connecticut Biofuel Consortium focuses on the development of green energy technologies ranging from carbon neutral, renewable fuels to biological systems capable of digesting and converting biomass into either hydrogen or electricity. This multidisciplinary research unit comprises faculty from Chemical, Materials & Biomolecular Engineering; Environmental Engineering; and the departments of Chemistry, Economics, and Plant Sciences, whose aim is to investigate the development, production and implementation of bio-derived fuels from sources such as algae, biogas or high-yield crops.

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He has 18 U.S. patents and has published more than 400 peer-reviewed journal articles, book chapters and conference proceedings. In addition, he is the editor-in-chief of the Society of Plastics Engineers' journals, Polymer Engineering and Science (1996-current) and Polymer Composites (1997-current); and former associate editor of both publications. He serves on the editorial boards of Macromolecules, the Journal of Applied Polymer Science, Polymer and Polymer Composites, and Chemistry Central Journal. He is also an adjunct Professor of Materials Science at the University of Florida.

UConn Material Advantage Student Chapter Wins Award

The UConn Material Advantage Student Chapter (http://www.engr.uconn.edu/ucma/index_004.htm) has won several awards in recent years for their educational outreach activities. This year they have surpassed themselves and have been selected for both the World Materials Day Award (once again) and the highly prestigious Chapter of Excellence (CoE) Award. The latter award is one of the highest honors that a Chapter can receive: Only 5 of the 75 active chapters receive this award each year and the recipients almost invariably come from the larger MSE departments with very well established undergraduate programs. Please join us in congratulating the UCMA Chapter members on this latest accolade. Their efforts are extremely important both for promoting the discipline of MSE in the broader community and for raising the profile of our own Program. The members of the UCMA Chapter Executive Board attended MS&T and received CoE award at the Material Advantage award ceremony in the COBO Center on Tuesday, September 18th.

Alternative Products and Green Chemistry:

Challenges and Opportunities of the

New Global Marketplace

Thursday, February 7, 2008

Northeast Utilities Conference Center

107 Selden St, Berlin, CT

New international chemical policies such as REACH (Registration, Evaluation, Authorization and Restriction of Chemical substances) and the Globally Harmonized System will have major impacts on Connecticut businesses. Challenges range from impacts on the export of products to Europe that use certain chemicals to changes in format and content of Material Safety Data Sheets. However, new approaches are being developed that greatly help in the availability and choice of safer alternatives to affected chemicals. Green Chemistry and Green Engineering both provide tools for developing substitutes; Control Banding uses newly developed risk phrases to determine proper controls and point to best practices; resources are being developed to more easily find safer alternatives that do the job as well or better. Responding to these challenges is important to developing sustainable businesses and for protecting human health and the environment. This conference will educate you on these emerging policies and tools and allow discussion of the implications for your workplace with others.

For more information contact Tim Morse at: tmorse@uchc.edu;(860) 679-4720, or visit the web site: http://www.oehc.uchc.edu/uconnconference.asp

Members Corner:

Gerber Technology

In each newsletter we present short descriptions of one or two of our member companies. In this issue we focus on Gerber Technology, a division of Gerber Scientific. We thank Tom Gordon of Gerber for this contribution.

Gerber Technology (www.gerbertechnology.com), a business unit of $517 million corporation Gerber Scientific, Inc., develops and manufactures the world's leading brands of integrated software and hardware automation systems for manufacturers and retailers in the sewn products and flexible materials industries.

Dozens of household names including Abercrombie & Fitch, Levi's, Carter's, Osh Kosh B'Gosh and others rely on Gerber Technology's products to design and manufacture products we touch, wear and rely on every day. From clothes, shoes, furniture, automobile interiors, composites for boats, bicycles and aerospace applications, the brakes on airplanes and so much more, Gerber's products have a hand in making them.

Gerber's systems automate and significantly improve the efficiency of information management, product design and development, pre-production, and production processes. The company offers specialized solutions to a variety of end-user markets including apparel, transportation interiors, furniture, composites and industrial fabrics.

Gerber Technology's world headquarters are located in Tolland, Connecticut, U.S.A. with regional offices, agents and distributors in 117 countries serving a total of over 16,500 customers through seven Customer Solutions Centers on six continents. The company engineers and manufactures its products in various locations in the United States, Europe and Asia. Earlier this year, Gerber Technology was awarded the prestigious President's "E" Award for excellence in exporting at a ceremony with President Bush at the White House.

Gerber Technology is one of four businesses of Gerber Scientific, Inc. (www.gerberscientific.com) of South Windsor, Connecticut, U.S.A., a corporation listed on the New York Stock Exchange under the "GRB" symbol.

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www.ims.uconn.edu/assoc

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) or Harris Marcus (860-486-4623, hmarcus@mail.ims.uconn.edu)

Gao Wins Honda Initiation Grant

(From the Hartford Courant Nov. 28, 2007)

Pu-Xian Gao, IMS Assistant Professor in Materials Science and Engineering Program/CMBE, was among several professors at seven U.S. universities to be awarded a total of $50,000 in advanced research grants at the 10th anniversary of the Honda Initiation Grant program and Technical Horizon Symposium held at the Computer History Museum in Mountain View, Calif. The goal of the grant program is to fund innovative ideas in the early stages of research that are likely to make valuable contributions to technology over a longer term of five to 10 years. Gao was recognized for his study of nanocatalysts for automotive emissions controls systems.

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The funded proposals and their faculty PIs are: Mark Aindow, C. Barry Carter, and Lei Zhu from Chemical, Materials, and Biomolecular Engineering *and IMS* (ed.) for a scanning transmission electron microscope; James Cole from Molecular and Cell Biology for a fluorescence detector for the analytical centrifuge; Senjie Lin from Marine Sciences for a cytobuoy and fast repetition rate fluorimeter; Joseph LoTurco from Physiology and Neurobiology for an intravital multiphoton imaging system; Steve Suib from Chemistry for a tandem mass spectrometer; and Adam Zweifac from Molecular and Cell Biology for a flow cytometer.

The cost of the equipment to be purchased ranges from $145,000 for the fluorescence detector to $800,000 for the scanning transmission electron microscope. The new equipment, which must be bought by May 2008, will enable scientists and engineers to better understand such things as the biodiversity and environmental stresses on Long Island Sound and to study materials such as metals, ceramics, semiconductors, and polymers at an extremely fine scale. It will allow chemists to do much more sensitive analyses and enable molecular biologists to study in detail one protein in a complex mixture. Seventeen users from nine different departments are listed on one successful proposal to purchase a flow cytometer.

Obtaining a new scanning transmission electron microscope will enable 21 engineers and chemists on one of the winning proposals to look at the size, shape, and features of a variety of materials at a very fine scale, says Mark Aindow, professor and director of the Materials Science and Engineering Program and one of three PIs on the proposal. The new equipment will replace a 25-year-old TEM housed at the Institute of Materials Science. It will be digital – the old instrument uses film – and will allow researchers to strain materials and see how they deform as they are looking at them. It will also allow them to look at soft materials, using frozen samples, without damaging them.

UConn Demonstrates Continuous Biodiesel Production

(For the complete article see *FrontierNews*, Issue 13, Nan Cooper, http://www.engr.uconn.edu/soe.php?pId=biofuels07)

Faculty and students associated with the multidisciplinary Biofuel Consortium at the University of Connecticut staged a technological first for academic biodiesel production: the continuous 16-hour operation of a pilot-scale reactor converting waste cooking oil to pure biodiesel. Following several short-run trials of the reactor, aimed at determining the conversion efficiency of the device (it was found to be functioning at a 99 percent conversion rate) the reactor began an uninterrupted overnight demonstration run. At the end of the trial, the team had produced 230 gallons of biodiesel that will be used in the University's fleet vehicles.

Richard Parnas, *IMS* (ed.) Associate Professor & Director of Chemical Engineering Program/CMBE, and Benjamin Wilhite, Assistant Professor, CMBE, headed up the demonstration project. Dr. Parnas is also the director of the Storrs-based Biofuel Consortium. Dr. Wilhite just completed his second year at UConn and is a DuPont Young Professor. The prototype production system was constructed by undergraduate Matt Boucher, who will begin his graduate studies in chemical engineering in September. In addition to Mr. Boucher, Drs. Parnas and Wilhite, the demonstration team included chemical engineering students Katie Bower, Steven Unker, Cliff Weed, Si-Yu Li and visiting India Institute of Technology - Delhi student Rajdeep Das.

According to Dr. Wilhite, what differentiates the UConn demonstration from other university biodiesel projects is the reactor's ability to operate continuously. "Other university biodiesel projects rely upon batch production, which limits the volume that can be effectively and economically produced," said Dr. Wilhite. The reactor's unique design features make it attractive to industry, said Dr. Parnas, who added that there is significant industrial interest in the new reactor technology. Several companies have approached UConn to request licensing rights to the reactor, for which Dr. Parnas filed a patent application in January 2007.

The Biofuel Consortium uses waste cooking oil as a feedstock in the reactor. By using waste vegetable oil, the team avoids the food-versus-energy debate currently surrounding corn based ethanol. However, spent cooking oil contains a variety of contaminants that must be removed before the oil can be used in the reactor. Gus Kellogg of Greenleaf Biofuels graciously donated 500 gallons of yellow

grease, a commercial waste vegetable oil, for the demonstration. In the week preceding the continuous run, Mr. Boucher pretreated the waste cooking oil to neutralize and remove free fatty acids and contaminants that resulted from the oil's earlier use in food production.

The Biofuel Consortium emerged from a 2004 demonstration project in which a team transformed waste cooking oil into biodiesel for use in one of the University's shuttle buses. By fall '06, the Biofuel Consortium team was producing and supplying the University with approximately 50 gallons of biodiesel weekly, using waste oils collected only from the on-campus restaurant Chuck & Augie's, and from the food court, both located in the Student Union.

In commercial applications, biodiesel is typically mixed with conventional diesel fuel, often at a ratio of 8:2 for the so-called "B20" fuel. When used in vehicles, biodiesel produces no sulfur dioxide, and significantly reduced hydrocarbons and particulate matter compared with conventional petroleum-based fuels.

Presentations by IMS Associates Program Staff Members

Recent

**"Syringeless Solvent Free Injection Device for GC and GC/MS
Systems"**

Gary Lavigne, Gulf Coast Conference, Galveston, TX, October 16 and 17, 2007.

Direct injection and removal of solids and viscous liquids from within an injection port is achieved by replacing the standard injection port liner with a Syringeless Injection Device. Sample temperature, injection duration and movement of the sample into and out of the injection port is facilitated through the injection ports controller, no external controllers are needed. The sample contained within a glass vial is reproducibly positioned 2 cm from the inlet of the capillary column, eliminating the need for a heated transfer line. Preheated carrier gas continuously sweeps volatile organics into the capillary column for collection and subsequent separation and detection.

Upcoming

"Failure Analysis of Class IV Rubber Insulated Gloves"

F. Leek[1], G.Lavigne[1], L.Pinatti[1], R.Ristau[1] and R.Raymond[2]
[1]Institute of Materials Science, University of Connecticut, Storrs, CT, [2] Northeast Utilities Service Company, Hartford, CT Society of Plastics Engineers Annual Technical Conference, Milwaukee, WI, May 4-8, 2008, Session on "Case Studies of Failure of Cross linked Polymers"

Linemen working with live, high voltage wires are double glove protected by a Class 4, rubber insulated glove-sleeve worn under a leather glove. Localized surface crazing was noted in both older and relatively new rubber gloves. Discharge during in-house tank testing confirmed this damage impacts glove integrity. Analytical investigation shows the damage results from mechanical fatigue. Results suggest the following other causes for concern; corona damage, depletion of antiozonant and the transfer of trace metal contaminants known to accelerate rubber degradation.

Boston's Big Dig Fatal Epoxy Adhesive Failure"

Myer Ezrin (former Director of the IMS Associates Program), Society of Plastics Engineers Annual Technical Conference in Milwaukee, WI, May 4-8, 2008

Based on the 7/10/07 Highway Accident Report of the National Transportation Safety Board, one year after the accident in 2006. Epoxy adhesive was used to secure steel bolts, attached to a tunnel roof, that anchored a concrete suspended ceiling. The epoxy had too much creep for the load applied leading to the collapse of the suspended ceiling and the death of a passenger in a car. Another epoxy adhesive was available that would have withstood the load and prevented the ceiling collapse. However, it was not used. The failure was partly one of construction people not properly applying polymer technology to construction practice.

"Environmental, Recycling and Health Aspects of Plastics Failure"

Myer Ezrin (former Director of the IMS Associates Program), Society of Plastics Engineers Annual Technical Conference in Milwaukee, WI, May 4-8, 2008

A broad review of recent objections being raised to plastics that have already led to banning of certain plastics. This is a new type of plastics failure, i.e., not being allowed to be sold, often because of health concerns. PVC and polycarbonate are under attack; with PVC, phthalate plasticizers are said to be a problem. For polycarbonate, bisphenol A monomer raises objections. The health of babies under 3 years old is the focus of health concern. An example of the public's concern about plastics disposal is reusable bags that say "I'm NOT a plastic bag".

Copies of all papers are available from Shari Masinda (smasinda@ims.uconn.edu, 860-486-3242).

Associates Program Member Companies

Here is a partial listing of our member companies:

- Aearo Company, Southbridge MA
- Ahlstrom Fiber Composites, Windsor Locks CT
- Bomar Specialties Corp., Torrington CT
- Chemtura Corp., Middlebury CT
- Dymax Corporation, Torrington CT
- Enthone Inc., West Haven CT
- Fluoropolymer Resources Inc., Willimantic CT
- Foster Corporation, Putnam CT
- General Cable, Willimantic CT
- Gentex Optics, Inc., Dudley MA
- Gerber Scientific, South Windsor CT
- Henkel Corp., Rocky Hill CT
- Laticrete International Inc., Bethany CT
- Okonite Company, Paterson NJ
- Olin Corporation, Waterbury CT
- Otis Elevator Company, Farmington CT
- Pentron Clinical Technologies, Wallingford CT
- Pfizer Inc., Groton CT
- Phonon Corporation, Simsbury CT
- Rogers Corporation, Rogers CT
- Saint Gobain, Northboro MA
- Smiths Medical Inc., Southington CT
- Spalding, Springfield MA
- Spellman High Voltage Electronics, Hauppauge NY
- Techni-Met Inc., Windsor CT
- Teleflex Medical, Coventry CT
- Tyco Telecom, Eatontown NJ
- Underground Systems Inc., Milford CT
- Varian Semiconductor Equipment Associates, Inc., Gloucester MA

Spring Semester Starts

Spring semester classes start January 22, 2008.
Some courses that may be of interest include the following.

MMAT-320-1	Physical Ceramics	Carter
MMAT-309	Transport Phenomena	Brody
MMAT-311	Mechanical Properties of Materials	Hebert
MMAT-117	Electrical and Magnetic Properties	Alpay
MMAT-320-2	Computational Materials Science	Ramprasad
MMAT-323	Electron Microscopy	Aindow
MMAT234	Corrosion and Materials Protection	Wei
MMAT-207	Failure Analysis	Shaw
CHEM-368	Rheology	Shaw
CHEM-353	Chemical Kinetics	Sung
CHEM-384	Polymer Characterization II	Zhu and Asandei
CHEG-352	Polymer Properties	Papadimitrakopoulos
MCB-315	X-Ray Analysis	Burkhard

Some courses require pre-approval of the instructor for registration.

IMS Associates Program

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We're on the Web!
www.ims.uconn.edu/assoc

IMS Annual Report Available On-Line

The 2006-07 IMS annual report is now available on-line at the IMS web page http://www.ims.uconn.edu/ims/. Among other things the report contains a summary of the years activities, a listing of IMS members, a brief description of their research, and a list of publications over this time period.

Department Seminars

Spring 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/poly/ and http://www.engr.uconn.edu/cmbe/). This information will be updated as additional seminars 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.

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 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 can not dispose of these types of material at UConn when they are created by external sources.

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) and X-ray Photoelectron Spectroscopy (XPS) 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.