



University of Connecticut Institute of Materials Science



IMS Associates Program Newsletter

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Governor Rowland Announces New Fuel Cell Research and Development Center

World-Class Facility at UConn Enhances State's Leadership In Fuel Cell Energy Technology

For the complete text of the following announcement, issued on December 20, 2001, see: <http://www.state.ct.us/governor/news/122001.htm>.

Governor John G. Rowland today announced the establishment of the Connecticut Global Fuel Cell Center at the University of Connecticut, a groundbreaking public/private partnership to fund leading-edge research and education in fuel-cell technology.

"This will be the most significant facility of its kind in the country, if not the world," Governor Rowland said. "It is an extraordinary concept that will create the knowledge base and the workforce that will influence the future of fuel-cell technology worldwide."

The Center will be funded through a challenge endowment from the Connecticut Clean Energy Fund, the State of Connecticut's renewable energy investment fund. The agreement provides for a \$3.5 million challenge endowment from the CEF, to be matched by funding from private industry and the University of Connecticut. The Center will be housed at a new building on the university's Depot Campus in Mansfield.

The building itself is a testament to recent advancements in fuel-cell technology. The new 16,000-square-foot

facility, constructed this year with a \$2 million grant from the federal Economic Development Administration, will be powered by a fuel cell developed and manufactured by Fuel Cell Energy Inc. of Danbury, Conn. (http://www.ercc.com/site/investor/press/releases/2001/08_14_01.html).

The new Center will be unique in terms of scale, with its own state-of-the-art facility and up to six chaired professorships. Within the next decade the center will bestow bachelors, masters and doctoral degrees upon scientists who will guide the future of this technology, here and around the world.

The Connecticut Global Fuel Cell Center will conduct further research in the conversion of hydrogen and other fuels into electrical energy with little or no emissions or environmental impact. Fuel cells are virtually pollution-free, depending on the fuel used, and offer one of the best near-term alternatives to conventional electrical power sources for many applications.

In addition, their mobility and variable size allow them to be used to provide power to everything from vehicles, buildings, data centers, hospitals and other users that demand round-the-clock access to reliable electrical power. The center will serve as a focal point to

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foster research and development of advanced fuel cells in collaboration with Connecticut's energy companies.

"To enhance the existing foundation of fuel-cell technology in Connecticut and help our fuel-cell companies compete in the global market, we must attract and retain superior scientific and engineering talent to Connecticut," said Governor Rowland. "The Center will attract talented people to our Connecticut fuel-cell companies, and will stimulate additional commercial,

government and academic interest in fuel-cell science and technology."

Connecticut is a national leader in fuel-cell technology. The state is home to three fuel-cell companies – Fuel Cell Energy of Danbury, UTC Fuel Cells of South Windsor and Proton Energy Systems of Rocky Hill. Fuel cells hold great promise for increasing our country's self-reliance by creating a reserve of sustainable, renewable energy sources.

Fuel Cell Donated to Engineering School

In a step toward becoming a worldwide research center for fuel cell technology, the School of Engineering has received a 200 kilowatt fuel cell donated by Connecticut Natural Gas Corp. The unit will be used in research and education.

The PC25 fuel cell, manufactured by UTC Fuel Cells of South Windsor, a United Technologies company, will provide electricity to the building on the Storrs campus that bears United Technologies' name. At the same time, it will serve as a learning tool for students engaged in research and development of fuel cells. The unit, weighing 40,000 pounds, has an estimated installed market value of \$1 million.

President Philip E. Austin said the donation provides a tangible example of the tremendous power and

future promise of fuel cells to provide clean energy to the state.

"Our School of Engineering is making major contributions to technological advancement," he said. "This gift will give Connecticut's future engineers an invaluable hands-on opportunity to investigate and improve upon a vital element of 21st-century technology.

"We are extremely grateful to Connecticut Natural Gas for this opportunity, and look upon the donation as an outstanding example of the kind of University-corporate partnership that benefits our students and all the people of the state," Austin added.

For the complete article see:
<http://www.advance.uconn.edu/story2.htm>.

Associates Program Annual Meeting

The Associates Program annual meeting will be held on Wednesday, May 22, 2002. Representatives from all member companies are encouraged to attend. Attendees learn of new developments, interact with other members, and have access to IMS faculty and staff. Please reserve the date. This year our three new professors, Richard Parnas, Associate Professor of Chemical Engineering; Alex Asandai, Assistant Profes-

sor of Chemistry; and Andrei Dobrynin, Assistant Professor of Physics, will make brief presentations describing their research interests as described in the last newsletter. Plans for other events that day are in development. It is likely this will include a tour of the IMS Microscopy facility that has installed \$1.5 million worth of new instrumentation over the last year. Watch your mail for details.

School of Engineering Sponsors Summer Workshop for Teachers

Twenty-two teachers from Connecticut and Massachusetts became students for a week during the da Vinci Project, a program geared to help teachers in grades seven through twelve integrate basic engineering concepts into their math and science classes. The

project, sponsored by the School of Engineering, was held in Storrs in August. Teachers worked with engineering faculty, learning engineering fundamentals and developing practical curricula and exercises to help them introduce students to engineering. Participants

selected one workshop from six areas of engineering specialization and spent the week immersed in the area. The majority of their time was spent conducting hands-on experiments. Robert Veith, director of the da Vinci Project said he hopes teachers will learn simple and effective ways of incorporating engineering into

their classrooms. "A heightened understanding of engineering is a start, but it is just as important the teachers leave here with course modules and experiments that can be infused into their school's curricula."

New Faculty

This spring the Department of Metallurgy and Materials Engineering welcomes two new faculty members.

Dr. Mei Wei received her BEng in Metallurgy and Material Sciences in Shenyang Polytechnic University, China in 1990. She got both her Masters and Ph.D. in the School of Material Sciences and Engineering and Graduate School of Biomedical Engineering, the University of New South Wales, Australia in 1994 and 1998, respectively. In 1998, she was awarded JSPS (Japan Society for the Promotion of Science) Fellow and joined one of the world's leading biomaterial research groups in Kyoto University, Japan. In late 1999, she returned to Australia taking a research fellow position with Queensland University of Technology before she joined the faculty at the University of Connecticut as an Assistant Professor in early 2002.

Dr. Wei's main teaching and research interests lie in biomaterials and related areas. Areas of particular interest include:

- Synthesis and characterization of hydroxyapatite and ion substituted apatites
- Electrophoretic and sol-gel coating of bioceramics on metal substrates
- Production of porous biomaterials for biomedical applications
- Preparation of ceramic/polymer composites mimicking the structure of bone
- Preparation of glass ceramics
- Surface modification
- Mechanisms of apatite nucleation and growth on biomaterials
- Interactions between cells and different biomaterials
- Modeling of cell behavior on biomaterial surfaces
- In vivo animal tests

Dr. Wei has published 25 refereed articles in the area of biomaterial studies. She has given more than 30 invited talks and conference presentations in the US and overseas. Currently, she is in the process of filing a patent for a promising biomaterial developed at Queensland University of Technology. She serves as a reviewer for some journals and funding agencies in her field. She was involved in organizing the annual international bioceramic conference, Bioceramics 14, held in Palm Springs, USA 2000. She is also a nominated committee member for the organizing committee for Bioceramics 15, which will be held in Sydney, Australia in 2002.

Dr. Tai-Tsui (T.T.) Cheng received a B.S. in Metallurgy and Materials Engineering from National Cheng-Kung University, Taiwan, and graduate degrees (M.S. & Ph.D.) in Materials Science and Engineering at Case Western Reserve University. After graduating from CWRU in 1989, Dr. Cheng spent a year working as a Staff Scientist in the Electron Microscopy Group at the Max-Planck-Institut für Metallforschung in Stuttgart, Germany. She then spent nine years as a Research Fellow in the Interdisciplinary Research Centre (IRC) in Materials for High Performance Applications at the University of Birmingham, UK. She joined the faculty at the University of Connecticut in 2001 as an Associate Research Professor.

Dr. Cheng's research interests include:

- Development of advanced aerospace alloys including titanium alloys, titanium aluminides and "exotic" intermetallics such as niobium aluminides
- Applications of transmission electron microscopy techniques, in particular high resolution lattice imaging
- Microstructural evolution in epitaxial thin films including defect introduction mechanisms and interfacial structures

The Polymers and Biosystems Group

The Polymers and Biosystems Group is a new IMS interdisciplinary research group that seeks to conduct basic and developmental research that will provide the basis for the design, synthesis, engineering, testing and application of polymers in environmentally friendly and biocompatible ways.

The emphasis of the research and development efforts are directed towards:

1. Fundamental research for understanding the interactions between polymers and biosystems
2. Design, synthesis, processing and testing of polymers from renewable biological resources with controllable lifetimes
3. Engineering and processing for biomedical, agricultural and packaging applications
4. Environmentally and biocompatible polymer waste management
5. Promote direct technical interactions and information exchange with industrial and governmental institutions
6. Interdisciplinary training at graduate and post-graduate levels as well as continuous education

The Group presently consists of thirteen faculty from five different departments. The Group's administrative body is a Management Committee which includes: Professors Samuel J. Huang, Professor of Chemistry and Group Director and A. Jon Goldberg, Director, Biomaterials Program, UConn Health Center.

Research areas presently under study:

- Syntheses of biodegradable polymers
- Multi-component polymers from α -hydroxy alcanoic acids
- Site specific chemical and enzymatic modifications of polysaccharides.
- Mechanisms of biodegradation
- Reactive processing of biocompatible polymers
- Surface modification and characterization

- Molecular modeling of enzymes-polymer interaction
- Controlled release kinetics

The Polymers and Biosystems Group has also established a program for industry-university interaction in order for industry and the University to cooperate in the research, development, training, and technology transfer activities of the Group.

Some of the benefits that membership in the Group brings to the industrial partner include:

- Awareness of fundamental research results of a large interdisciplinary group on environmentally-friendly and biocompatible polymers prior to normal release
- Participate in shaping research directions
- Nonexclusive royalty-free irrevocable license on designated research
- Exchange and training of personnel
- Opportunity to interact with other members
- Direct access to well-trained students, post-doctoral fellows in interdisciplinary areas and other university resources

Membership requires payment of an annual fee to the University which conveys certain rights and privileges including one voting member in the Group's governing Industrial Advisory Board and a technical liaison who will be the responsible contact person for the Member company as regards the technical programs and scientific interactions. Such interactions may include arranging visits by University faculty and students or Member personnel to each other's facilities, donating samples for use by the group, and coordinating a technical workshop to be held each year in conjunction with the annual meeting of the Board.

For further information regarding membership in the Polymers and Biosystems Group, please contact Professor Samuel J. Huang at polysci@uconnvm.uconn.edu or (860)486-4627.

Members Corner

As a new feature we will present short descriptions of one or two of our member companies in each newsletter. In this issue we focus on Rogers Corporation and St. Gobain. Rogers is a charter member of the IMS Associates Program, a member since the Program's initiation in 1974. St. Gobain (previously Norton) has been a member for over 20 years. Carlos Barton and Chris Mirley, our program coordinators at Rogers and St. Gobain respectively, submitted the articles. We thank them for their contributions.

Rogers Corporation is a specialty materials manufacturer, headquartered in Rogers, CT. The company operates nine manufacturing facilities located across the United States (Connecticut, Arizona and Illinois) and Europe (Ghent, Belgium) with sales outlets throughout the world. Besides its wholly owned operations, Rogers has joint ventures with Inoac and Mitsui Chemicals in Japan, Chang Chun Plastics in Taiwan, and 3M in the United States. Included in the company's portfolio of specialty materials are rigid and flexible circuit materials, silicone and urethane foams, phenolic, epoxy and diallyl phthalate molding materials, laminated bus bars, and electroluminescent lamps. The key markets for Rogers' specialty materials are communications, computers, transportation, imaging and consumer applications.

Rogers' materials make possible the products that enrich people's lives. Although you won't see the Rogers name on any consumer products, the company's materials are found in cell phones and laptop computers, PDA's, wristwatches, automobiles (under the hood and in the dashboard), airplanes, trains, and even the shoes people wear on their feet.

Rogers is committed to the development of innovative specialty materials to make tomorrow's products possible. As such, the company invests significant resources in research and development activities, and

IMS Short Courses

The IMS Associates Program will present two short courses this summer. The first, an overview of thin film deposition and characterization will be held on June 18 and 19. The second course will be an over-

maintains affiliations with leading academic institutions such as The University of Connecticut. Rogers' membership in the Associates Program has provided not only important research, but has proven to be a valuable tool for recruiting the people that will continue to make Rogers a worldwide leader in specialty materials.

Saint-Gobain Ceramics & Plastics, Inc. (SGCP) is the holding company for all the Saint-Gobain Ceramics & Plastics operations in North America. SGCP has over 88 manufacturing facilities and more than 8,000 employees. Annual sales are approximately \$1.3 billion.

Saint-Gobain (Paris), of which Saint-Gobain Ceramics & Plastics, Inc. is a part, is a leading worldwide producer of building materials, high-performance plastics, insulation, flat glass, glass containers, piping, reinforcements, abrasives and industrial ceramics. One of the top 100 industrial companies in the world, Saint-Gobain had sales of \$26.6 billion in 2000. In the United States and Canada, Saint-Gobain employs approximately 31,000 people and operates more than 200 plants. Worldwide, the company employs about 171,000 people in 46 countries.

Over the years the Associates Program has assisted St. Gobain with numerous projects. The Program has assisted St. Gobain in setting up a thermal desorption GC/MS which is used extensively in the analysis of polymers and other organic compounds. The thermal desorption attachment was designed by Gary Lavigne and fabricated at IMS. Recently Mark Aindow, Associate Professor of Metallurgy and Materials Engineering, has been working with the St. Gobain microscopy group at Northboro investigating the feasibility of using transmission electron microscopy to characterize (chemically and size) alumina suspensions.

view of surface analysis techniques. The date is still to be determined. Any comments or suggestions would be appreciated. Watch your mail for details.

Spring Semester Starts

Spring semester 2002 classes start Wednesday, January 23, 2002. Some courses that may be of interest include the following.

CHEM-384	Polymer Characterization II	C. Sung
CHEG-352	Polymer Properties	M. Shaw
CHEM-394-1	Advanced Polymer Synthesis	S. Huang
CHEM-394-2	Surfaces, Interfaces and Complex Fluids	A. Dobrynin
MCB 313	Structure and Function of Biological Macromolecules	J. Knox
MMAT-309	Transformation Phenomena	H. Brody
MMAT-317	Electrical Structure of Materials	J. Galligan
MMAT-320-2	Welding	T. Kattamis
MMAT-320-3	Alloy Casting Processes	H. Brody
MMAT-320-4	Surface Spectroscopy	H. Marcus
MMAT-323	Microscopic Investigation of Materials	M. Aindow
MMAT-343	Corrosion	N. Greene

Some courses require pre-approval of the instructor. For further information please call Ed Kurz.

Department Seminars

The seminar schedule for the Polymer Program is included (see page 11). Seminar schedules for other departments have not been finalized at this time. This information will be available on the World Wide Web at <http://www.ims.uconn.edu/>. 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.

IMS Expansion-Construction Completion

Construction of the expansion to IMS located on the plaza of the Gant complex is complete and the building is fully occupied and functional. The present building for IMS was completed in the early 1970s. Since that time our growth has led to building rooms in the halls, converting three of the four seminar/class rooms into offices or laboratories, and serious overcrowding in the laboratories. IMS is very pleased that support from UConn 2000 was made available for construction of a 15,000 sq. ft. addition.

Funds are badly needed to equip this new space and to upgrade outdated laboratory equipment in our existing space. This is truly a "once in 30 years" opportunity. Approximately \$5M is needed. The new building and associated update of research equipment at IMS will be very important in projects that are of interest to IMS Associates Program member companies. Examples include small spot x-ray photoelectron spectroscopy

and time of flight SIMS facilities. Each of these equipment groupings costs in excess of \$500,000. Several items will be available only at UConn in this region. As with all IMS facilities, they will be available to all Associates Program member companies.

We respectfully request that member companies and friends consider, as partners and close collaborators, a one-time gift for the re-equipping of the Institute. This new equipment will help IMS, which already has an excellent reputation, step forward as a national leader.

In our 30 year history IMS has not made such an appeal. This is truly a special time when we need to advance our mutual interests through this equipment and facilities. For further information please contact: Harris L. Marcus, Director, Institute of Materials Science, Tel. 860-486-4623, Fax 860-486-4745, Email: hmarcus@mail.ims.uconn.edu.

Selected Recent IMS Publications

Mark Aindow

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Pamir Alpay

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Alexandru Asandei

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Harold Brody

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Tai-Tsui Cheng

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Andrey Dobrynin

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Myer Ezrin

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James Galligan

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Maurice Gell

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Theo Kattamis

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James Knox

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Edward Kurz

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Harris Marcus

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Patrick Mather

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John Morral

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Nitin Padture

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Richard Parnas

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Daniel Scola

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POLYMER SCIENCE SEMINARS

Spring Semester 2002

- February 8 Optical Ellipsometry and X-ray Scattering Complementary Techniques
for Studies of Structure
Prof. Peggy Cebe, Tufts University
- February 26 The Effects of Confinement on the Structure of Sheared
(Tuesday) Polymer Blends
Dr. Kalman Migler, National Institute of Standards & Technology
(A joint seminar with Chemical Engineering Department, UTEB Room 150, 11 AM)
- March 1 Mechanism of Group Transfer Polymerization:
Living Anionic Polymerization of Methyl Methacrylate
Prof. Owen W. Webster, University of Pennsylvania
- March 8 Regulation of Viral Enzymes by Macromolecular Interactions
Prof. James L. Cole, University of Connecticut
- March 15 MesoStructure Control of Polymer-Inorganic Nanocomposites
Dr. Richard A. Vaia, Air Force Research Laboratory
- April 16 *Chemical Engineering Frontiers Distinguished Lecture:*
(Tuesday) Reactions at Polymer-Polymer Interfaces
Prof. Christopher W. Macosko, University of Minnesota
(Time and Place - TBA)
- April 19 DNA Nanotechnology
Prof. Nadrian Seeman, New York University
- April 26 Self-Assembled Nanoparticles as Selective Oxidation Catalysts
Prof. Steven L. Suib, University of Connecticut
- May 3 New Insights into the Microstructure of Polymeric Systems
Using Optical Coherence Tomography
Dr. Joy P. Dunkers, National Institute of Standards & Technology

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

Coffee will be served at 10:30 AM outside the seminar room.

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

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IMS Associates Program

The need for technological innovation is self-evident. So is the desirability for closer ties between technical personnel pursuing parallel goals in an industrial or university laboratory. The collective expertise of over one hundred faculty associated with the Institute of Materials Science provides an exceptional resource for the technological industries in Connecticut and other states. With the narrowing of the gap between research findings and their commercial implementation, a close working relationship between industrial firms and IMS works to the mutual benefit of both.

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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 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 which do not contain such additives can be purchased. One source of such bags is the Kapak Corporation, 5305 Parkdale Drive, Minneapolis, MN 55416, 612/541-0730. Typical price is about \$200 per thousand depending on the exact size. Be sure to specify non-contaminating/non-plasticized material.