



University of Connecticut Institute of Materials Science



IMS Associates Program Newsletter

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Joint Research Agreements

The Institute of Materials Science has recently entered two joint research agreements. One is with the National Institute for Materials Science in Tsukuba, Japan. The National Institute for Materials Science (NIMS) was established with the overall purpose of improving the level of materials science and technology by conducting research and development work in a comprehensive manner, including basic research in materials science/technology and R&D in connection with associated technologies and the research and intellectual infrastructure. The scope of activities undertaken at NIMS includes basic research related to materials science and technology, and research and development of related research and intellectual infrastructure; encouragement of practical application of R&D results, including transfer to the private sector; shared use of institute facilities and equipment with researchers from other institutions; and training and development of researchers and technical people. This research agreement focuses on soft-bio/nano materials. Professor Fotios Papadimitrakopoulos is the IMS contact for more information on this program (papadim@mail.ims.uconn.edu). For more information on NIMS see <http://www.nims.go.jp/eng/>.

The second agreement is with the Korea Research Institute of Chemical Technology in Daejeon, Korea. The Korea Research Institute of Chemical Technology (KRICT) was established in September 1976 to conduct research and development in the field of chemical technology and to disseminate the results to industry. KRICT is one of the first government-supported research institutes in Korea to license its patents abroad. KRICT has also developed entire manufacturing processes for the fine chemicals industry. These contributions among many others have shaped KRICT into one of Korea's core government-supported chemical research institutes. This agreement focuses on the implementation of joint research on nano-materials and reliability evaluation of polymers. Professor Montgomery Shaw is the IMS contact for more information on this program (montgomery.shaw@uconn.edu). For more information on KRICT see <http://www.kRICT.re.kr/eng/>.

MRS Gold Medal Award to Ingrid Rousseau

Congratulations to Ingrid Rousseau (studying with Professor Mather) on winning the Materials Research Society (MRS) Gold Medal Graduate Student Award for her work entitled "When Liquid Crystallinity Meets Actuation" at this fall's MRS Meeting. For this award, 153 graduate students were nominated, 28 were finalists and 9 were chosen to receive Gold Medals. The selection was based on nomination letters, a student-written research description, an oral presentation (separate from the MRS contributed presentations) to a panel of four MRS representatives. The competition was quite keen with excellent reports from such disparate fields as carbon nanotubes, inorganic crystallization, intercalates and polymers.

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IMS Distinguished Lecture

This year Nathan S. Lewis, Professor in the Division of Chemistry and Chemical Engineering from California Institute of Technology, Pasadena, California, will present the IMS Distinguished Lecture. The presentation is entitled "An Electronic Nose from Arrays of Polymer Composite Vapor Sensors." The presentation will be on Tuesday, January 25, 2005 at 4pm in IMS Room 20 and is free and open to the public. As with all seminars we urge you to call before leaving to insure there are no last minute changes due to weather or other issues. An abstract follows.

A method is described for generating a variety of chemically diverse, broadly responsive, low power vapor sensors. A key to our ability to fabricate chemically diverse sensing elements is the preparation of processable, air stable films of

electrically conducting organic composites. An array of such sensing elements produces a chemically reversible, diagnostic pattern of electrical resistance changes upon exposure to different odorants. Such conducting composite elements are simply prepared and are readily modified chemically to respond to a broad range of analytes. In addition, these sensors yield a fairly rapid, low power, dc electrical signal in response to the vapor of interest, and their signals are readily integrated with software or hardware-based neural networks for purposes of analyte identification. Principal component analysis has demonstrated that such sensors can identify and quantify different airborne organic solvents and can yield information on the components of gas mixtures.

Connecticut Nano Study Update

Connecticut Nanotechnology Initiative (CNI) is pleased to invite you to its next event on **Wednesday, January 19, 2005 5:00 to 7:00 p.m.** Radisson Hotel, 100 Berlin Road, Cromwell, Connecticut.

CNI is pleased to have as their guest Mitchell Horowitz from the Technology Partnership Practice of the Battelle Memorial Institute in Columbus, Ohio, one of the Nation's leading technology development consulting groups. The State of Connecticut has commissioned Battelle to assist the State in assessing Connecticut's relative position in nanotechnology and in developing a strategic framework to leverage Connecticut's nanotechnology resources and assets and address potential areas of focus and enabling investments. In connection with this effort, Battelle will conduct a systematic analysis and inventory of Connecticut's business, financial, and scientific strengths in nanotechnology, available funding opportunities and efforts of other states to promote and develop nanotechnology. Battelle will also seek input

from Connecticut businesses, academic institutions, researchers, educators and government leaders to best position Connecticut as a leader in nanotechnology.

At this meeting Mitch will be joined by his colleague from Battelle, Marty Grueber, and by Rob Keating, Director of the State's Office of Workforce Competitiveness. Mitch will describe the planned study and solicit input from all that are present. Please come and add your ideas for the study to assist in making it as complete as possible.

Please join us to hear a presentation by Mitchell Horowitz, Director of Strategy, Battelle Technology Partnership Practice. Networking and light hors d'oeuvres will follow the presentation. Cost: \$20 per person. Cash or a check will be accepted at the door on the day of the event. Check should be made out to: Connecticut Nanotech Initiative. **R.S.V.P. by January 15, 2005 to:** Kim Post at 860 486-4623 or by email to kim.post@uconn.edu.

Focus on Research

In each issue of this newsletter we profile one of the active research areas at IMS. In this issue we focus on the research being led by Montgomery T. Shaw, A. T. DiBenedetto Distinguished Professor of Chemical Engineering.

After completing B.Ch.E. and M.S. degrees in chemical engineering at Cornell University, Dr. Shaw moved south to Princeton University, where he studied under the late Professor Tobolsky, obtaining his Ph.D. in Chemistry. For the next six years he was associated with the R&D department of Union Carbide Corporation in Bound Brook, New Jersey. In 1977 Dr. Shaw joined the faculty of the Chemical Engineering Department at the University of Connecticut. He is co-author of the monographs *Polymer-Polymer Miscibility* (Academic, 1979) and *Computer Programs for Rheologists* (Hanser, 1994). Due to be published in 2005 is the 3rd edition of the well-known textbook *Introduction to Polymer Viscoelasticity*, which he is coauthoring with W. J. MacKnight. He is serving as Associate Editor of *IEEE Transactions on Dielectrics and Electrical Insulation*. Recognitions include the SPE International Award for Research (1998), Engineering Distinguished Professorship (1999-2001), SPE Fellow (2000), A. T. DiBenedetto Distinguished Professorship (2002-2004), the SPE International Award (2002), the Founder's Award of the Polymer Analysis Division of SPE (2004), and the Chancellor's Research Excellence Award (2004).

At the Institute of Materials Science Shaw conducts research in the following areas.

Phase Behavior in Polymer Solutions & Blends: Polymer solution properties are extremely important to both the processing of polymeric materials and to the properties of the final product. Although many theories of polymer solutions have been developed and tested for dilute solutions and can be applied to concentrated solutions, many problems remain, especially for solutions of stiff polymers and their hydrodynamic properties. For solutions in which

phase separation occurs, theoretical description becomes extremely difficult.

Under this broad heading fall several current research topics. Included in these are the phase behavior of block copolymer solutions and the influence of electric fields on mixed polymer solutions for membrane applications including proton exchange membranes.

Polymer Rheology & Processing: The flow properties, or rheology, of polymer solids and melts are important to the understanding of polymer fabrication processes and the properties of the final polymeric product. Rheology also provides insight into the structure of the material. Rheological properties are measured by rotational, capillary and extensional rheometers, along with other specialized instruments. Current projects include studies of electro-rheological fluids and gels, the behavior of block copolymer solutions, and the processing of nanocomposites.

Aging of Polymeric Dielectrics: In any application, knowledge of the failure and degradation of the polymeric material is important. While polymers can initially possess very good properties, these often decay with time and, eventually, failure may occur. Research is aimed at discovering the mechanisms of degradation under electrical, chemical, and radiative stresses. We are particularly concerned with methods for modeling the degradation of materials exposed to several stresses at once, so that reasonable predictions of useful life of a material can be made. While most of the methods developed so far are empirical in nature, they have proven to be useful. We are currently working on methods that can connect physical property degradation with the fundamental, underlying chemical reactions.

More information regarding Dr. Shaw's research interests can be found at http://www.engr.uconn.edu/cheg/cheg_fac_shaw.htm or by contacting Professor Shaw directly (montgomery.shaw@uconn.edu).

UConn Student SPE Chapter

The UConn Society of Plastics Engineers (SPE) Student Chapter was founded in 1981. The President is graduate student Eric Catuccio and the SPE advisor is Dr. Myer Ezrin, Director of the IMS Associates Program. The sponsoring SPE Section is the Western New England Chapter. The Student Chapter renders assistance to IMS in various ways and sponsors programs to benefit polymer graduate students. It provides for the audio-visual equipment used by seminar speakers. For many years it has taken part in presentations for youth programs on CPTV (Connecticut Public Television). It has sponsored a series of talks by industry representatives, some from Associates Program members, for polymer graduate students. This helps to introduce students to what it is like to work in industry. Another series of talks each year is by polymer faculty on their research to help introduce the new students to the variety of research going on and to help in selecting a research advisor. SPE Student Chapter officers have met annually with the IMS Advisory Board to share with them areas of concern and interest from the students' point of view. When IMS sponsored tours for the Western New England Section of SPE, the students played a key role in all aspects. SPE students have attended various programs of the Western New England Section of SPE including technical presentations and plant tours.

The other officers of the Chapter besides Eric Catuccio, President, are Smita Boob, VP; Rongfu Li, Treasurer; Gobinda Saha, Secretary.

UConn Material Advantage Student Chapter

The UConn ASM/TMS Student Chapter has been officially renamed as the UConn Material Advantage Student Chapter effective Fall '04, reflecting the merger of the ASM/TMS and American Ceramic Society (ACerS) Chapters. Among the purposes outlined in the charter of the UConn Material Advantage Student Chapter are to support the UConn Materials Science & Engineering (MSE) department's K-12 outreach efforts; foster interaction between the UConn MSE student community and the ASM, TMS, and ACerS chapters; and to add quality to the overall Materials Engineering experience of the MSE students. Mr. Chandrasekhar Kothapalli has been elected President for the academic year 2004-05 and Prof. Rampi Ramprasad has graciously agreed to act as the faculty advisor to the student chapter.

The UConn Student Chapter won another national award sponsored jointly by ASM International, TMS and AIST - the 2004 World Materials Day Award. The award

Funds are always in short supply to help with possible programs of interest. The Western New England Section has helped sometimes. The students have sold various items, including a calendar with international recipes contributed by polymer graduate students. Other items sold are coffee mugs with the polymer logo and sweatshirts.

What does all this have to do with the members of the IMS Associates Program? The SPE Student Chapter is a reservoir of potential future employees who have demonstrated an interest in the polymer/plastics industry and are leaders for the benefit of all polymer graduate students, whether affiliated with SPE or not. If you get to know them, you may find an important future employee for your company in polymer science and technology who knows how to lead, to relate to people and to get things done.

As Director of the IMS Associates Program and advisor to the UConn SPE Student Chapter, Mike Ezrin can help make the connection between your company and this promising group of students. Possibilities are a plant tour for the whole group, learning of their research, targeting an individual for contacts regarding their research or for consideration of future employment. Possibly a student could be invited to give a seminar at the company. Or the other way around -- an offer to present a seminar or round table discussion at IMS.

carries a trophy and \$750 cash prize. More than 60 universities entered the competition, and UConn and Cal Poly were selected as the winners. Prof. Leon Shaw, the previous faculty advisor to the chapter, led outreach efforts designed to interest middle and high school students in the New England area via several events. In Fall '04, the chapter coordinated a poster contest for the graduate students and an industry visit to the Wood Group (West Hartford, Connecticut). On the fun side, teaming up with the UConn Society of Polymer Engineers Chapter, the Material Advantage Chapter members enjoyed an outing at Chucks & Margaritas on November 3. The Material Advantage Student Chapter will be involved in several events in Spring '04, including the MSE Student Night, Materials Week, departmental visitation day, road-show for high school students and Connecticut Invention Convention.

Contributed by Chandrasekhar Kothapalli.

Members Corner

In each newsletter we present a short description of one or two of our member companies. In this issue we focus on Henkel Technologies (formerly Loctite). We thank Hank Temme for this contribution.

The Henkel Technologies division of Henkel Corporation is a leading supplier of adhesives, sealants, and surface treatments for industrial customers. Strong brands, such as Loctite®, Teroson®, Hysol® and Liofol®, and a multi-million dollar commitment to research and development place Henkel Technologies at the forefront of the industry. The company's products are used in the transportation industry for automotive engineering and aircraft design and construction. Henkel Technologies also sells to a variety of industrial sectors including manufacturing assembly, food and beverage packaging, paper converting, and industrial maintenance and repair. The electronics industry uses Henkel products in cell

phones and computers. Henkel Technologies also develops adhesives for surgery and medical device manufacturers.

Over the years the Associates Program has assisted Henkel Technologies (formerly Loctite) with numerous projects. Some examples of areas in which the Program has assisted the testing and analytical labs of Henkel at Rocky Hill include: GPC analyses of products being developed, ESEM imaging of rubber modified adhesives, thermal desorption GC/MS of cured adhesives for component and contaminant analyses, and various XPS studies of commercial products. In addition, Henkel has sponsored short courses and seminars for employees at the Rocky Hill Labs run by UCONN faculty and IMS faculty have consulted on a number of projects at Henkel.

New Associates Program Member

Founded in 1995, Techni-Met, Inc. is a high value added manufacturer of precision coated materials, specializing in the vacuum deposition of inorganic materials (such as precious, refractory, non magnetic metals, alloys, and ceramics) onto flexible polymeric films. Techni-Met facilities located in Windsor, Connecticut currently have one of the largest production capacities in the industry. This enables Techni-Met

to work with international corporations as well as small businesses on projects of all sizes, allowing our customers to develop new and innovative products for many different markets.

There are now 31 members of the IMS Associates Program.

Spring Semester Starts

Spring semester classes start Tuesday, January 18, 2005. Some courses that may be of interest include the following.

CHEM-384	Polymer Characterization II	Sotzing and Sung
CHEG-352	Polymer Properties	Parnas
CHEM-394-A	Special Topics: Advanced Synthesis	Sotzing, Asandei and Seery
CHEM-394-C	Special Topics: Semiconducting Polymers and Nanostructured Materials	Papadimitrakopoulos
CHEG-367	Rheology	Shaw and Weiss
BME-271	Biomaterials	Wei
MMAT-234	Materials Protection	Wei
MMAT-311	Mechanical Properties	Shah
MMAT-309	Transport Phenomena	Brody
MMAT-323	Transmission Electron Microscopy	Aindow

Associates Program Staff Presentations and Papers

- The following paper has been submitted to the SPE (Society of Plastics Engineers) 2005 Annual Technical Conference in Boston, May 2005, for presentation at the Case Studies session of the Failure Analysis and Prevention Special Interest Group. M. Ezrin, G. Lavigne, M. Dudley and L. Pinatti, "Case Studies of Plastics Failure Related to Molecular Weight or Chemical Composition."
- The following paper has been submitted to the new journal "International Journal of Forensic Engineering," M. Ezrin and G. Lavigne, "Adhesion Failures of Plastics Bonded to Various Materials."

Copies of both papers are available from M. Ezrin,

myer.ezrin@uconn.edu or tel. 860-486-4628.

- "Interfacial Characterization of Glass Surfaces and Encapsulant Bonding in Thin-film Photovoltaic (PV) Modules" Kurz, Dewan, Agro, and Tucker; DOE Annual Solar Review Meeting, Denver, CO Oct. 2004. To be published in Solar Program Annual Report.
- "Applications of Optical Profilometry", Mark Dudley, Ed Kurz, Hardial Dewan; Eastern Analytical Symposium, Nov. 2004, Somerset, NJ.

Copies of these two papers are available from E. Kurz, ekurz@mail.ims.uconn.edu.

Nicholls Named UConn Provost & Executive Vice President

Peter J. Nicholls, Provost and Academic Vice President at Colorado State University, has been named Provost and Executive Vice President for Academic Affairs at the University of Connecticut. Nicholls is expected to join UConn on or about April 1. Nicholls, who has been at Colorado State since March 2002, has also served as Dean of the College of Arts and Sciences at Kansas State University and Associate Dean of the College of Liberal Arts and Sciences at Northern Illinois University. A native of Kent, England, Nicholls holds a B.Sc. in mathematics from London University and a Ph.D. in mathematics from Cambridge University. During his tenure in Colorado, Nicholls achieved many academic goals that addressed issues such as revision of the first-year

curriculum, development of an enrollment management plan, restructuring of the graduate school and the division of continuing education, and development of K-12 outreach activities. Nicholls replaces Provost John D. Petersen who left UConn to become president of the University of Tennessee. For more information see <http://www.news.uconn.edu/2004/dec2004/rel04101.htm>.

Fred Maryanski, who has been Interim Provost since June of 2004, will be leaving UConn to become President of Nevada State College. For more information see <http://www.lasvegassun.com/sunbin/stories/lv-ed/2004/dec/16/517995014.html>.

Department Seminars

Spring seminar schedules have not been finalized at this time. We will send the schedules to our members for the Materials Science & Engineering Department and the Polymer Program when finalized. This information, and the seminar schedules for most departments, will also be available on the World Wide Web. 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 Short Course

Plans are still in development for this summer's short course. We welcome your suggestions for future short courses. You will receive detailed information in the spring.

All Associates Program member companies will receive one reduced price registration.

Short Course Registrations

In the past a small number of people have registered for short courses through the Associates Program and not attended. The Associates Program must still pay in this situation. Please note that participant substitutions can be made

at any time and registration can usually be canceled at minimal cost until the day before the course. We understand that occasionally plans must change but request your assistance when such changes occur.

Associates Program Annual Meeting

The Associates Program annual meeting is tentatively scheduled for Wednesday, May 18, 2005. Plans are still in development. We have several new faculty members and will try to present their research interests. 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. Watch your mail for details.

Membership Fee Changes

Some time ago a careful and detailed review of all of the finances associated with the IMS Associates Program revealed that the Program was not adequately recovering its true expenditures. After much thought, review, input from members, and discussion with the IMS external advisory board (many of whom are representatives of Associates Program members) the following changes in fee structure are being implemented.

Beginning January 1, 2004 all new Connecticut companies with more than 250 employees joining the Program are charged an annual fee of \$25,000. Starting July 2004 all existing in-state members will be offered continuing membership for one year at \$20,000 if they pay in full within 30 days of their renewal date.

This year (again beginning July 2004) existing out-of-state members will be handled exactly the same, i.e. given an option of staying at \$20,000 per year, for one year, if they pay in full within 30 days of their renewal date. In July of

2005 the annual membership fee for out-of-state companies will increase to \$30,000 per year. Again, for the year starting July 2005, all existing out-of-state member companies will be able to delay this increase by paying \$25,000 within 30 days of their renewal date.

Starting January 2004 all new out-of-state members are charged an annual rate of \$30,000 per year.

Finally, for existing small (less than 250 employees) in-state members, the annual fee will be increased in a fashion similar to that of the large in-state members but details will vary depending on the size of the company. As with large companies, new in-state small company members have been charged the new rates since January 2004.

We hope you understand the necessity of these changes and look forward to continuing to serve our members in the future.

IMS Associates Program

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Gel Permeation Laboratory

The GPC lab (Gel Permeation Chromatography) is operational with the new Viskotek four detector GPC for polymers - refractive index, ultraviolet, viscosity and light scattering. Advantages are molecular weight values that are more accurate. Older GPC typically uses polystyrene (PS) standards. For polymers other than polystyrene the molecular weights may not be accurate when the calibration is based on PS.

Nitin Pature

Professor Nitin Pature has moved to Ohio State University starting January 5, 2005. We wish him and his family all the best in the new career and life at OSU.

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 some-

times 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, 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.