PSE Newsletter Fall 2012

It has been quite a while since the January 2009 publication of the last PSE Newsletter, and a lot has happened in the department since then. Notwithstanding the backlog of news items, we will do our best in this issue to bring you quickly up to speed on the latest goings-on in PSE. One small change that you may notice is that Todd Emrick has handed over the editorship of this newsletter to me as he has taken on new responsibilities, including the Directorship of the UMass MRSEC (page 7). As a relatively new member of PSE myself, I look forward to getting to know more of the great PSE alumni community and reaching out on a regular basis through this newsletter.

Among the many changes taking place, in 2010 Dave Hoagland took over as PSE department head. Shaw Ling Hsu had ably served the department for the previous six years, overseeing a period of great growth in terms of external funding, faculty size, and student numbers.

In faculty news, we are excited to announce at long last the newest member of the PSE faculty, Alejandro (Alex) Briseno (page 10). Alex joined us already few years ago now (back in Fall 2010), and he's excited to be here just as we are to have him. Congratulations are due to Ryan Hayward who was promoted to Associate Professor with tenure last year. Please also join me in congratulating a number of faculty members who recently were promoted to Full Professor: Todd Emrick, Greg Tew, Ken Carter, Bryan Coughlin and Al Crosby. We are also delighted over the addition of two excellent facility directors who were appointed at the research faculty/lecturer level: Volodimyr Duzhko is overseeing the EFRC Photovoltaics Facility; and Alex Ribbe has been appointed director of the campus microscopy facility.

PSE continues to do what it does best, adding *over 60* new members to the roster of PSE alumni since winter 2009 (pages 8-9), collecting numerous awards for research and education (page 12), and expanding and fostering research efforts on polymers at UMass through an array of interdisciplinary research centers (pages 6-7).

On a sad note, Dick Farris and Bob Lenz, two well-known members of the PSE community passed away in the summer of 2010. In honor of their many contributions to UMass and department, we have included a tribute to them in this issue (page 11).

PSE Newsletter Editor
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PSE Faculty September 2012

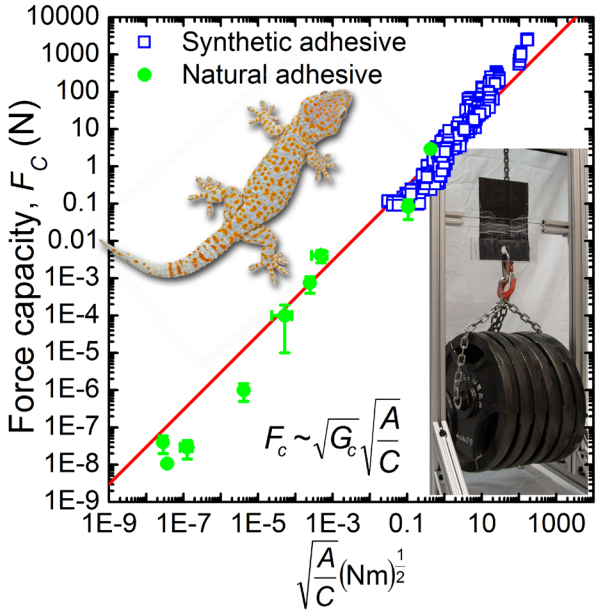
(*front, from left)* Alex Briseno, Alan Lesser, Sam Gido, Maria Santore, Tom Russell, M. Muthukumar; (*middle)* Dave Waldman, Ken Carter, Harry Bermudez, Greg Grason, Bryan Coughlin; (*back)* Ryan Hayward, Greg Tew, Tom McCarthy, Shaw Ling Hsu, Dave Hoagland, Al Crosby, Todd Emrick (*not pictured:* Jim Watkins)

PSE Highlights

Engineering Gecko Adhesion

For years, biologists have been amazed by the power of gecko feet, which lets these 5-ounce lizards produce an adhesive force roughly equivalent to carrying nine pounds up a wall without slipping. Recently, a team of researchers led by Al Crosby in PSE and Duncan Irschack from UMass Biology, have discovered exactly how the gecko does it, leading them to invent "Geckskin™," a device that can hold 700 pounds on a smooth wall. Their discovery has been published in the February 2012 issue of *Advanced Materials*.

Geckos are equally at home on vertical, slanted, even backward-tilting surfaces. "Amazingly, gecko feet can be applied and disengaged with ease, and with no sticky residue remaining on the surface," Irschick says. The combination of these properties has never been achieved before at the scale of everyday materials. Crosby says, "Our Geckskin™ device is about 16 inches square, about the size of an index card, and can hold a maximum force of about 700 pounds, while adhering to a smooth surface, such as glass." Beyond its impressive sticking ability, the device can be released with negligible effort and reused many times with no loss of effectiveness. For example, it can be used to stick a 42-inch television to a wall, released with a gentle tug and restuck to another surface as many times as needed, leaving no residue.



Scaling prediction and test of dependence maximal adhesive strength on geometric and mechanical properties of contact.

The "Geckskin" Team (left to right): Al Crosby (PSE), Dan King (PSE), Mike Bartlett (PSE), Duncan Irschick

Previous efforts to synthetically engineer the adhesive power of gecko feet and pads were based on the qualities of microscopic hairs on their toes called setae, but efforts to translate them to larger scales were unsuccessful, in part because the complexity of the entire gecko foot was not taken into account. As Irschick explains, a gecko's foot has several interacting elements, including tendons, bones and skin that work together to produce easily reversible adhesion.

The key innovation discovered by the group was to create an integrated adhesive with a soft pad woven into a stiff fabric, which allows the pad to "drape" over a surface to maximize contact. Further, as in natural gecko feet, the skin is woven into a synthetic "tendon," yielding a design that plays a key role in maintaining stiffness and rotational freedom. It is the quantitative understanding of the roles these two properties play that has allowed the team to "scale up" the size and adhesive strength of Geckskin™ several orders of magnitude.

Importantly, the Geckskin™ adhesive pad uses simple everyday materials such as polydimethylsiloxane (PDMS), which holds promise for developing an inexpensive, strong and durable dry adhesive. The UMass Amherst researchers are continuing to improve their Geckskin™ design by drawing on lessons from the evolution of gecko feet, which show remarkable variation in anatomy.

PSE Alum recieves honorary degree

QiFeng Zhou, President of Peking University and PSE Alum, was honored on May 14, 2010 during the UMass graduate commencement ceremenonies. President Zhou was awarded an hononary Doctorate of Public Administration by the Chancellor of the UMass Amherst campus .

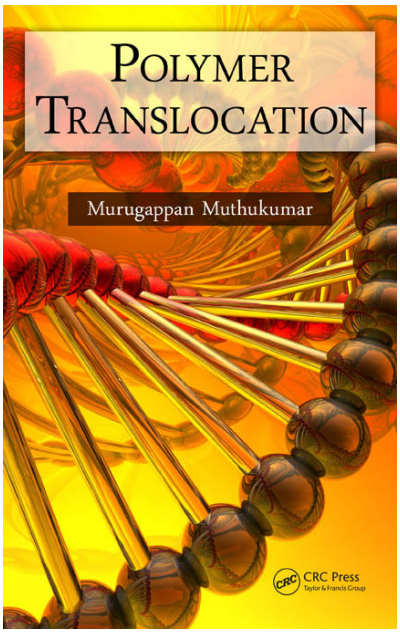
Qifeng Zhou (PSE 1983)

A native of Hunan Providence, QiFeng received his undergraduate degree in chemistry from Peking University. He came to UMass to pursue his graduate degrees in polymer science and engineering in 1980. Quifeng received has Ph.D. from UMass in 1983, working with Bob Lenz on the synthesis and characterization of thermotropic liquid-crystalline polymers. QiFeng then returned to China as a faculty member in the Chemistry Department of Peking University. QiFeng held numerous adminstrative positions in his department at Peking University, before he was appointed President of Jilin University from 2004 - 2008. In November 2008, he was appointed President of Peking University. He is also a member of the Academic Degrees Committee of the State Council in China.

The honorary degree from UMass was given in recognition of President Zhou's distinguished record of accomplishment, as one the first students to study abroad from China in the early 1980s. Given his own roots at UMass and the strong ties between the US and China during his career, President Zhou was sure to stress the importance of educational ties between the countries as he addressed the UMass graduate degree recipients. "I want you to join me in promoting friendship and collaboration between China and the United States," he told the assembly. "As global citizens, you are always welcome in China and to start your career in China."

Unraveling *Polymer Translocation*

In summer 2011, Murugappan Muthukumar (Muthu), Wilmer D. Barratt Professor of Polymer Science and Engineering, published a new book entitled *Polymer Translocation*. The monograph, published by CRC Press, presents a comprehensive and pedogogical overview of the application of the principles of polymer physics to problems of biopolymer translocation.



Polymer translocation, or the threading of macromolecules through channels much smaller in dimension than typical chain size, underlies many of the most vital biological processes, such as the passage of the polynucleotides and proteins through the membranes that separate inter- and intra-cellular compartments. In recent decades, the advent of electrophysiological methods for monitoring the passage of single molecules through pores as well as the ability to make or manipulate nanopores in the lab, has led to a complex and quantitative picture of the dynamics of this process. The rapidly evolving study of translocation is paving the way for new technologies for rapid, and affordable, genome sequencing.

Polymer Translocation describes how the modern tools of polyelectrolyte and polymer physics are adapted to address the rich and quantitative phenomenology of translocation. The book aims to reach a broad audience, including those working in the field without a detailed knowledge of polymer physics. As such, the first chapters serve as a concise overview of polymer physics concepts and tools ranging from elementary topics like random chain structure, to more advanced topics like polyelectroyte dynamics. The second half of the book discusses the application of these tools to the specific problem of macroion transport to, into and through the confined pore geometries, with later chapters focusing heavily on specific comparisons between theory, simulation and experiments.

The burgeoning interest in biopolymer translocation in the scientific community and pressure to bring down the cost per basepair of gene sequencing make the publication of *Polymer Translocation* quite timely. While inital plans for the book began in 2009, Muthu finalized the monograph in parallel with a special topics course he taught on the topic in spring 2011. Among his various sources for inspiration for the book, Muthu notes, "I have been really inspired by the generations of students who bring their diverse skill sets to the study of polymers."

Voices from PSE

For this issue, we posed a single question to four current and three former students from PSE about their experiences in the department. The responses from our "future alumni" and "former students" are featured below.

"What have you learned during your time at PSE that you were most surprised or impressed to find to be useful for your research or career?"

Marcos Reyes-Martinez
Hometown: Santo Domingo, Dominican Republic
Undergrad: Manhattanville College, 2009 (Math & Physics)
Group: Briseno & Crosby
Research: mechanics of organic single crystals & flexible electronics

A fundamental part of an academic community is the exchange of ideas, results, and theories related to research. It was very surprising to me the need to hone my artistic skills in order to enhance science communication. Before coming to graduate school, I never considered how the artistic representation of scientific concepts could affect communication efficacy. I observed that when presenting details regarding research in the form of experimental schematics, simulation predictions, representation of intricate nanostructures, etc, the exact combination of aesthetic tact and conciseness was key; this balance is something I strive to reach continuously. I never imagined I was going to have to learn to work with drawing and 3D-rendering software. I have learned that when an audience can capture a concept visually they can connect with your ideas better and offer more effective feedback on your work. Effective feedback, of course, is so important for the progress of research.

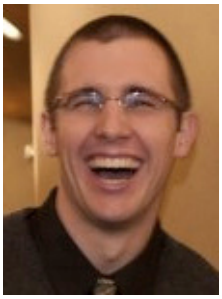
Nick Hendricks
Hometown: Dayton, Ohio
Undergrad: Wright State Univ., 2007 (Chemistry)
Group: Carter & Watkins
Research: porous metal oxide materials

The importance of communication and listening skills. This may sound like a set of skills that is often associated with networking, i.e. for job opportunities after graduation and such, however, I have found it equally imporant to my research. The ability to clearly communicate ideas and research through meetings, presentations, and just everyday conversations was crucial for spurring creativity and innovation during my dissertation. By effectively communicating to scientists and researchers, especially members of research communities outside of my field of expertise, I was provided with unique perspectives on how to handle specific research problems. The other side of communication is listening, specifically active listening. By actively listening to research issues fellow colleagues were experiencing, I was presented with an opportunity to be helpful while also acquiring knowledge from an expert in a research field outside of my own. With this additional knowledge acquired from active listening, several collaborative research efforts were established and the general knowledge of the researchers involved was enhanced.

Cathy Walker
Hometown: Springwater, New York
Undergrad: Wells College, 2009 (Chemistry)
Group: Tew
Research: lithium ion conducting networks

I attended a science policy workshop in Washington DC last summer with a group of about 10 other graduate students from different science and engineering disciplines. I was the only polymer scientist and the only one to get questions specifically based on my discipline. For example, one student asked me, "Hey, *polymer scientist*, can I put this plastic coffee mug in the microwave?" and another asked "What is silly string made out of?". I was impressed to find that I turned out to be the expert in the room on everyday materials. Meanwhile nobody had any questions specifically for any of the other disciplines represented in our group.

Ben Mohr
Hometown: Monterey, California
Undergrad: Colorado School of Mines., 2008 (Chemistry)
Group: Muthukumar
Research: light-scattering properties of human crystallin proteins and opacity of cataracts



I am often stunned that the phenomenon which causes our sky to be blue has played a vital role in my Ph.D. thesis. Suspended particles in the air scatter light, with shorter wavelengths scattering the greatest there

by turning the sky a brilliant blue. Light can also be scattered off of nanoscopic particles in solution such as colloids and polymers. Using a laser to emit a single wavelength, precisely measuring the scattered light intensity and now one has an extremely useful characterization technique. Throw in a correlation function, an inverse Laplace transform or Cumulant function, the Stokes-Einstein equation and now it is possible to accurately measure the true size of these nanoscale objects. During my Ph.D. I have used light scattering to study aggregation events of human lens proteins in order to gain insight into what causes cataracts. Light scattering reminds me that the answers to our research questions can often be found in the world around us, we just need to discover where to look.

Eric George
PSE Entering Year: 1981
PSE Advisor: Roger Porter
Current Position: scientist, Johnson & Johnson

Building on the fundamental work of Professor Porter on cholesteryl ester phase diagrams and my thesis we have been able to develop a more thorough understanding of the role of meibomian gland secretion and dry eye disease. The meibomian glands secrete a mixture of lipids including several cholesteryl esters. The temperature of the ocular environment is approximately 35 degrees C. The eutectic point of the cholesteryl ester mixture (though not totally understood) must be below 35 degrees C. One factor in meibomian gland disease is a less than optimum ratio of cholesteryl esters in the medium. This leads to tears that evaporate too quickly and the result is dry eye disease. The tears must have an outer layer of lipids in order to keep the ocular surface lubricated. In the absence of melting, the lipid layer will not form a continuous coating over the tears between blinks.

Laurie Gower
PSE Entering Year: 1990
PSE Advisor: Dave Tirrell
Current Position: Assoc. Prof. Materials Sci. & Eng., Univ. of Florida

I was so annoyed when my advisor, David Tirrell, wouldn't let me do my proposal defense on a topic that was *somewhat* related to my research. My research involved a polymer-induced liquid-precursor (PILP) mineralization process, and I wanted to do a proposal dealing with the use of this PILP process for scaffolding a bicontinuous phase of lipids. There were plenty of new things in this topic since I didn't know much about lipid phases, but NO- I had to come up with a whole new topic area. So, I chose to do a proposal entitled "Stabilization of Organic Dopants In Sol-Gel Glasses using Dendrimer Unimolecular Micelles for Tunable Lasers." It was so far removed from my research that I was clueless, and it was probably a terrible proposal. In fact, my committee made me a do a rewrite of the proposal, even though I had a new job lined up with a non-negotiable start date. Though initially annoyed about his, in the end glad to learn this new area because of a new collaboration in the Particle Engineering Research Center at UF, where the use of sol gels was widespread. I never would have even known what sol Gel polymers were it not for the proposal. It turns out, a couple of years later, I was at the MRS conference and came across a poster doing exactly what I had proposed to do in my proposal defense! And my committee thought it would never work. Ha!

Juin-Tai Chen
PSE Entering Year: 2003
PSE Advisor: Tom Russell
Current Position: Asst. Prof. Applied Chemisty, National Chiao Tung Univ.

I really appreciate what I learned at PSE. In the summer of 2010, I came back to Taiwan and became an assistant professor. As I started my academic career, I began to appreciate some of the simple lessons learned from my Ph.D. advisor, Tom Russell. Tom used to tell me: "Doing research must be fun. If it's no fun, why bother doing it? The more you enjoy what you do, the more productive you are." Working with students in my own group, I now strive to encourage them to be passionate at what they do. Looking back, I am also impressed by Tom's ability to give vivid and amusing examples to illustrate scientific concepts and engage the imagination. I recall when he asked Xuan Ding to stand up during group meeting. Pointing to Xuan's head, Tom indicated that it was the "nanoparticle". Pointing out Xuan's hair, Tom described these as the "ligands" coating the nanoparticle surface. On another occasion, we were discussing about conducting polymers. Sivakumar Nagarajan, another group member, asked what "holes" really means. In response to this question, Tom answered, "They are just like the teeth in your mouth. If somebody took away one of your teeth, then you have a hole, and you become a hole carrier. If you get a tooth from other person, then they have holes. So you are transporting the holes."

News from the Centers

Nanomanufacturing Center Renewal

In a September 2011 ceremony in Conte, Prof. Jim Watkins, Director of the Center for Hierarchical Manufacturing (CHM), announced the renewal of the Center by the National Science Foundation (NSF) for an additional $20 million over 5 years. The CHM, an NSF Nanoscale Science and Engineering Center, conducts both fundamental research in nanoscale materials and devices and translational research focused on developing efficient process platforms to make cost-effective nanomanufacturing a reality. The CHM supports the research of 30 faculty at UMass and the work of collaborators at MIT, Mt. Holyoke College, The University of Michigan, and Rice University.

The CHM efforts include the development of a manufacturing platform for low-cost, large-area nanomaterials and devices using roll-to-roll processing technology. The center accepted delivery of a custom roll-to-roll, UV-assisted nanoimprint lithography (R2RNIL) tool in June 2011 and an advanced R2R coater for nanostructured hybrid materials in 2012. CHM researchers are currently developing new materials and processes to enable printing of NIL features below 75 nanometers and coating self-assembled polymer/inorganic hybrid materials with domain sizes below 20 nm on these tools. By combining advances in fundamental science with the R2R test bed platform, the CHM is enabling the development, study, and practical fabrication of nanotechnology-enabled materials and devices for applications in computing, flexible electronics, optical and optoelectronic devices, energy generation and storage, medical diagnostics and human health. For additional information on the CHM see http://chm.internano.org/.

Ribbon cutting ceremony to announce CHM renewal and expansion of nanofabrication facilities, Fall 2011.

CUMIRP Welcomes New Director

David Waldman, Ph.D. and PSE Alum, started his new role at UMass Amherst in July 2012 as the PSE CUMIRP Director. David brings a breadth of experience to the job, including industry experience, knowledge of characterization and metrology methods, leadership in strategic planning and implementation of corporate initiatives, institutional financing, joint development programs, and intellectual property analysis and protection.

Dave Waldman (PSE 1983), CUMIRP Director

David's industry experience emphasized innovative research and product development. He led the development of novel monomers, oligomers, polymers and other chemical materials, their chemical formulations, as well as their use in engineering applications, and is a co-inventor on over 40 granted patents. David has held positions of Senior Research Chemist at Dow Chemical in the Polymer Structure Group, Senior Scientist and Technical Program Director at Polaroid in the Imaging Materials Research Laboratory, and Vice President of Research and Development and Chief Technology Officer at Aprilis, a spin-out startup company he co-founded that was financed by venture capital and industry investors. He was Chief Scientist in the follow-on company (DCE Aprilis, which was a subsidiary company of Dow Corning); and Chief Technology Officer and Executive Vice President of Media Engineering in the second follow-on company (STX Aprilis which was a subsidiary company of the STX Group of Korea). In 2007, in recognition of his overall scientific contribution to the development of holographic memory materials based on novel photopolymers, David received the Inaugural Career Achievement award from the International Work Group Holographic Memories (IWHM) from the Japanese industry Tera Byte Optical Memory consortium, Center for Advanced Photonic Information Memories, HVD Forum, and the Volume Hologram Memory Technology group.

Jim Capistran served as the CUMIRP Director from 1996 through 2011. Last year, Jim accepted a new position at UMass Amherst as the Executive Director of the UMass Innovation Institute (UMII).

UMII will serve as a portal for industrial collaborations across the Amherst campus. The Institute is a pilot program for UMass to engage industry more efficiently and effectively to move the science and technology research output into society. This position builds upon his role in CUMIRP and will bring his experience and knowledge of the industry/academic interface to the Amherst campus. For more information on see http://www.umii.umass.edu/ .

From the MRSEC Director

Todd Emrick, Director UMass MRSEC on Polymers

The *UMass MRSEC on Polymers* is one of 24 National Science Foundation supported Materials Research Science and Engineering Centers in the U.S., and its presence at UMass reflects the very high level of polymer-based research performed on campus. Directed by PSE faculty member Todd Emrick, the MRSEC supports 30 faculty members on campus and at our partner colleges and universities. While PSE researchers form the core of the research effort by leading Interdisciplinary Research Groups and Seed Projects, crucial to MRSEC research is its interdisciplinary approach, with input from faculty in Physics, Chemical Engineering, Mechanical Engineering, Chemistry, and Biology. The Center, funded from 2008-2014, has been incredibly productive, with over 250 publications resulting from MRSEC-sponsored research, many of which are described as highlights on the MRSEC website: http://www.pse.umass.edu/mrsec/index.html. In conjunction with the research, MRSEC strives to very broadly impact education and diversity at many levels, with K-12 level projects, expressing science as art, by establishing state-of-the-art facilities that are available broadly to interested users off campus, and the effort to gauge the impact of the Center through partnership with the School of Education and Center for Teaching on campus. With the end of the current Center now less than two years away, we are currently evaluating ideas and initiatives in anticipation of a proposal for a new 2014-2020 Center, and would welcome input and participation from our Alumni.

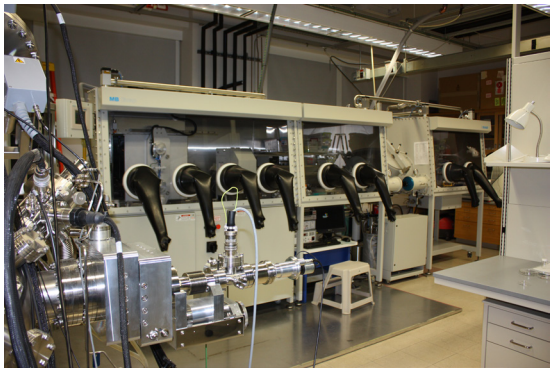
Energy Frontier Research Center

In Fall 2009, a major U.S. Department of Energy "Energy Frontier Research Center" (EFRC) was established on the UMass Amherst campus. The Center, Polymer-based materials for Harvesting Solar Energy (PHaSE), was funded by an initial five-year, $16 million grant funded under the American Recovery and Reinvestment Act. PHaSE's technical focus is basic research on conversion of the sun's energy into electrical power, using polymer-based materials. The research plan integrates the expertise of 17 faculty members from four different departments at the University (Chemistry, PSE, Chem E and Physics) with that of partner investigators from UMass Lowell, University of Pittsburgh, and Rensselaer Polytechnic University. PHaSE also has collaborations with researchers at several U.S. National Laboratories as well as at several foreign universities. The center is co-directed by Tom Russell of PSE and Paul Lahti, UMass Chemistry.

The Center's research portfolio integrates work across multiple disciplines in three distinct Energy Research Groups (ERGs). In ERG 1, researchers synthesize new self-assembling polymers and nanocomposite materials, with well-defined structures and architectures that are capable of harvesting light and generating photocurrent. The goal of ERG 2 researchers is to control the morphology and structure of polymer-based and polymer/inorganic-based hybrid photovoltaic devices in order to optimize efficiency, and in ERG 3, researchers elucidate the photophysical details of charge and energy transport within nanostructured photovoltaic composite films.

Several accomplishments have taken place in the three years since the Center was established. The center has acquired a host of new major research equipment for the characterization of PV materials, including the newly renovated Photovoltaic Facility. To date, PHaSE support has been provided to 28 graduate students and 17 postdoctoral fellows, and over 52 research papers based on PHaSE-supported work have been published in peer-reviewed journals.

The current cycle of EFRC funding ends in August 2014. Center staff are currently planning for a renewal proposal to be due in 2013.



The EFRC sponsored Photovolataic Facility.

Recent PSE Graduates

(Jan. '09-Jul. '12)

Gunjan Gadodia (Coughlin) *Synthesis and Study of Hybrid Organic-Inorganic Polyhedral Oligomeric Silsesquioxane Based Polymers*
Surangkhana Martwiset (Coughlin) *High Temperature Proton Conducting Materials and Flourescent-Labeled Polymers for Sensor Applications*
Scott Eastman (Lesser & McCarthy) *Composite Fabrication and Polymer Modification Using Neoteric Solvents*
Douglas Holmes (Crosby) *Wrinkling, Folding, Snapping Instabilities in Polymer Films*
Jessica Zimberlin (Crosby) *Mechanics of Hydrogels and Biological Tissues*
Dalton Chang (McCarthy) *Correcting Misconceptions in Wettability Theory and Fluid Surface Tension to Create Complex Hierarchical Polymer Structures*
Joonsung Yoon (Lesser & McCarthy) *Polymer Composites and Porous Materials Prepared by Thermally Induced Phase Separation and Polymer-Metal Hybrid Methods*
John Harner (Hoagland) *Interactions of Ionic Liquid Dissolved Polymers*
Damla Koylu (Carter) *Polymer Brush-modified Photopolymer Network Surfaces and their Applications*
Suriyakala Ramalingam (Hsu) *Analysis of Chain Configuration in Semi-Crystalline Random Copolymers*
Deepak Arora (Winter) *Structure-Property Evolution during Polymer Crystallization*
Beth Cooper (Emrick) *PEGylated and Zwitterionic Aliphatic Polyesters: Novel Polymers and Pro-drugs*
Kan Du (Dinsmore & Russell) *Self-assembly of nanoparticles at liquid-liquid interfaces*
Xuan Ding (Dinsmore & Russell) *Toward a 'bijel' structure: light scattering and morphology studies of spinodal decomposition in polymer blends mixed with nanoparticle*
Malvika Bihari (Hoagland & Russell) *Diffusion and Structure in Complex Fluids I. Axial Diffusion in Membranes II. Proteins in Ionic Liquids*
Wei Chen (Russell) *Photocontrol over the Order Transitions in Block Copolymer Thin Films*
Yunxia Hu (Emrick & Russell) *Functionalized Bionanoparticles: Grafting Chemistry and Self-Assembly*
Donna Wrublewski (Lesser) *Mechanical Evaluation Methods for Polymer and Composite Systems*
Bokyung Kim (McCarthy & Russell) *The Manipulation of Patterned Surfaces: I. Oriented Nanoscale Porous Materials II. Drop Mobility on Surfaces with Patterned Wetability*
Jeremy Rathfon (Tew) *Fiber Formation form the Melting of Free-standing Polystyrene, Ultra-thin Films: A Technique for the Investigation of Thin Film Dynamics, Confinement Effects and Fiber-based Sensing*
Jungwook Kim (Hayward) *Mechanically Unstable Hydrogel Sheets: Formulation of Stimuli-Responsive Surfaces and Structures*
Curran Chandler (Watkins) *Phase Behavior of Block Copolymers in Compressed CO2 and as Single Domain-Layer, Nanolithographic Etch Resists for Sub-10nm Pattern Transfer*
Christopher Ziegler (Watkins) *Surfacant Templated Inorganic Materials: A Biomimetic Approach*
Shilpi Sanghi (Coughlin) *Ion Mobility Studies of Functional Polymeric Materials for Fuel Cells and Lithium Ion Batteries*
Ji Xu (Russell) *Directed Self-Assembly of Block Copolymers in Thin Films on Surfaces Patterned by Electro-oxidation Nanolithography*
Deniz Civay (Muthukumar) *Electrostatic Effects in Aggregation of Crystalline Proteins*
Sinan Yordem (Lesser) *In Situ Reinforced Polymers Using Low Molecular Weight Compounds*
Vikram Daga (Watkins) *Role of Strongly Interacting Additives in Tuning the Structure and Properties of Polymer Systems*
Jeffery Kalish (Hsu) *Effects of Molecular Architecture on Crystallization Behavior of Poly(lactic acid) and Ethylene-Vinyl Acetate*
Semra Colak (Tew) *Norbornene Based Polybetaines: Synthesis and Biological Applications*
Mark Kelly (Muthukumar) *Multi-Scale Modeling of Biophysical Phenomena: Ionic Transport, Biomineralization, and Force Spectroscopy*
Saugata Gon (Santore) *Discriminatory Bio-Adhesion over Nano-Patterned Polymer Brushes*
Xinyu Wei (Russell) *Click Chemistry to Modify Block Copolymers and their Morphologies*
Joseph Peterson (Carter) *Design of Hybrid Conjugated Polymer Materials: 1) Novel Inorganic/Organic Hybrid Semiconductors and 2) Surface Modification Via Grafting Approaches*
Derek Ronald Breid (Crosby) *Controlling Morphology in Swelling-Induced Wrinkled Surfaces*
Dian Chen (Russell) *Organic Photovoltaics Based on P3HT/PCBM: Correlating Efficiency and Morphology*
Andrew Thomas Detwiler (Lesser) *Aspects of Network Formation and Property Evolution in Glassy Polymer Networks*
Burcin Erenturk (Carter) *High Resolution Imprinting for Microelectronics and Photovoltaics*
Le Li (Hayward & Russell) *Kinetically Trapping Co-Continuous Morphologies in Polymer Blends and Composites*
Eunyoung You (Watkins) *Fabrication of Nanostructured Metal Oxide Films with Supercritical CO2: Processing and Applications*
Raghavendra Maddikeri (Tew) *Characterization of Self-Assembled Functional Polymeric Nanostructures: I. Magnetic Nanostructures from Metallopolymers II. Zitterionic Polymer Vesicles in Ionic Liquid*

Christopher Scilla (Coughlin) *Systematic Synthesis of Organic Semiconductors with Variable Band Gaps*
Alexander Eliseev (Muthukumar) *Theory of Interaction Polyelectrolytes Under Confinement*
Jung-Won Keum (Bermudez) *Design and Construction of Novel DNA Nanostructures for Therapeutic Applications*
Chelsea Davis (Crosby) *Surface Instabilities for Adhesion Control*
Arnout Bolens (Muthukumar) *On the Effect of Elasticity on Drag Due to Polymer Additives Using A Hybrid D.N.S. and Langevin Dynamics Approach*
Ian Henderson (Hayward) *Tuning the Properties of Metal-Ligand Complexes to Modifty Properties of Supramolecular Materials*
Alvin Romang (Watkins) *Enhanced Mechanical Performance of Low Dielectric Constant Films Through Polymer Blends Synthesized in Supercritical CO2, and SANS Studies of CO2-Induced Microemulsions*
Adam Paul Hathorne (Bermudez) *Fundamental Studies of Elastin-like Oligo- and Polypeptides*
Jing Hua (Muthukumar) *Phase Transitions in Polyelectrolyte Systems* **Naveen Singh** (Lesser) *Aspects of Alternative Network Structure Evolution*
Peiwen Zheng (McCarthy) *Preparation, Characterization, Surface Modification and Applications of Siloxane Polymers*
Stephen Mirigian (Muthukumar) *Dynamics and Kinetics of Model Biological Systems*
Katrina Kratz (Emrick) *Phosphorylcholine Substituted Polyolefins: New Synthesis, Solution Assemblies, and Polymer Vesicles*
Hyun Suk Kim (Crosby) *Aspects of Network Formation and Property EvolMacroscopic Patterning via Dynamic Self-assembly and Wrinkling Instability*
Daniel Miranda (Russell) *Interactions and Morphology of Triblock Copolymer – Ionic Liquid Mixtures and Applications for Gel Polymer Electrolytes*
Joseph Krumpfer (McCarthy) *Chemistry at Silicone – Inorganic Oxide Interfaces*

Welcome 2012 Incoming PSE Class!

(*front, from left)* Adam Hauser, Wamuo Onyenkachi, Seokyoung Kim, Coralie Backlund, Ying Zhou, Kim Garth, Michael Leaf, Diana Goulding, Ben Cherniawski (*middle)* Nihal Kanbargi, Yue Gai, Carmen Fischer, Polina Gokun, Soeun Kim, Feyza Dundar, Haomiao Yuan, Jared Harris, (*back)* Jooyoung Chang, Christian Muhl, Stephen Strassburg, Ned Burnett, Matt Skinner, Marcus Conrad, Martin Nalbach, Jigneshkumar Patel

Faculty Profile: Alex Briseno

Assistant Professor Alejandro L. Briseno is the newest addition to the faculty in PSE. "Alex," as he likes to be called, received his Ph.D in Chemistry from the University of Washington (UW) in 2008 under the supervision of Professor Younan Xia where he focused on fundamental charge transport of organic semiconductors. He accepted his current position while finishing his Ph.D. at UW. Alex deferred his start at UMass for a one-year postdoctoral position at UC Berkeley. There he carried out research with Professor Peidong Yang in the Department of Chemistry, centered on the synthesis of hybrid materials for photovoltaic applications.

Alex started his position in PSE in 2009, excited to join his new colleagues and looking forward to establishing himself in the field of organic and polymer semiconductor electronics research. "These are the scientists I used to read about when I was beginning my academic research career", comments Alex. "I remember I published one of my first papers as an undergraduate in the journal, Macromolecules, and the associate editor was Professor Tom Russell. I remembered his name and affiliation from that day on." Alex also enjoys the opportunity of collaborating with his colleagues and working with the young PSE students. "I still feel like I am a graduate student. I want to take advantage of my high energy and enthusiasm for research while I'm still young and strong. If I pace myself over the coming years, I should be able to do this for several more decades."

Alex's research focuses on answering fundamental questions related to organic, oligomer, and polymer crystallization and charge transport at interfaces. "One of our goals is to understand crystallization in conjugated rig-rod polymers such as the poly(alkylthiophenes). Our approach is to systematically synthesize a series of oligomers and extend their chain length until we reach the effective conjugation length of the corresponding polymer under study. This will enable us to quantitatively measure their properties in a controlled manner as opposed to working with the corresponding polymer which is difficult and nearly impossible to grow crystals from." "We are crystal chemists," explains Professor Briseno. His group also focuses on understanding changes in electronic structure at organic and metal interfaces. "Our research is bringing an understanding to the performance limitations in devices such as field-effect transistors and solar cells."

Alex was born in Los Angeles, California and has three older brothers and one older sister. He is the youngest and only child in the Briseno family to attend college. Alex received a B.S in Biology from Cal State, Los Angeles. As an undergraduate, he carried out research in the laboratory of Professor Nathan S. Lewis at Caltech where he worked on conducting polymer vapor sensors. Thereafter, Alex was awarded a full fellowship from Bell Laboratories-Lucent Technologies to continue his graduate studies. In 2006, Alex completed his Master's in chemistry at UCLA with Professor Fred Wudl and collaborated with Professor Zhenan Bao at Stanford University. Two years (and 20-plus publications) later, Alex received his Ph.D with Younan Xia from the University of Washington.

Alex has published over 45 papers and two issued patents. His research has been published in leading journals (*Nature, Nature Materials, Nano Letters, Advanced Materials, JACS, Applied Physics Letters*, etc.) and widely highlighted in the popular press. Among the honors and awards he has received include an NIH (MBRS-RISE) fellowship, Lucent Technologies graduate fellowship, ACS excellence in graduate polymer research, MRS graduate silver award, the XEROX technical minority scholarship, the Frank J. Padden Jr. Award for Excellence in Polymer Physics Graduate Research (finalist), 3M Non-Tenured Faculty Award, ONR Young Investigator Award, and most recently the Presidential Early Career Award for Scientist & Engineers (PECASE). His hobbies include fishing, restoring classic cars, and fossil and antique collecting.

In Memorium

In 2010, two long-standing members of PSE and the polymer program at UMass, Richard Farris and Bob Lenz, passed away. As scientists, colleages, mentors and friends both will be sorely missed by all of us in the PSE community.

Richard Farris, long-time PSE faculty member and department head, passed away after a long illness on Tuesday, May 25, 2010. He was 73.

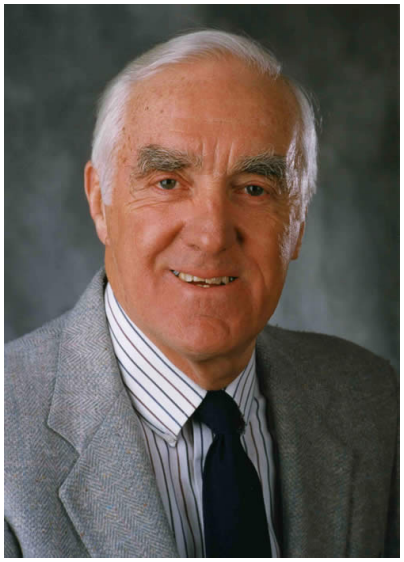
Dick made PSE the focus of his life for many years. He not only crafted much of PSE's unique culture, he was instrumental in the development of CUMIRP and CVIP, organized the department's engineering curriculum, and contributed greatly to the realization of the Conte Building. Dick was an outstanding educator who mentored, with a strong personal touch, several generations of research group members who went on to outstanding careers in our field.

During his 33 years at UMass, Dr. Farris graduated over 60 PhD. candidates, numerous Master's candidates, and hosted dozens of postdoctoral associates, visiting professors and scientists from around the globe. He authored over 300 research publications and held 16 U.S. patents. He served as department head for years and was promoted to Distinguished University Professor in 1991. He retired in 2002, but remained active with the department and other consulting ventures. In recent years, much of his research focused on fire-safe polymers, and he led a team of UMass researchers working together with government and industry labs.

In honor of Dick's career and accomplishments, the Polymer Science and Engineering Department has established the **Richard J. Farris Graduate Scholarship in Polymer Science Engineering**. Contributions in Dick's memory to the scholarship fund may be made to the University of Massachusetts and sent to the Polymer Science and Engineering Department, 120 Governors Drive, Amherst, MA 01003.

Robert (Bob) Lenz, who began his career as a faculty member at the University of Massachusetts in 1966, passed away on Friday, July 2, 2010. He was 84.

Bob began teaching at UMass Amherst in 1966, and became one of four founding members of the Polymer Science and Engineering Program. He was central to the organization and growth of the university's polymer program, with significant roles in three departments: Chemical Engineering, Chemistry, and Polymer Science & Engineering. He retired from the Polymer Science & Engineering Department in 1995.



Over the course of his career, Bob made major contributions to polymer synthesis, including the writing of the well-known textbook, *Organic Chemistry of Synthetic High Polymers,* extensive research into liquid crystalline and bio-derived polyesters, and chief advisor to many students who went on to become luminaries of the polymer field. In addition to his faculty role, Bob was Editor of the prestigious journal *Macromolecules* for a decade.

A recipient of many teaching and research awards, he also served from 1986 to 1991 as a member of the Cult Awareness Network, a national organization dedicated to educating the public on the dangers of destructive cults.

The Lenz family and the Polymer Science and Engineering Department have established the **Robert Lenz Memorial Endowment for Graduate Scholarships**. Contributions to the scholarship fund may be made to the University of Massachusetts and sent to the Polymer Science and Engineering Department, 120 Governors Drive, Amherst, MA 01003.

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Recent Faculty Honors

Alex Briseno - Office of Naval Research Young Investigator Award (2012); Presidential Early Career Award for Scientists and Engineers (2012)

Harry Bermudez - NSF CAREER Award (2009)

Al Crosby - ESPCI-Michelin Visiting Professorchip (2012); Human Fronteirs Science Pragram Award (2012)

Todd Emrick -Milestone Award, UMass CVIP (2010)

Greg Grason - NSF CAREER Award (2010); Sloan Research Fellowship (2011)

Ryan Hayward - Presidential Early Career Award for Scientists and Engineers (2010); DOE Early Career Research Award (2011)

Thomas Russell - MRS Kavli Lecturer (2012)

Maria Santore - ACS Fellow (2010)

Greg Tew -ACS Polymer Divsion Fellow (2010)

Recent Student Honors

Felicia Bokel - Top-10 Award Winner in NSF IGERT National Poster Competition

Anesia Burns - NSF Graduate Research Fellowship (2011)

Kyle Bryson - NSF Graduate Research Fellowship (2011)

Brian Cromer - National Defense Science and Engineering Graduate Fellowship (2012)

Andrew Davis - DSM Polymer Technology Awards Finalist (2012)

Brittany deRonde - Pre-Doctoral Training Award, Chemistry-Biologiy Interface Program NIH (2012)

Katie Gibney - ACS POLY Division Student Travel Award for IUPAC MACRO (2012)

Melissa Lackey - TA Instruments Graduate Student Presentation Award

Samantha McRae -NSF Graduate Research Fellowship (2010)

Zachariah Page - Office of Science Graduate Fellowship, DOE (2010)

Cathy Walker - ACS POLY Division Student Travel Award for IUPAC MACRO (2012)

Yongping Zha - ACS POLY Division Student Travel Award for IUPAC MACRO (2012)

Peiwen Zheng - DSM Polymer Technology Awards Finalist (2012)

Alumni Honors - We are always pleased to highlight notable accomplishments and honors of our alums. If you have any items you would like us to share in an upcoming newsletter, please contact the editor at *grason@mail.pse.umass.edu.*