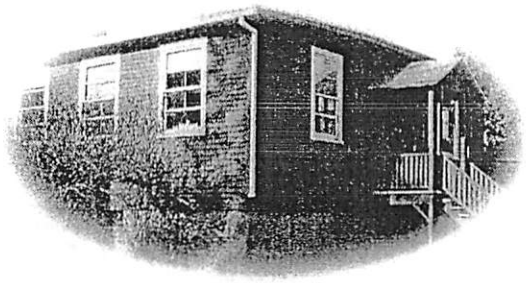
The Annex

December 2000 Volume 4, Number 1



Snippets

McCarthy Appointed New Head

This past year has brought about many changes in the PSE Department. We have hired two new faculty members, Greg Tew and Todd Emrick, from the University of Illinois at Urbana-Champaign and UC Berkeley, respectively. There is additional information about them in the new faculty section (pgs 8 & 9). Among other faculty, Prof. Richard Stein celebrated his 75th birthday with a one-day seminar series. Prof. Richard Farris stepped down as head of the department, and there is a short article about his highlights as head on page 3. Prof. Tom McCarthy was appointed the new head and we wish him the best in this new endeavor. Prof. Muthukumar was appointed Wilmer D. Barrett Distinguished University Professor. Sadly, Prof. Robert Lenz will step down as the editor for Macromolecules.

CUMIRP Celebrates its 20th Year

This past May during the spring meetings, CUMIRP celebrated its 20 year anniversary. CUMIRP currently has 40 industrial sponsers and brings in $1.7 million in annual research funding which is one-third of the total polymer funding at UMass. The meetings were a huge success. They were held at the Mullins Center and we had the best seats in the house-if only there was a game that day! The fall meeting also went extremely well, with the highlights being the new student poster formats that are now available in an electronic format. This year over 90 students presented posters. Contact CUMIRP if you wish to obtain an electronic copy of the current research in the department.

PSE Club Activities

The PSE Club has been very active in the intramural sports at UMass: the Club is currently champions of both basketball and Ultimate Frisbee. ASPIRE and OUTREACH have been a continuing success. Additionally the Club has volunteered to judge numerous science fairs. The Club also has plans to visit a few industrial plants in the New England area starting with Solutia's Indian Orchard plant.

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The Editorial

The Annex is now into its fourth edition. This is the third on the trot for this editorial team. We have enjoyed working on this project. Our guests in the section on Alumni profile in this issue are Wade Adams, Dhamodharan Iyengar, and Lothar Kleiner. Read about their experiences at UMass and where they presently are working. Our Snippets should provide you a totality of activities in PSE in the past year. Jump in and find out all that's happening.

The PSE Club is very thankful to everybody who bought Memorabilia last year. Your feedback was very encouraging. This year, too, we have new gifts to offer. Just let us know what you want and we'll mail you a Christmas parcel. We wish you all a Merry Christmas and a very Happy New Year. Keep in touch. You can email us at alumni@mail.pse.umass.edu or visit us on the web at www.pse.umass.edu/psecl/alumni.html. Thanks for all your support.

- Jeremy Morin, Arun Raman

Upcoming Events

CUMIRP/MRSEC 2000 Meetings
Spring – May 15 - 17, 2001
Fall – October 16-18, 2001

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Richard Farris's Points of Pride as PSE Department Head

I would like to thank the countless PSE faculty, staff, and students not mentioned who helped the PSE Department achieve these many great accomplishments. The following list of highlights is in no particular order.

- I inherited the headship after the great leadership of Bill MacKnight. Bill served as department head twice for a total of 16 years and his contributions are too numerous to mention. He was also a tough act to follow.
- Moved into the new Silvio O. Conte National Center for Polymer Research. At that time only about 50 out of 150 chemical fume hoods were fit for use, and there were numerous problems associated with laboratory fit-outs, security, locks, cabinetry, and several safety issues. Today Conte is a fully functioning state-of-the-art polymer research facility.
- Represented PSE in the planning and execution of the Conte building dedication.
- Coordinated spending of the roughly $5 million windfall associated with the building construction that we were able to spend on equipment for the Conte facility. Most of this money was used to start-up new faculty, but it also helped remedy the needed upgrades of PSE's older research equipment.
- With the help of MRSEC, the department created a Mass Spectrometry Central Facility that has three state-of-the-art spectrometers and is managed jointly via PSE/MRSEC/Chemistry. In addition we also added an ultra-centrifuge and a high temperature GPC for additional molecular weight determination.
- During my tenure as department head, we had many personnel changes of both faculty and staff. Bob Lenz, Roger Porter and Bill MacKnight all retired as did Norm Page. There has been a great deal of faculty turnover; David Tirrell, Bruce Novak and Klaus Schmidt-Rohr left and we hired Tom Russell, Jacques Penelle, Helmut Strey, Bryan Coughlin, Todd Emrick, and Greg Tew. In addition Brad Moynahan left as CUMIRP Director. James Capistran, a PSE alum, was hired to manage that program. One can only conclude that this department is very resilient.
- Although we always knew we were #1, PSE was never ranked in the traditional publications. We have been consistently ranked as the #1 Doctoral Program in Polymer Chemistry since 1996 in the annual rankings by U. S. News & World Reports. We were also included in the National Research Council's rankings of Doctoral Programs in America under the classification "Materials Science" where we placed 2nd in Quality of Ph.D. Graduates and 7th in Scholarly Quality of Faculty.
- Reorganized the PSE Club from a social to a service-oriented club.
- Got PSE on-line with our homepage and brochure.
- Began the newsletter, "The Annex" to inform our alumni and friends about current activities.
- Established the PSE Faculty Fellowship Endowment Fund which received an initial gift of over $100,000 from all of our faculty, past and present, and a few key alumni. This money will be used to help fund first-year students and take care of other departmental emergencies.
- Set up exit interviews with every student graduating from PSE to learn what they thought of our program and listen to their suggestions about how we could improve.
- Worked hard to keep the Silvio Conte Research Facility a polymer research facility. The Microanalytical Facility managed by Dr. Greg Dabkowski moved into Conte. Greg now is employed part-time for PSE and is a great asset to the department.
- I have taken a lead role in the fight against some of the University's intellectual property issues associated with external grants. These policies were causing strained relations with many of our industrial sponsors and generally hurting research on campus. Since PSE has so much industrially sponsored research, we were like an early warning signal for the rest of the campus. Slowly, these problems are being resolved for the benefit of all.
- Established the FAA Fire-Safe Polymers and Composites Program under CUMIRP, which is now being used as a model whereby federal money can be used in a manner that obtains industrial matching funds.
- I am most proud of the great work done by my research group. Having a great group of students and postdoctoral associates who helped manage my projects while I was department head has maintained the viability of my research program.
- Organized the Roger Porter Symposium to honor his many accomplishments. It was well attended by his many students and friends.
- I established the PSE Graduation Reception held annually to honor our Ph.D. graduates.

Alumni Profile

We are back this year with some more distinguished guests. Let us see what they have to say about their days at UMass and how that has led them to where they now are.

Walter Wade Adams (Air Force Research Laboratory, Edwin L. Thomas '84)

"I am the Chief Scientist of the Materials and Manufacturing Directorate, Air Force Research Laboratory, at Wright-Patterson Air Force Base in Dayton, Ohio. As a senior technologist, I am 'responsible for providing consultative and advisory service to the laboratory director and staff on the technical and scientific merit of the laboratory's research and development programs.' I have been in this technical leadership position since January 1996, after I was promoted to the grade of Senior Scientist for polymeric materials in 1995. After I left UMass in 1981 (taking another 3+ years to finish the thesis!), I resumed my job as a group leader and in-house researcher in the Polymer Branch of the Materials Directorate. I moved to another branch to do research on laser-resistant materials in 1990, helping to build a very strong research team of some 50 people doing interdisciplinary work on NLO materials, biomaterials, and other new optical materials concepts. I became the team's research leader in 1994, and moved to the Chief Scientist job for the entire 1000 person materials lab two years later - we are the largest aerospace materials lab in the world!"

"My personal research has always been in polymer physics, concentrating on structure-property relations in high-performance organic materials for nearly 30 years. I still do a little hands-on work on high performance rigid-rod polymer fibers and films, X-ray scattering studies of fibers and liquid crystalline films, and theoretical studies of ultimate polymer properties. I try to review a few papers every year, am on the editorial board for Polymer, and even found time a few years ago to teach a polymer course locally. I also spend time on K-12 education outreach, and started the Wright-Patt education outreach office which now manages some 15 different programs for kids in the region, including about 20 materials projects from local schools that we will fly on the International Space Station next year."

Skills developed at UMass: "Besides learning how to take tests and study after a ten year break from school, the most valuable "skill" was opening my horizons for research and technology. I probably would have been happy to be just an X-ray jockey, but my advisor, Ned Thomas, persuaded me to become a polymer morphologist, and a polymer physicist, and a materials scientist, and a technologist. What we all learned about teamwork to allow us to jointly succeed, such as studying for cumes and team lab assignments, was great experience for future in team building. Meeting many of the VIP visitors to UMass was also incredibly valuable, not just for the connections that would later prove useful in research, but also in learning how to interact with these "gods and goddesses" of the polymer world."

Advice to current students in PSE: "These are the best years of your life! Enjoy them - work hard, but soak up absolutely everything around you, and have fun!"

UMass memories: "Meeting, discussing polymer science with, arguing about chain-folding with, and becoming friends with Paul Flory, Henri Benoit, and Pierre deGennes, among others. Learning a lot about the broad field of polymer science and engineering from my committee - Dick Stein, Roger Porter, and Dick Farris, and from the rest of the faculty in courses and seminars and discussions. Many overnights on the TEM, some with my advisor, and study groups for the cumes that started as three week sessions, later shrinking to only one day. Friendships with classmates that have outlasted the memories of stress and tension. The best fried donuts anywhere from the campus center coffee shop. Playing El Dorado and Gorgar pin ball machines, later Dig Dug and Quebert (I bought the El Dorado machine from the Blue Wall - still have it!) Friday night parties in our basement (we were the only students with kids), and reroofing our house that hot summer day in 1979 with a big student, and postdoc party. Assembling a great volleyball team for PSE (Nylon 4-2, later Nylon 6-0) that beat all the undergrad frat teams for the UMass intramural championship. Living in a great neighborhood in Amherst, with great neighbors, walking a mile to school and picking raspberries and blackberries for breakfast, attending a real New England church, and enjoying all the clean atmosphere and colorful scenery, especially in autumn. "Enjoying" a -25°F snowy Christmas. We had a great two and a half years in Amherst!"

Dhamodharan Iyengar (IIT-Madras, India, McCarthy '92)

"A significant amount of my time is spent teaching smart and dynamic youngsters. Teaching undergraduate and postgraduate courses in chemical thermodynamics and kinetics keeps me in constant touch with the fundamentals besides helping me remain in top mental shape. The rest of my time (around 40 %) is spent in performing research classified as sponsored and consultancy work. My research has centered on polymer modification chemistry, block copolymer synthesis by ATRP, photochemical polymerizations and developing applications for the new materials synthesized. Visit my website at, http://members.rediff.com/dhamodharan/index.html"

Skills developed at UMass: "One of the key skills that I picked up at UMass while in Tom McCarthy's group is to "do it yourself" and not wait for things to happen.

This has helped me in building my own polymer characterization laboratory consisting of several sophisticated instruments with the carpentry and plumbing work done with my students' assistance!"

Advice to current students in PSE: "Getting into PSE and performing is somewhat similar to climbing up a steep mountain. The greater you climb, the broader is your perspective. To me this experience demonstrated that science and engineering differ only from the "beholder's" eye."

UMass memories: "Quite a lot to state here! Just about enjoyed most things at UMass. This includes good 'American folk music' with the kinds of Bob Dylan and Arlo Guthrie, happy hour after Friday seminar which normally ended up in late night pool games in and around Amherst, ultimate Frisbee and the ever-appealing radio and TV shows dealing with American Politics."

Lothar Kleiner (Alza Corporation, MacKnight/Karasz '78)

"I moved to California in 1983 to take a position at Raychem where I was responsible for all materials development for the development and commercialization of circuit protection devices based upon low resistivity polyethylene composites. I did everything from formulation, evaluation and process development, and held several position which included senior materials development engineer, process plant manager and materials and process engineering manager. After 8 years in a broad-based company (mostly based upon engineered polymeric materials) in a rapidly growing electronics division, I completely switched gears, left Raychem and joined Alza corporation which is now headquartered in Mountain View, CA, although I work in Palo Alto within walking distance of Stanford University. Alza is a research-based pharmaceutical company with leading drug delivery technologies including Transdermal Patches, Implant Devices and Osmotic Tablets."

"I have been at Alza for 10 years. Most of those 10 years I have been working in the materials development of components in a transdermal device. I have had the opportunity to work with skin adhesives, polymeric electrodes, conductive polymers and housing materials. This past summer I switched to the Implant Group. So, currently I am in charge of the research and development of implantable depots. These depots are delivered subcutaneously via an injection. The injection contains a biocompatible and degradable polymer, a biocompatible solvent and a drug such as a protein. After injection, the polymer rapidly precipitates in the body, while the drug slowly diffuses out of the polymer depot. After about 3 months or less, the polymer has biodegraded and delivery of drug stops."

"Both Raychem and Alza are located in the San Francisco Bay Area. This is a very interesting place with many opportunities for taking part in many diverse activities with my wife, Donna, including the Stanford lively arts, the wine country, and seeing interesting places nearby such as Carmel and Monterey. All of this in a nice Mediterranean climate!"

Skills developed at UMass: "I have been very lucky to have graduated from the Polymer Science and Engineering department because my education provided me with many opportunities. First in the plastics industry, then in electronics and now in the pharmaceutical industry. The common theme is the understanding and foundation I received and developed in polymer materials science. The understanding of the physical chemistry, thermodynamics and processing behavior of polymeric materials is a key skill I developed at UMass. I am still learning, but also now do considerable mentoring in the areas of polymer materials science, stability and structure-property-process relationships and how they now apply to developing a good implantable delivery platform."

Advice to current students in PSE: "My advice is to seek a position where you can make a noticeable contribution, the climate is open, and where you can build upon the foundation provided to you by your education at UMass. Even though I am now a Director and manage a group of people, I still utilize many of the basics I learned at UMass. My advice to students who become managers is to always hire the best and the brightest, become their mentors and provide the atmosphere for them to thrive. Final bit of advice is to learn and develop good presentation and communication skills early. Do not leave UMass without them. They are one of the key ingredients for success."

UMass memories: "Aside from the outstanding faculty who pushed me to become confident and independent, my best recollections are the friends I made while studying there. Even after 23 years, I am still in touch with many of them. We went though a lot together and those times with my friends were certainly the best. The gamut ran from studying and partying together to just enjoying the environment and seasons at UMass. I also enjoyed all the fine art evening programs. Well, in short, there was always something interesting to do. Now, I enjoy coming back, interacting with the faculty and attending the well-organized CUMIRP meetings."

Current Research in the PSE Department

"So What's Cooking?" Three fourth year students discuss their research and future plans.

Recycling of 100% Vulcanized Scrap Tires with Only Heat and Pressure

Jeremy E. Morin (Advisor Richard J. Farris)

In 1844, Charles Goodyear obtained the patent for the sulfur vulcanization of rubber. He stated, *"No degree of heat, without blaze, can melt it. It resists the most powerful chemical reagents. Aquafortis (*nitric acid*), sulphuric acid, essential and common oils, turpentine and other solvents....."* Sulfur vulcanization of rubber fueled the industrial revolution and made possible the development of the rubber-tired automobile and transportation as it exists today. Because he was so successful and correct in his comments about vulcanized rubber, he also created one of the most difficult materials to recycle, as it will not melt, dissolve, or lend itself to the usual methods of chemical decomposition. Discarded tires represent one of the most serious sources of pollution in the world. Studies estimate there are roughly 2 billion scrap tires in U. S. landfills and more are being added at a rate of over 270 million tires per year.

My research aims to develop an understanding of the novel recycling method for scrap tires coined high-pressure high-temperature sintering. In short, I have discovered a way to recycle rubber powders made from scrap tires with the application of only heat and

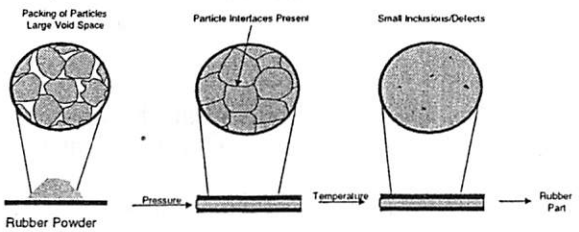


Figure 1, Schematic of a typical cycle for the technique of "High-Pressure High-Temperature

pressure and achieve good mechanical properties. The mechanical properties of typical consolidated rubber powders, while not as good as the virgin rubber tire, are respectable 6.0 MPa strength, 2.0 MPa modulus, and 400% strain at break. To date every type of cross-linked elastomer investigated has been able to produce a solid sintered part. Rubber recycling has sparked an interest in the PSE faculty and interdisciplinary collaborations are beginning both within and outside our department: in particular, we are working with UMass Lowell on continuous powder processing.

With plans to graduate next spring, I would like to begin my career with a position in industrial R&D where I hope to begin learning about business. My long-term goal is to become a manager of an R&D team in applied research.

Morphological Behavior of "Model" Graft Block Copolymer / Homopolymer Blends

Lizhang Yang (Michael) (Advisor Samuel P. Gido)

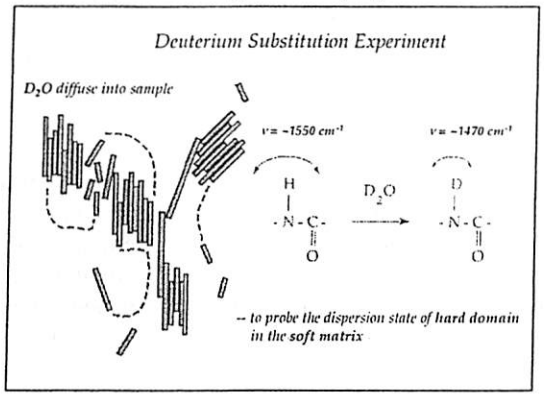
The first project studies the morphological behavior of "model" graft block copolymer / homopolymer blends. The model non-linear block copolymer materials used in the study are architecturally asymmetric I2S block copolymers and architecturally symmetric I2S2 block copolymers. Previously reported linear diblock copolymer / homopolymer blend systems showed that the order-order transitions (OOTs) occur at about the same volume fractions as in pure linear diblock copolymers. This study shows that, when blending a homopolymer with an I2S block copolymer, the OOTs split so that they occur at different volume fractions depending on whether they are approached by blending homopolymer into the two arm or the one arm side of the block copolymer interface. Asymmetry swelling of the multi-arm domain by the homopolymer was observed. By swelling the domain parallel to the interface, the homopolymer relieves the multi-arm crowdness and thus the architecture effects. General schemes to predict the morphological behavior of star shaped block copolymer / homopolymer blends are proposed. These approaches are further examined in I2S2 block copolymer / homopolymer blend series. A perforated lamellar morphology is obtained by solvent casting one of the blend samples. TEM features of this complex morphology are analyzed. A slow casting procedure is developed to cast a Gyroid morphology blend sample with "Single Crystal" like long range order. The amazing Small Angle X-ray Scattering pattern of this blend sample can prove the structure of the "Gyroid" morphology unambiguously, solving a long-time puzzle on block copolymer morphology.

Additionally, we investigated the effects of selective solvent and block copolymer irreversible morphology transformation. Using selective solvent, we can cast the block copolymer into kinetically trapped unstable morphologies. During subsequent thermal annealing, these unstable morphologies will transform into stable morphologies. By control the annealing temperature and length of annealing time, we are able to track the detail of the morphology transformations and microphase separations. To cast block copolymer films with globally oriented microstructure, I designed and constructed a Roll Caster. Polymer solution was rolled between two counter–rototating adjacent cylinders while the solvent was evaporating. As the solvent evaporated, the block copolymer microphase separated into a globally orientated structure. The new design is compact and efficient, making it suitable for casting small amount of block copolymer samples.

The Influence of Inter-domain Interactions on the Physical Properties of Polyurethanes

Xiaodong Wu (Advisor Shaw L. Hsu)

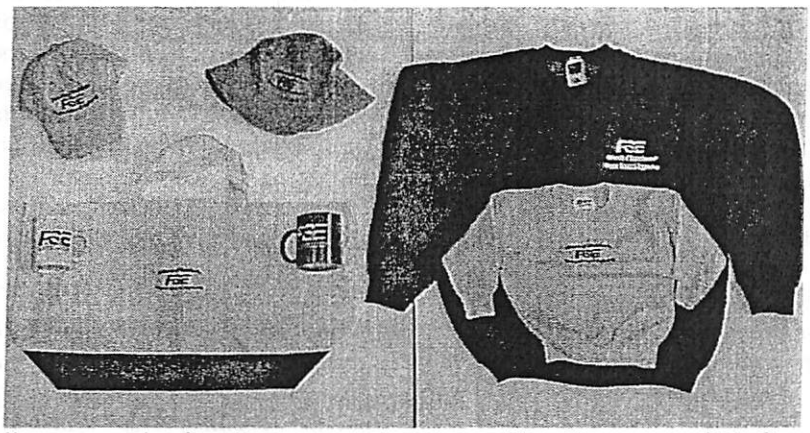
The objective of my research is to understand the morphology and physical property relationship of a heterogeneous polymeric material. It is well known that the phase separated morphology is attributed to the excellent mechanical properties of polyurethanes. However, the true mechanism of the reinforcement of the hard domain is still not well understood. We found that the interconnecting hard domain morphology provides enhanced modulus and strength of the material. Based upon the characterization of the hard domain using deuterium substitution experiment, the surface and interfacial regions of the hard domain have been specified. It is found that the interfacial region, the interconnecting bridge between hard domains, is crucial to the performance of this material. The deformation behavior of polyurethane has been studied on a molecular level by infrared dichroic measurements. In addition to the traditional studies of orientation of different domains upon stretching, the volume change of hard domain has been investigated. It is found that the hard domain is involved in the deformation throughout the stretching process, even at low strain. This observation points to the stress-softening effect and large energy hysteresis associated with polyurethanes.



How to generate favorable phase separated morphology in polyurethane chemistry for various applications, such as foam, adhesives and coatings, is my second pursuit. It is found that the water miscibility in the polyol before polymerization, the dispersion state of additives and catalyst package are important factors to contribute to the final morphology of the materials.

I plan to complete my research in about six months. Following graduation, I would like to start my career in industrial R&D.

PSE Memorabilia



Hats $17: Baseball caps, one size fits all,
Bucket caps, large or small
All hats are khaki with a maroon embroidered PSE logo

Mugs $5: Building dedication mug, white with maroon printing, plastic
Recycling mug, maroon with white printing, ceramic

Tote Bags $20: Cream with a black bottom and maroon embroidered PSE logo
Size: 24"/14"/8"

Infant Shirts $12: Sweat shirts and T-shirts, sizes from 12 months – 2T, Yellow or blue with a maroon embroidered PSE logo

Sweat Shirts $20: Navy blue with the PSE logo printed in white, medium size only

For more information or to purchase any of the above items please contact Greg Constable at:
gconstable@mail.pse.umass.edu or 413-577-1635

Faculty Profile: Todd Emrick

B.S. degree from Juniata College in organic chemistry followed by a Ph.D. from the University of Chicago in Chemistry. Currently at the University of California Berkeley completing a little more than two years of work with Jean Fréchet.

My interview last Spring at UMass left the impression that an offer from PSE would present a unique opportunity to pursue a variety of research interests, with the privilege of interacting closely with an outstanding group of faculty, staff, and some of the top graduate students in the world. The combination of all these attractive aspects at PSE led me to accept the position that I look forward to starting in January 2001.

Much of my research background is centered in synthetic organic chemistry. It was in the period between these schools that I was first exposed to polymer chemistry through working in Owen Webster's labs at DuPont Central Research. While most of my efforts in graduate school involved organic synthesis of small molecules, my curiosity in the area of polymer science grew. In fact, I devoted some of my Ph.D. work to the transformation of cubane from a simple (though highly unusual) molecule into a rigid rod-like polymeric material!

I decided to focus on polymer chemistry more appreciably through postdoctoral work, and I have pursued several synthetic polymer targets at U.C. Berkeley in Jean Fréchet's group. This has included "living" free radical polymerization, dendrimer synthesis, and economical approaches to highly functional, branched (e.g., "hyperbranched") polymer materials. This postdoctoral experience has been extremely valuable in that I have been involved in many areas of polymer science, as well as some "broader picture" aspects of research, for example the value of academic research with real-world targets that involves collaboration with experts in industry.

As I begin my independent career at PSE, I would like to continue to move into new research areas that will allow my group to focus their efforts at the forefront of polymer science. In general, I am interested in the effect of molecular and macromolecular architecture and function on the properties of materials. Polymer chemists have made tremendous advances towards controlling polymer architecture, which is of course critical when targeting specific applications.

My group will emphasize organic aspects of polymer science as we prepare novel macromolecules for various applications. With a sound knowledge base in organic and polymer synthesis, we will be well positioned to impact a variety of interesting research areas. For example, the demand for synthetic polymers in the biological sciences is increasing in scope and importance. The biomaterials field is in need of polymer scaffolds for numerous applications, including gene delivery, biosensors, biomechanics, bioadhesives, and drug delivery. Requirements for ultimate applications of a given polymer as a biomaterial include adherence to stringent biocompatibility and/or biodegradability properties; thus these will be considered as we design novel, functional synthetic materials for biological applications.

The important advances in nanotechnology are evident in the scientific community, and increasingly emphasized in the broader public and government. I am interested in the organic and polymer aspects of nanotechnology, with targets that should blend well with interests of others in PSE. Nanoscale science is often of an interdisciplinary nature, and as such I will initiate a program at the organic/inorganic/physical interface on various aspects of nanomaterials, including, for example, quantum dot semiconductors. The inspiring work in this field (by Paul Alivisatos at Berkeley, and others) has demonstrated the ability to prepare a variety of shapes and sizes of very well defined nanocrystalline materials. There are fundamental organic aspects in this area that my group will explore, with ultimate goals focused on the preparation of novel nanocrystalline-based architectures. Such architectures will lead to material devices that rely on the unique optical and electronic properties of nanocrystals.

While my group will pursue the above targets, in general I am interested in developing a variety of projects to include various aspects of mechanistic polymer chemistry, the synthesis of block copolymer materials, and the use of these materials for studies at interfaces and surfaces.

In closing I would like to express my enthusiasm to tackle the tasks ahead, as well as my gratitude for being given the opportunity to work in the first-rate intellectual environment of the University of Massachusetts Amherst, and the Polymer Science and Engineering Department. In the end, it will be the teaching and learning with the students and faculty of PSE that will make the experience most gratifying.

Faculty Profile: Gregory N. Tew

B. S. degree from North Carolina State University in Chemistry followed by a Ph.D. from the University of Illinois at Urbana-Champaign in Chemistry with graduate work in Materials Science. Currently at the University of Pennsylvania completing a one year post-doctoral stay in Bill DeGrado's laboratory.

My introduction to chemistry occurred more than 10 years ago and since then I have continued to be fascinated with molecules and their properties. The ability to harness the power of chemical transformations for the construction of interesting and complex macromolecules continues to inspire many of my research ideas. One of the challenges for the synthetic chemist in synthesizing large molecular structures is control over sequence, molar mass, polydispersity, and functionality. Although great strides have been made in synthetic tools over the last several decades, our ability to prepare large, complex macromolecules still pales in comparison to the elegance of Mother Nature. Living cells exhibit spectacular ability to synthesize not only small molecules but very large, complex structures with molecular weights in excess of 100,000 daltons. As if this is not impressive enough, natural systems also display remarkable sophistication at many different length scales with respect to self organization. For example, not only does nature fold complex macromolecules like proteins into discrete and functional shapes, but organizes both organic and inorganic materials into functional tissues like bone, teeth, and cartilage.

Much of my interest in biological materials grew out of my graduate work that focused on the synthesis and characterization of a unique class of molecules we termed "triblock rodcoil molecules." This set of molecules was prepared by step-wise chemistry to construct the conformationally rigid or rod-like segment which was then covalently connected to a diblock oligomer of styrene-isoprene. The diblock segment was synthesized by means of living anionic polymerization techniques. Once these molecules were in hand, we characterized the solid state structure of the materials with a variety of techniques including X-ray and electron diffraction, electron and optical microscopy, surface tension, second harmonic generation, absorption and fluorescence spectroscopy, piezoelectricity, DSC, and variable temperature X-ray. Interestingly, the materials exhibit hierarchical ordering on several length scales from the molecular to the bulk. For example, it was discovered that the molecules self-assemble into discrete objects with dimensions of roughly 8nm in height (one molecular length) and 6nm in diameter. These discrete objects then pack in 2-dimensions to form layers characterized by a pseudo hexagonal arrangement of the objects. Finally, these layers stack in the third dimension to provide a bulk 3-dimensional film. It remains unclear if the discrete objects pack with registry from one layer to another. This work spanned the interface of several traditional disciplines including chemistry, materials science, and physics. My graduate work required me to work closely with scientists from many different backgrounds, providing an extremely stimulating environment in which to do science.

I am convinced that some of the most exciting research during the next century will occur at the interface of traditional disciplines. This requires researchers who accept the challenge to work with other investigators from a variety of backgrounds such as physics, math, chemistry, engineering, and biology. The PSE Department has a long-standing history of collaborative interactions among its faculty and graduate students. This tradition places the PSE Department in a unique and very valuable position as we approach research in the 21st century. It will be my goal to continue and enrich this tradition of collaborative research in the PSE Department.

In addition to encouraging collaborative efforts in the research laboratory, I plan to bring a cross-discipline approach to teaching. One of the main goals in coursework will be to provide the students with an understanding and appreciation for learning at the interface of traditional disciplines. This will include a wide background of material including chemistry, polymer science, and biology. Furthermore, beyond the scientific fundamentals, polymeric macromolecules play an important technological role in every aspect of our society and it is important to provide the student with insight into these aspects as well.

Much of the research in my lab will focus on the synthesis of natural and non-natural architectures leading to new materials. We will rely on all synthetic techniques for the construction of these architectures, including traditional step-wise and polymer chemistry as well as more recent techniques like biosynthesis and PCR. Once the material is in hand, we will want to fully characterize both the structure and properties of the new material. In this area, we will rely on many of the traditional techniques of polymer science to investigate these materials. Both the synthesis and characterization of materials will require collaboration within and beyond the department in an effort to deliver new materials from the initial design and synthesis to a practical application.

Snippets

EP^2 invites you to come to Amherst

Over the 30 years of its existence, the Polymer Science and Engineering Department at the University of Massachusetts Amherst has consistently strived to provide an education that would give young scientists all the tools needed to assume successful careers in industry and academia. This note invites you and your company to join our educational activities by contributing to our "Excellence in Polymer Education Program" $(EP)^2$.

An important trend in our graduate curriculum is an increasing focus on professional and industrial relevance. Designed as a progressive course, it gives our graduates knowledge and skills beyond the traditional boundaries of their field of study. The curriculum is purposefully dynamic to respond to the ongoing and anticipated changes in polymer science, technology, and the American industrial sector. Selected topics include:

- Workshops on Technical Writing Skills
- Communications and Presentations
- Industrial Polymer Synthesis and Processing
- Basic Engineering Concepts in Design and Operation of Polymer Plants
- Issues in Science, Technology, Government Regulation, and the Environment
- Business and Marketing Fundamentals
- Project Definition and Project Management
- Invention, Patents, and Entrepreneurship
- Workshops on Leadership Skills
- Team Research

If you or your company would like to participate in the important endeavor, please contact Alan J. Lesser. (AJL@Polysci.UMass.Edu , 413-577-1316).

Awards

Prof. Robert W. Lenz received the prestigious Herman F. Mark Polymer Chemistry Award for "research and leadership in polymer science" in Hawaii. Prof. Frank Karasz received a award from the Serbian Academy of Sciences and Arts. Prof. Bryan Coughlin received the OMNOVA Solutions Signature Faculty Award along with the 3M Non-Tenured Faculty Award. Dr. Gregory Dabkowski received the University of Massachusetts Award from the Provost, for Distinguished Academic Outreach. Nicole Karttunen and Paul Welch also both received the OMNOVA Student Award. Kathryn Wright won the Santos Go Award. Didem Oner received an ACS Travel Grant to attend the national meeting in San Francisco. Xinqiao Jia received a University of Massachusetts Amherst Graduate School Fellowship. Congratulations to everyone on a job well done.

Lecture Series

This year, apart from the weekly seminar, the 1999 Dow Chemical Seminar Series was Ulrich W. Suter and the 1999 Fraser Price Seminar Series was Issac Sanchez. Additionally, the 2000 Dow Chemical Seminar Series was Robert Frechet. 2000 also saw the fourth Richard Stein-Bayer Corporation Honorary Seminar was Robert Langer, as Speaker.

MRSEC Sponsored Meetings

During the past spring there was a seminar series on interfacing biology and polymer science, and it was great success. Additionally, MRSEC has sponsored a quarterly workshop on complex fluids held on a site rotation throughout the Northeast. The goal of this workshop is to allow students the experience of publicly presenting their research. These workshops have been well attended by between 60-90 people

2000 PSE Graduates

The following is a list of 2000 PSE graduates, their employer, advisor and dissertation title.

Jeffrey Cafmeyer
Battelle
Novak
Simple Isomerization Routes to Precursor Monomers for Poly(Vinylamine) Analogues

Gustavo Carri
University of Akron
Muthukumar
Theory of Solutions of Semiflexible Polyelectrolytes

Susan Dawson
Eastman Kodak
Tirrell
Model Polypeptides and Molecular Recognition at a Monolayer Interface

Matthew Dunbar
Chemical Abstract Services
Schmidt-Rohr
Exploring the Local Structure of Amorphous Polymers by Solid-State NMR

Mikhail Gelfer
SUNY Stony Brook
Schmidt-Rohr
The Effect of Branch Distribution on Morphology, Chain Dynamics and Rheological Behavior of Metallocene and Ziegler Natta Linear Low Density Polyethylenes

Douglas Harris
Sandia National Labs
Schmidt-Rohr
Solid-State NMR Studies of PEO in Various Environments: Conformation, Chemical Shift, and Dynamics

Terry Hobbs
3M
Lesser
New Routes to High Performance Fibers and Films

Xin Jin
Heidelberg Digital
Novak
Aminoiminate Metal Complexes: Novel Catalysts for Alpha-Olefin Polymerizations

Chung Yin Kong
Switchboard, Inc.
Muthukumar
The Physics of Polyelectrolyte Adsorption and Charged Brushes

Richard Larson
Markhem
McCarthy & Novak
Polycarbodiimides at Interfaces: Polymer Adsorption at Solution-Silica Interfaces and Thermal Decomposition of an Adsorbed Thin Polymer Film

Michael Pollard
Inst. Organische Chemie, Mainz
Russell
Phase Behavior Studies in Block Copolymers of Poly(Styrene) and Poly(n-Butyl Methacrylate)—The Effect of Pressure on the Lower Disorder-Order Transition

Lee Rockford
Intel
Russell
Polymers on Nanoperiodic, Heterogeneous Surfaces

Newsletter Committee:
Co-editors: Jeremy Morin and Arun Raman
Contributors: Wade Adams, Eileen Besse, Greg Constable, Todd Emrick, Richard Farris, Dhamodharan Iyengar, Lothar Kleiner, Alan Lesser, Frank Mari, Tom McCarthy, Jeremy Morin, Angelo Pedicini, Greg Tew, Lizhang Yang, and Xiadong Wu.

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A Penny for Your Thoughts

We are interested in hearing from you! Promotions, job changes, awards, publications, patents, family information? Let us know and we will print it in our next issue of The Annex. You can email us at alumni@mail.pse.umass.edu, or fax the information to (413) 545-0082, or visit us on the web at www.pse.umass.edu/psecl/alumni.html for an online form along with links to a fax back form.

Name_____

Degree/Year Graduated_____

Advisor(s)_____

Address change_____

Suggestions, news, comments?

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