POLYMER TECHNOLOGY CENTER

Summer 2008 Edition

PTC Newsletter

Polymer Specialty Certificate Program

TAMU students can apply for this program. Please visit:
http://essap.tamu.edu/polymer.htm

MARK YOUR CALENDAR FOR PTC's NEXT CONFERENCES!

October 30th - SCRATCH
@ Texas A&M University
October 30-31st - PTIC
@ *Texas A & M University*

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Short Course: Scratch and Wear Behavior of Polymers and Composites

Instructors are left to right: Dr. Cris Schwartz,, Texas A&M University; Dr. Klaus Friedrich, University of Kaiserslautern, Germany; and Dr. Hung-Jue Sue, Texas A&M University

The short course was held on April 22-23, 2008 at Texas A&M University; companies present were:

☆ 3M ☆ Advanced Composites, Inc. ☆ BASF The Chemical Company ☆ Dow Chemical Company ☆ Dupont Experimental Station ☆ Japan Polypropylene Corporation ☆ Korea Research Institute of Chemical Technology (KRICT) ☆ Mytex Polymers ☆ Rio Tinto Minerals ☆ Solvay Advanced Polymers, LLC, ☆ Sunoco Inc. ☆ Tokai Rubber ☆ Total Petrochemical ☆ U.S. Army/Soldier Systems Center ☆

The Scratch Consortium was held on April 24, 2008 and the PTIC was held on April 24-25, 2008, (companies in attendance are listed below).

Scratch Behavior of Polymers Consortium

- 3M
- Advanced Composites, Inc.
- BASF - The Chemical Company
- Japan Polypropylene Corp.
- KRICT (Korea Research Institute of Chemical Technology)
- Lyondellbasell
- MyTexPolymers
- RIO TINTO MINERALS
- Sunoco
- Tokai Rubber
- U.S. Army Natick Research

Polymer Technology Industrial Consortium

- 3M
- Advanced Composites, Inc.
- BASF - The Chemical Company
- Japan Polypropylene Corp.
- KRICT (Korea Research Institute of Chemical Technology)
- Lyondellbasell
- MyTexPolymers
- The Research Valley Partnership, Inc
- Tokai Rubber
- Total Petrochemicals
- SPE South Texas Section
- Sumitomo Chemical

PTC Faculty Research – Dr. Hong Liang, Mechanical Engineering
Liang Research Group: Polymers as Biomaterials for Artificial Joints

Despite recent successes of surgical implants, materials used in artificial joints still need to be further improved in order to extend their lifespan. Our recent study has indicated that improved cell–material interaction is important for a long-lasting implant. Polymers have superior adhesion property due to the nature of their bonds. In order to understand the adhesion mechanisms, we developed a methodology to evaluate how cells attach to polymer-based materials. Materials that we have characterized are, for example, polytrimethylene carbonate nanocomposites, poly(methy methacrylate), polycarbonate, along with the standard biopolymer, ultrahigh molecular weight polyethylene. We are able to design, select, and synthesis new materials that satisfy the requirements of artificial joints.

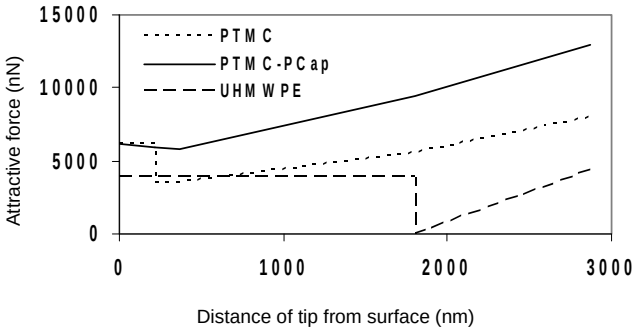


Figure 1, Adhesion force measurement over different polymers using an atomic force microscope. [R. Ribeiro, P. Ganguly, D. Darensbourg, M. Usta, A. H. Ucisik, and H. Liang, "Biomimetic Study of a Polymeric Composite Material for Joint Repair Applications," J. Matls. Res., Vol. 22, No. 6, 2007, pp.1632-1639.]

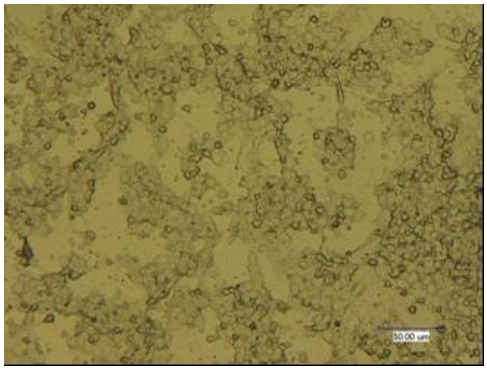
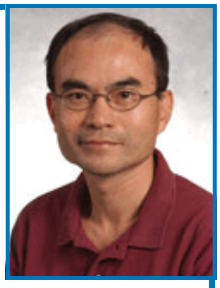
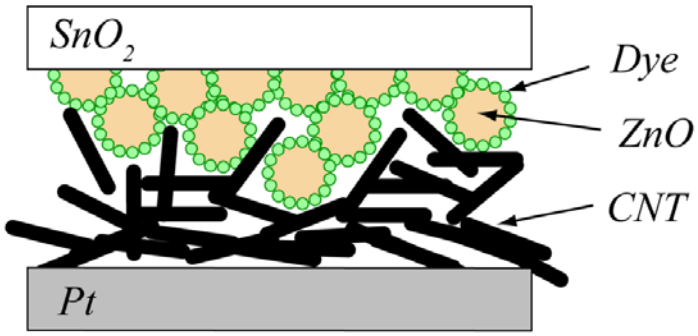


Figure 2, Cultured cells were found to attach to the polymeric surface. Photo taken by graduate student Aracely Rocha.

PTC faculty members receive ERP funds to develop low-cost, stable and efficient solar cells
Xing Cheng, Dept. of Electrical & Computer Engineering and Hung-Jue Sue, Dept. of Mechanical Engineering



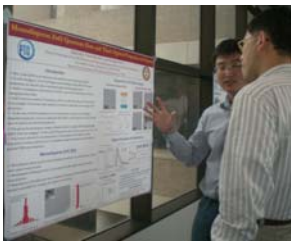
Xing Cheng, Department of Electrical & Computer Engineering and Hung-Jue Sue, Department of Mechanical Engineering received $100,000 funding from Texas A&M's Energy Resources Program, which funds research initiatives in advanced and emerging technologies in energy to foster interdisciplinary and multidisciplinary research programs to address immediate and future energy needs of the State of Texas. The main objective of this two-year project is to develop a low-cost, stable and efficient solid-state dye-sensitized solar cells (SSDSSC) [see figure below] using solution processing of nanomaterials. The new solar cell uses single-walled carbon nanotube (SWNT) film prepared from stable and individually dispersed SWNT suspension, high quality synthesized ZnO nanoparticles, and a novel mixture of three dyes that are designed for maximum absorption over a broad spectrum range of solar radiation. Since all material processing and device fabrication are based on solution processing, the SSDSSC device and panel are inexpensive to produce and large-scale manufacturing is straightforward. The elimination of the liquid electrolyte that exists in conventional dye-sensitized solar cells simplifies device packaging and increases panel lifetime. The team hopes that their work will eventually lead to much more efficient, stable and economical solar panels for generating electricity that can serve as a competitive and practical alternative to fossil fuels.



PTIC Student Poster Session April 24-25, 2008

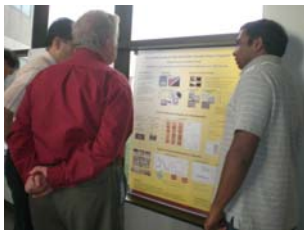
The Student Poster Session was a great success, students from Aerospace Engineering, Biomedical Engineering, and Mechanical Engineering were able to share their research/ideas with the Polymer Industry.

- Inorganic-Organic Hydrogel Scaffolds with Tunable Properties
  Yaping Hou, Cody A. Schoener, Katherine R. Regan, Mariah S. Hahn, and ***Melissa A. Grunlan****—Dept. of Biomedical Engineering*



- Poly(ethylene Oxide) with Siloxane Tethers: Crosslinked Coatings and Grafted Surfaces with Improved Protein-Resistance
  Ranjini Murthy, Courtney Shell and ***Melissa A. Grunlan****—Dept. of Bio medical Engineering*

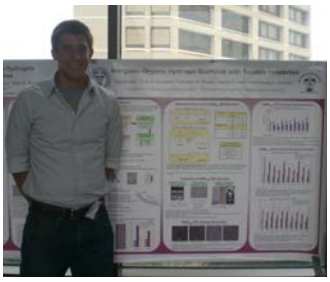
- Thermoresponsive Nanocomposite Hydrogels with Cell-Releasing Properties
  Yaping Hou, Andrew R. Matthews, Ashley M. Smitherman, Allen S. Bu lick, Mariah S. Hahn, and ***Melissa A. Grunlan****—Dept. of Biomedical Engineering*



- Electric Field-Tailoring of Single Wall Carbon Nanotube Polymer Compos ites
  Sumanth Banda and ***Zoubeida Ounaies****—Dept. of Aerospace Engi neering, Materials Science of Engi neering*

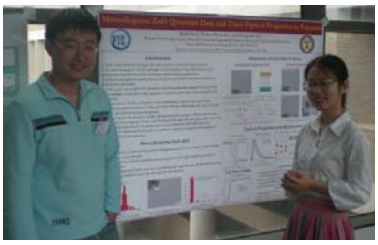
- Polymer Nanocomposites as Electrostrictive and Piezoelectric materials
  Sujay Deshmukh and ***Zoubeida Ounaies****—Dept. of Aerospace Engi neering*

- Single Walled Carbon Nanotube Reinforced High Density Polyethylene Composites by Solution Casting
  Jessica Dowden, Sanjay Kalidindi, ***Zoubeida Ounaies****—Dept. of Aero space Engineering*



- Electrospinning beaded fibers and pure fibers based on fluid mechanics
  Cristopher Call and ***Cris Schwartz—****Dept. of Mechanical Engineer ing*

- FEM Simulation of Scratch Behavior of Polymer Coatings
  Han Jiang, R.L. Browning, J.D. Whitcomb and ***Hung-Jue Sue****—Dept. of Mechanical Engineering*



- Fracture Mechanisms in Polymeric Materials
  J. (Daniel) Liu, J.-I. Weon, W.-J. Boo and ***Hung-Jue Sue****—Dept. of Mechanical Engineering*

- Monodisperse ZnO Quantum Dots and Their Optical Properties in Polymers
  Dazhi Sun, Nubuo Miyatake and ***Hung-Jue Sue****—Dept. of Me chanical Engineering*

- Optimal Material Parameters for Polymer Scratch Resistance
  Han Jiang, R.L. Browning, J.D. Whitcomb and ***Hung-Jue Sue—****Dept. of Mechanical Engineering*

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PTC Visiting Scholar from Spain
Ms. Paola Castrillo

Hello everyone! My name is Paola Castrillo and I am working as a visiting scholar at the Polymer Technology Center (PTC) for two months. I come from the Universidad Carlos III De Madrid in Spain, although I am originally from the "heart of South America," Bolivia. I left my country a few years ago and began the Materials Science and Engineering PhD program in Spain. Once there, I have been granted a fellowship of the Spanish Personnel Research Training Program that includes financial aids for research stays in well-known research groups and centers, including PTC at Texas A&M University.

I would like to thank Dr. Sue for giving me the opportunity to work at PTC, since that means not only sharing the experience of their members and learning a lot from them in my research area, but also meeting and interacting with people of different cultures that I enjoy very much since those experiences always enrich my life.

The aim of my visit to PTC is to find out the toughening mechanisms that govern polymer nanocomposites based on an amino modified kaolin dispersed in an epoxy matrix by means of the double notched four point bend technique, and to learn how to achieve a good exfoliation of other kinds of layered inorganic fillers, such as α-ZrP, from the experience of Dr. Sue´s group.

Finally, I would like to thank the people who trusted me to be here, especially Dr. Dania Olmos and Dr. Javier González-Benito, and to the Ministry of Education and Science of Spain for funding this visit.

PTC Seminars at Texas A&M University

Trends in Industrial Research for Polymer Materials
May 9, 2008 @ ENPH Room 301
Volker Warzelhan
Senior Vice President
BASF Aktiengesellschaft
Polymer Research, GKT – B001
D-67056 Ludwigshafen/Rhein, Germany

ABSTRACT:
In the past decades a shift in paradigm took place in industrial polymer research for structural materials. Despite their excellent properties only a few new polymers based on new monomer building blocks have been commercialized. Main reasons are the high costs for the manufacturing of the new monomers and polymers compared to existing materials including metals. Even the synthesis of new polymers out of cheap "old monomers" with the help of new catalyst systems had been not successful in most cases (e.g. polyketone, syndiotactic polystyrene), as the problems of economy of scale and re-qualification costs for existing applications had been underestimated. On the other hand the potential of the "old polymers" has by far not yet been exhausted as a consequence of the tremendous progress in polymer science. The steady improvement of the "old polymers", so-called drop-in solutions, is much more attractive from an economic standpoint of view. Some examples from BASF will be given, how the improved "old polymers" fulfill increasing customer needs and help to solve current challenges like reduction of CO2-emission: metal substitution in automotive applications by polyamides to reduce weight and costs, next generation thermal insulation materials for housing based on styrenics to save energy and "biodegradable PBT" for progressive packaging applications. Additionally the nano technology offers further potential for improvements of the existing polymers (e.g. nano flow additives, nano foams). Increasing oil prices and the CO2-discussion draw the attention to sustainable polymers based on renewable resources, being the latest challenge of the "old polymers". New polymers like polylactic acid and polyhydroxybutyric acid which are biodegradable and bio-based, are being introduced. However, as for many applications besides packaging biodegradability is rather a disadvantage, biobased and durable but otherwise more conventional polyamides and polyesters based on renewable monomers are under development. As a conclusion our polymers have to be steadily improved to reduce costs and fulfill increasing customer and society needs what necessitates continued research efforts.

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