POLYMER TECHNOLOGY CENTER

Winter 2005 Edition

MARK YOUR CALENDAR FOR PTC's NEXT CONFERENCES!

April 2005

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17	18	19	20	21	22	23
24	25	28	27	28	29	30

April 21 - SCRATCH
Spring Conference
April 22 - PTIC
Spring Conference
@ Texas A & M University

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If you are interested in placing an ad in the PTC quarterly newsletter, please contact Isabel Cantu. Revenue will be used for PTC Student activities.

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FROM ARGENTINA TO THE HEART OF TEXAS: MEET DR. PERLA B. BALBUENA

Dr. Perla B. Balbuena was appointed as Professor of Chemical Engineering and joined TAMU last May, 2004. Her professional career started in Argentina where after receiving her bachelor's degree, she worked on an engineering design of a chemical plant for several years. She then came to the USA where she obtained a master's degree in Chemical Engineering at the University of Pennsylvania and returned to Argentina to teach for a few years, and worked on several problems related to thermodynamics of solutions and supercritical mixtures. In 1990 she came back to USA, obtained her Ph. D. at the University of Texas at Austin specializing on molecular modeling and computational chemistry, and immediately after graduation was appointed as Assistant Professor and then promoted to Associate Professor at the University of South Carolina. While at South Carolina she developed a research program on computational materials design that was sponsored by various federal agencies (DOE, ARO, NSF) and received recognitions including POWRE and CAREER awards from NSF. But she was already a Texan by adoption, and happily accepted the TAMU offer last year.

Dr. Balbuena's current research focuses on the development and application of state-of-the-art molecular simulation techniques for the prediction of material properties. Applications include the study and design of metal nanoparticles for catalysis, polymer electrolyte membranes used for single ion transport in fuel cells and lithium-ion batteries. Her group is also working on the simulation of synthesis processes such as the catalytic growth of single-wall carbon nanotubes, and the growth of nanoparticles by web chemistry methods in the presence of macromolecular templates.

SCHOLARSHIP AWARDS

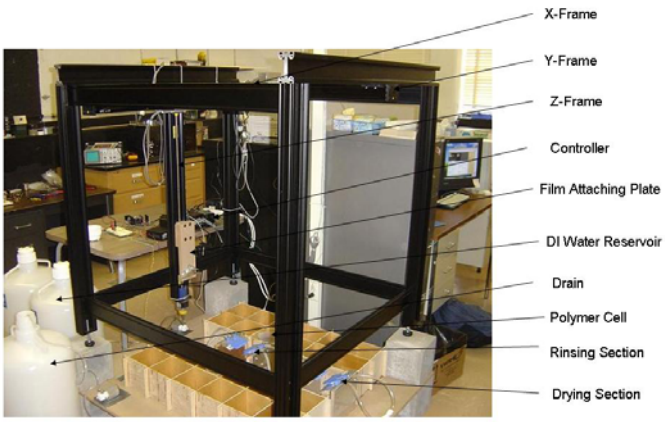
The following students received Scholarships from the Society of Plastic Engineers (SPE) at the International Polyolefins Conference 2005, February 28, 2005, Wyndham Greenspoint Hotel, Houston, TX .

Woong Jae Boo
William Neil Everett
Kunwoo Han
Amber Spades
Ben Ronck

Congratulations to these students, and to find out more about the conference, please go the website: http://www.spe-stx.org/

NEW EQUIPMENT FOR PTC

1. 3-D ROBOTIC MANIPULATOR:



This robotic system is capable of surface modification by depositing thin polymer films on thick polymer films (e.g., polyolefins and polyesters), inorganic substrates (e.g., glass) and metals. The desired substrate is mounted to the Z-frame, which will then dip the substrate into dilute, charged solutions of polymers and/or particles. After each dip the film is rinsed with water and dried with air in the center of the platform. Positively and negatively-charged layers are alternately deposited until the desired thickness is achieved. Each layer is typically 1 – 100 nm depending on the makeup of the solution. Thin (< 1 μm), transparent films with high oxygen barrier (OTR < 0.005 cc/m^2·day) have already been produced on PET substrates using this technique. Polyolefin films are currently being studied to produce a comparable effect. Thin films of carbon black with electrical conductivity greater than 25 S/cm have also been produced, along with antimicrobial films containing colloidal silver.

2. PERKIN ELMER DIAMOND THERMOMECHANICAL ANALYZER

This TMA is ideal for measuring the mechanical behavior of small polymer and composite samples as a function of frequency and/or temperature. Force between 0.01 mN to 5.8N can be applied to samples and displacement can be resolved to within 0.02 μm. With liquid nitrogen cooling, the furnace can operate between -150 and 650^{0}C. Despite being a TMA, this instrument can perform dynamic measurements between 0.001 and 1 Hz. With expansion, penetration, bending, and tension (shown in picture above) probes, the Diamond TMA can be used to test thermal expansion of metals and ceramics in addition to fully characterizing the mechanical behavior of polymeric materials. Typical tests run on the TMA include expansion coefficients, glass transition, softening, shrinking, swelling, gel time, creep, stress-strain, stress-relaxation, and elastic modulus.

3. FOUR-POINT PROBE:

A four-point probe (FPP) has been built to measure sheet resistance and bulk resistivity of materials. Films with sheet resistance between 3000 and 0.01 Ω/□ can be accurately measured. This system is currently being used to test electrically conductive polymer composites made with carbon black and carbon nanotubes.

POLYMER SPECIALTY CERTIFICATE

The Polymer Technology Center (PTC) of Texas A&M University (TAMU) is offering a Polymer Specialty Certificate program. The objective of this certificate is to provide an interdisciplinary educational program for undergraduate students interested in the polymer education. Polymer students at TAMU benefit from the distinguished research, education, and industrial outreach that comprise the PTC. This program will be the first of its kind offered in the State of Texas. Students will be able to structure an individualized program from a selection of courses to meet their career objectives. Required courses will be in the areas of Polymer Chemistry, Processing and Characterization of Polymers, and Introduction to Polymer Engineering. Course options will be available in a variety of other areas of polymer study. Completion of 9 semester credit hours of the following courses earn a Polymer Certificate and the specialty is recorded on the students' permanent University record.

Course Code	Course Title	Instructor	When Offered	Frequency Offered	Credit Hours
CHEN 451	Intro to Polymer Engineering	Michael Bevan	Fall 2004	Annually/Fall	3
MEEN 458	Processing & Characterization of Polymers	Hung-Jue Sue	Spring 2005	Annually/Spring	3
CHEM 466	Polymer Chemistry	Stephen A. Miller	Spring 2005	Annually/Spring	3
MEEN 455-500	Engineering with Plastics	Roger Morgan	Spring 2005	Annually/Spring	3
MEEN 458	Processing & Characterization of Polymers	Jaime Grunlan	Fall 2005	Annually/Fall	3
CHEN 641	Intro to Polymer Engineering	Michael Bevan	Fall 2004	Annually/Fall	3
CHEN 643	Applied Statistical Mechanics of Fluids	David M. Ford	Spring 2004	Even years/Spring	3
CHEN 689	Colloidal & Interfacial	Michael Bevan	Spring 2004	Even years/Spring	3
CHEN 689	Computational Chemistry and Molecular Modeling for Engineers	David M. Ford	Spring 2005	Odd years/Spring	3
MEEN 606	Polymer Laboratories	Hung-Jue Sue	Fall 2004	Every two years	3
MEMA 607	Flow & Fracture of Polymeric Solids	Hung-Jue Sue	Spring 2005	Annually/Fall	3
MEMA 610-600	Applied Polymer Science	Roger Morgan	Spring 2005	Annually/Spring	3
MEMA 613	Principles of Composite Materials	Ozden Ochoa	Spring 2005	Annually/Spring	3

CONSORTIUM MEETING HIGHLIGHTS

On the previous Consortium meeting it was recommended that a 2-3 day short course/training be offered on:

◊ Physical and Mechanical Properties Polymers and Nanocomposites. Course fees, time and location will be announced at a later date.

It was also proposed that an evening poster reception be displayed on the evening prior to the Consortium Meetings. The plan will be discussed at the meeting.

PTC would like to hear from Members and the Industry

PTC'S NEW POSTDOC, DR. LUYI SUN

Dr. Luyi Sun joined PTC in TAMU as a TEES Assistant Research Engineer in January, 2005. He obtained his Ph.D. degree in The University of Alabama under the guidance of Prof. Joseph S. Thrasher in August, 2004. After that he did a short term postdoctoral research in the same research group, mainly working on developing new polymer electrolyte membrane and membrane electrode assembly for polymer electrolyte membrane fuel cell (PEMFC) applications

Dr. Sun's research interests include polymer nanocomposites, polymer thin films, polymer electrolyte membranes, nano-structured materials, silicon based materials from rice husk, and thermal hazards evaluation of reactive chemicals. His strong background in polymer science and extensive experience in surface analysis enable him to obtain clear understanding of the morphology structure of Nafion®, a fluoropolymer membrane widely used in PEMFC. Recently, he also developed a new methodology to prepare membrane electrode assembly with high efficiency for fuel cell applications. His current work is focused on polymer nanocomposites with excellent mechanical, thermal, and electrical properties.

PTC faculty

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MEET THE NEW OFFICERS OF SPE STUDENT CHAPTER & THEIR MISSION

President - Jia "Daniel" Liu, Mechanical Engineering
(Email: jialiu@tamu.edu)
To provide overall direction for the chapter, arrange speakers for monthly seminars, and connect with related organizations.

Vice-president - Poulomi Ganguly, Chemistry
(Email: pganguly@mail.chem.tamu.edu)
To coordinate social activities and make plans for the attendance of Polyolefins and ANTEC conferences.

Secretary - Minghui Liu, Mechanical Engineering
(Email: liuminghui@gmail.com)
To prepare for monthly seminars and handle membership and publicity of the chapter news.

Treasurer and webmaster - Francisco Tschen, Mechanical Engineering (Email: itschen@neo.tamu.edu)
To handle the financial transactions and prepare and maintain the annual budget; to maintain and update

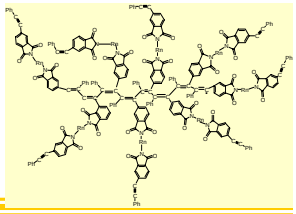
"SYNTHESIS AND CURE CHARACTERIZATION OF HIGH TEMPERATURE POLYMERS FOR AEROSPACE APPLICATIONS"

Yuntao Li obtained his Ph.D. degree in Materials Science in December, 2004. The title of his dissertation is "Synthesis and cure characterization of high temperature polymers for aerospace applications".

The electron-beam (E-beam) curable bismaleimide (BMI) resins and phenylethynyl terminated imide oligomer and monomer were synthesized and characterized. Thermal cure mechanism was found to be introduced during high intensity E-beam cure process by investigating the temperature-time characteristic of E-beam curing of BMI systems and E-beam cure kinetics. The effects of E-beam dosage, temperature rise, diluent concentration and catalysts on cure reactions were studied. N-Vinylpyrrolidone was found to be a good reactive diluent for BMI resins. 80% E-beam cure conversion and the product's T_g of 180°C can be achieved at the ambient temperature for BMI/NVP resins. The thermal cure kinetics of phenylethynyl terminated imide oligomer AFR-PEPA-4 and monomer N-phenyl-[4-(phenylethynyl) phthalimide] was performed by FT-IR and DSC analysis. The cure reactions were described as a fast first-order reaction stage followed by a slow second stage that is kinetically controlled by diffusion. The chemical structure of cured AFR-PEPA-N was also proposed.

Dr. Li is currently doing his postdoc research in Dr. Roger Morgan's group in Department of Mechanical Engineering at Texas A&M University. His research projects focus on structure-property relations of high temperature polymers.

Dr. Li's office is CHEN 341G and the phone number is 979-862-6836.



The proposed structure of partially cured AFR-PEPA-N

POLYMERIZATION DISCOVERY

At the age of 20 and after three years of study at SUNY Plattsburgh, I received my B.S. in Chemistry with Magna Cum Laude honors. I have served as the president of the SUNY Plattsburgh Chapter of the American Chemical Society (ACS) Chemistry Club which, under my direction, received the award of "Commendable" at the 2000 ACS national meeting. The Academic Awards I have received include: The Paul and Alice Krueger Scholarship in Chemistry, Sara A. Munsil Scholarship, Analytical Chemist Scholarship, SUNY Academic Achievement Scholarship, National Grange Scholarship, American Institute of Chemist Award, and Texas A&M College of Science Fellowship. I am currently a Ph. D. candidate in the Chemistry Department at Texas A&M working under the tutelage of Dr. Stephen A. Miller (http://www.chem.tamu.edu/rgroup/miller/).

My research focuses on the development of novel homogeneous organometallic catalysts for the homo- and co-polymerization of olefins. My work in this area has recently led to the discovery of what we believe is the only known complex to be more reactive in 1-octene polymerization than ethylene polymerization. (*J. Am. Chem. Soc.* 2004, *126*, 16716-16717.) Inspection of the polyethylene produced by the catalyst shows that at elevated temperatures (up to 170°C), long chain branches (LCB's) are abundant with over 90 times more LCB's present than with other commercial catalysts. We have also used this same catalyst to prepare what may be the highest melting syndiotactic polypropylene known (T_m = 164°C, T_m annealed = 174°C). Insight into this amazing behavior is found in the unprecedented solid state structure of the precatalyst, which reveals the most sterically accessible constrained geometry catalyst reported to date.

MEET THE PROGRAM COORDINATOR, FOR POLYMER TECHNOLOGY CENTER, ISABEL CANTU

Mrs. Cantu came from the City of Bryan, BTU Department, where she worked for the Engineering and Line Design Department as a New Services Assistant. She worked at the City of Bryan/BTU for 22 1/2 years where she retired from. Mrs. Cantu found herself missing the people contact, she decided to returned to the work force. Mrs. Cantu has been married for 25 years to Husband Omar Cantu, they have 2 children, daughter Veronica Christine 16, and son Omar Jr., 7 years old.

I am excited and looking forward to the challenges of my new assignment in the Polymer Technology Center. I am also excited in working with each one of you. Thank You for welcoming me as part of the Polymer Technology Center, the hospitality I have received has been great.