



POLYMER TECHNOLOGY CENTER

Summer 2005 Edition



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**MARK YOUR CALENDAR
FOR PTC's NEXT
CONFERENCE!**

**October 13 - SCRATCH
@ Detroit , MI**

**October 28 - PTIC
@ Texas A & M University**

**ADVERTISE IN THE
PTC NEWSLETTER!**

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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**Other Links:
<http://thelook100.tamu.edu>
<http://www.tamu.edu/vision2020>**

Scratch Behavior of Polymers Consortium

The meeting for the Scratch behavior consortium was conducted on the 21st of April and was well attended by several companies that include:

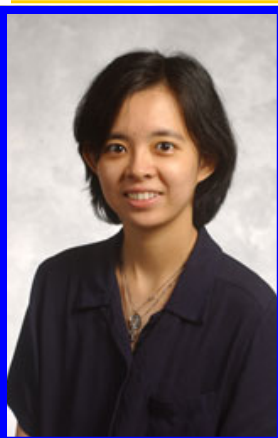
- Advanced Composites
- Chevron Phillips Chemical Co.
- Ciba Specialty Chemical
- Dow Chemical Co.
- Eastman Chemical Co.
- Essilor R&D
- Innovene USA, LLC
- Kaneka Texas Corporation
- Luzenac America
- Phillips Sumika Polypropylene Co.
- Solvay Engineered Polymers
- Sumitomo Chemical America, Inc.
- Visteon

Polymer Technology Industrial Consortium (PTIC)

The PTIC meeting was held on the 22nd of April. The list of participating companies and professional societies are as follows:

- Cytec
- Dow Chemical Co.
- Eastman Chemical Co.
- Engelhard
- Essilor R&D
- Luzenac America
- Solvay Engineered Polymers
- Society of Plastic Engineers (SPE)
- Specialty Minerals
- Sunoco
- Total Petrochemicals

Wonderful research ideas and exciting collaboration opportunities have been proposed between the consortium members, our PTC faculty members and students during the meetings. Relishing the meetings success, PTC would like to thank the active participation and contribution of the members and look forward to seeing you again in our next consortium meetings in the Fall (see the Meeting Announcements on this page). Below are some of the pictures taken during the meetings.



Meet PTC's Newest Faculty Member Dr. Anastasia Muliana

and structures, and finite element simulation and neural network modeling of indentation tests.

Dr. Muliana is a member of American Society of Composite and American Institute of Aeronautics and Astronautics.

Dr. Muliana joined the Department of Mechanical Engineering (TAMU) and PTC in the Fall 2004. She received her M.S. degree (1999) and Ph.D (2004) both in structural mechanics area from Georgia Institute of Technology. Her area of research are computational and experimental solid mechanics, which includes the development of multi-scale nonlinear framework for multi-layered composite systems, numerical algorithms of nonlinear viscoelastic material response, micro-mechanics of composite materials, thermal stress analysis, progressive damage and creep failure of composite materials

Material Characterization Facility (MCF)



- **X-ray Photoelectron Spectroscopy (XPS): Kratos AXIS Ultra Imaging**
 - XPS is a powerful technique for the elemental surface detection of variations in chemical composition and oxidation state. Subtle changes in peak shape and position can yield important information about changes in surface chemistry. AXIS Ultra has a high energy resolution capability for both conductive and insulating samples through a patented charge neutralization system.
 - The incorporation of the patented spherical mirror analyzer into the standard hemispherical system in the AXIS Ultra provides the ability to acquire high spatial resolution images, while the real-time parallel detection allows high quality chemical images to be obtained in only a few seconds.
 - A key feature of XPS instrumentation is its ability to obtain spectroscopic information from a selected area of a sample without the need to translate the specimen. The ability to obtain a fast parallel chemical image, which can be used as a reference to perform a spectroscopic analysis, is an integral part of the AXIS Ultra. In addition, the incorporated electrostatic deflection system allows for easy multi-point analysis to be carried out from within the imaged field of view.



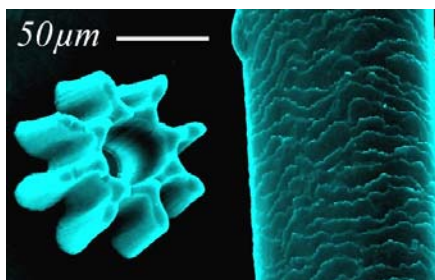
- **AFM/STM: Digital Instruments Nanoscope (scanning probe microscopy)**
 - Contact mode atomic force microscopy (CM-AFM).
 - Intermittent mode (tapping mode) atomic force microscopy (TM-AFM)
 - Scanning tunneling microscopy (STM)
 - Phase contrast AFM
 - Lateral force (friction) microscopy (LFM)
 - Imaging in liquid environments
 - Variety of scanner sizes (few mm to tens of microns)
 - Sample heater (ambient up to 100°C)



Micro/nano Manufacturing Lab
 112A Thompson Hall
 Contact: Dr. Wayne NP Hung, Director
 Email: hung@tamu.edu
 Website: <http://mnmlab.tamu.edu>

The new 1556 ft² Micro/nano Laboratory (μnM Lab) is part of the Department of Engineering Technology and Industrial Distribution at TAMU. Its vision is to (i) serve as the key center for micro/nano manufacturing at TAMU, and (ii) to integrate TAMU with national micro/nano manufacturing network. The missions of μnM lab are to provide expertise and initiate synergistic collaboration between various departments at TAMU, industry, and international institutions and also to inspire and prepare our students for further study in nanotechnology as well as to expose local high school teachers with the state-of-the-art micro/nano manufacturing technology.

μnM Lab focuses to developing new technologies to fabricate 3D micro/nano components using novel materials such as super alloys, engineering polymers, electroactive polymers, and nanocomposites for engineering applications. A dedicated team of undergraduate and graduate students and faculty are working together in this group to develop innovative technologies using micro-machining, micro electrical discharged machining, laser micro machining/welding, micro-molding, investment micro-casting, micro-extrusion, micro-assembly, and focused ion sputtering. The group has extensive research collaborations with industries and faculties across the university as well as with renowned research institutions in Mexico and Singapore.



Comparable size between a molded micro-gear and a human hair.

Selected On-going Research Projects at μnM Lab:

- Fatigue of ZrP-epoxy nano-composites.
- Design and fabrication of micro-fasteners for orthopedic applications.
- Manufacture of micro-turbines.
- Development of micro-grippers with vision and haptic feedback.
- Fabrication of hybrid vascular stent.



South Texas Section of Society of Plastic Engineers, SPE

Mr. Ananda Chatterjee of SPE, presented Dr. Sue, Director of PTC with a check in the amount of \$11,000 for the undergraduate and graduate education in polymer science and research. Over the years, SPE has been providing financial support to students in the form of conference travel fund, SPE scholarships, equipment and the local SPE student chapter fund. With much appreciation, PTC would like to acknowledge the generous support of SPE and their continual contribution to higher education and research in TAMU.

Student Poster Participation

During the recent PTIC meeting, a special poster session had been arranged to provide a good opportunity for PTC students to share their research works with consortium members and solicit invaluable feedbacks. With the largest number of poster submission in this meeting, PTC would like to thank the participating students and encourage more students to join the session in future meetings. Below are some of the outstanding posters displayed at the meeting.



New Scratch Consortium Members

PTC would like to welcome three new members to the Consortia for the Scratch Behavior of Polymers: Dow Chemical Company, Kaneka Corporation, and Sumitomo Chemical. Welcome Aboard!!!



PTIC New Members

Two new companies have also joined the PTIC Consortium: Specialty Minerals and SUNOCO. Welcome Aboard!!!



CAREER: Research and Education on Deformation of Coated Materials by Dr. Jyhwen Wang

The objective of this research is to advance fundamental understanding of deformation of coated materials and to develop their processing technologies. Deformable coated materials have diverse applications, ranging from polymer coated sheet metal for stamping to metallic thin film coated polymer for flexible electronics. The major challenges in forming coated materials into useful products are in keeping the coating from tooling contact damage and in maintaining the adhesive bond in the elastic-plastic deformation process. The approach toward the research objective is a multidisciplinary methodology that consists of both experimental and theoretical efforts. Specifically, the research will develop novel experiments to improve the understanding of contact damage and interface decohesion. The modeling framework will be based on the development of phenomenological descriptions and constitutive models of the coatings, substrates, and polymer-metal interface. Applied mechanics and adhesion science theories will be integrated to devise novel fabrication techniques for coated materials.

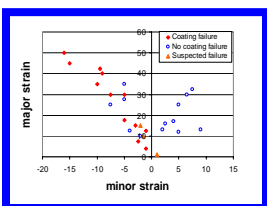
Advancing the understanding of deformation of coated materials will accelerate the development of new coating materials and new coating processes. Application of coated material can lessen environmental impact and reduce manufacturing cost. Development of new deformation techniques will result in enabling technologies for new products. The CAREER project will undertake various efforts in curriculum development, student mentoring, industrial collaboration, and outreach activities such as local science museum exhibitions.



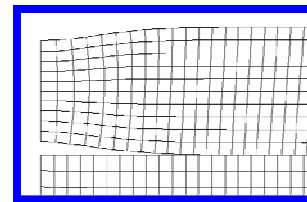
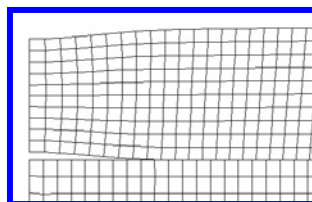
Coating Durability Test



Strain Induced Debonding



Coating Durability Limit Diagram



Finite Element Simulations of Debonding and Necking



PTC faculty

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SPE SCHOLARSHIPS FOR 2005-2006

The SPE Henry Kahn Scholarship for graduate students was awarded to:

- William Neil Everett. GPA 3.68, Ph.D Student, Major: Mechanical Engineering (MSEN Program)
 - ◊ Field of Research: Specific and non-specific bio- and macromolecular interaction forces
- Jeng-Shiung Jan, GPA 4.0, Ph.D Student, Major: Chemical Engineering
 - ◊ Field of Research: Study of Block Copolypeptide Synthesis, self-assembly, structure-directing ability, and applications.

The SPE Scholarship for undergraduate students was awarded to:

- Jennifer Garcia-Meitin, GPA 3.31, Senior, Major: Civil Engineering
- Brentley James Smith, GPA 3.97, Senior, Major: Chemistry/Philosophy

Congratulations to these students!!!

PTC's GRADUATING STUDENTS



Dr. Jong-Il Weon

Ever since when I was a kid, I have always wanted to be a doctor of engineering and enjoyed reading magazines on natural science and engineering. More than thirty years later, the kid's dream has now become a reality as I have finally earned my doctoral degree this August.

After I received my Bachelor of Science and Master of Science in South Korea, I decided to move to the US to pursue a doctoral education. Here at Texas A&M University (TAMU), I have the opportunity to work under the guidance of Dr. Sue. As a research assistant in PTC, I have participated in several research projects related to the development and application of nanotechnology-based functional polymer composites. As part of my dissertation research, I have carried out investigative experiments to evaluate mechanical, thermal and optical properties as well as surface damage characteristics. The title of my dissertation research is "*Roles of Nanofiller Structure on Mechanical Behavior of Thermoplastic Nanocomposites*". From this research, five journal papers have been published or submitted. These achievements would not have been possible without the constant encouragement and careful guidance by Dr. Sue, to whom I am sincerely grateful. Also, I have greatly benefited through working with my colleagues in PTC. Their friendship and unconditional support will always be remembered and cherished. Last but not least, I would like to thank my parents and my wife for all the support they have shown me throughout all these years.

I will soon return to South Korea with my wife. There I plan to start a career and hopefully a family too. My time in the U.S. have been interesting and I will certainly miss College Station and TAMU. My e-mail address is 'aggies05@gmail.com'.

Kwang Jik Lee

It was in the summer of 2003 that I left my country to study abroad with hope and curiosity. When I arrived at Texas, the initial impression was that the weather of Texas was just too hot. In a totally new environment and due to my elementary command of English, this hope and curiosity began to turn into anxiety and fear. As a graduate student, immediate dismay was that my research topic as well as advisor for the master degree had not been determined yet. Fortunately at that time, I was presented with an opportunity to join PTC, which turned out to be a good choice as I was interested in polymer nanocomposites and PTC is pushing ahead with research in this area, even till today.

This marks a new change for me at TAMU and I began to immerse myself in research, conducting experiments and discussing research with my advisor, Dr. Sue and fellow colleagues. There have been times that I often agonized over my inability to find reasons for certain discrepancies. Through these difficult times, I realized that I was learning and getting myself acquainted with various research methods to analyze and interpret data. In addition, the times spent with colleagues have certainly made those difficult moments easier and they will remain as good old memories to me. In all, I would like to express my gratitude to Dr. Sue for his guidance and also to my colleagues for extending their helping hands to me when I needed them.

