



POLYMER TECHNOLOGY CENTER

Spring 2007 Edition



PTC Newsletter

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New Member joins the Scratch Consortium

PTC is excited to announce that Kraton Polymers has just joined the Scratch Behavior in Polymers Consortium. Please help us in welcoming Kraton Polymers to the Scratch Consortium:



Undergraduate Polymer Specialty Certificate Program

PTC would like to acknowledge Mr. Andrew Stephenson for being the 1st TAMU student to take advantage of the Undergraduate Polymer Specialty Certificate Program. Mr. Stephenson is an officer candidate of the US Naval Forces and is majoring in Mechanical Engineering. TAMU students can now take advantage of this opportunity. To apply for this program please visit:

<http://essap.tamu.edu/polymer.htm>



2 PTC faculty members receive NSF Career Awards see page 2 & 3

MARK YOUR CALENDAR FOR PTC's NEXT CONFERENCES!

**April 26th - SCRATCH
@ Texas A & M University**
**April 27th - PTIC
@ Texas A & M University**

**Polymer Technology Center
Texas A&M University
MS 3123
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New PTC Faculty Member from the Department of Electrical and Computing Engineering, Dr. Xing Cheng



Howdy! I am Xing Cheng from the Electrical and Computer Engineering department. I graduated from the University of Michigan in early 2005. After a brief postdoc appointment at Purdue University, I joined TAMU in January 2006 and became a faculty member in the Solid State Electronics, Photonics & Nano-Engineering program.

My area of specialty is nanoimprint lithography, which is a high-resolution, high-throughput and low-cost technique for creating micro- and nanoscale structures in soft materials, particularly polymers. In the past, we have created micro- and nanopatterns in polymers such as PMMA, PC and PS for photonic and bioengineering applications. My current research interests have extended to patterning functional polymers, including polymer semiconductors, piezoelectric polymers, biodegradable polymers and polymer composites, with nanoimprint for applications in miniaturized electronic, photonic and bioengineering devices and systems. Aside from the applications of the nanoimprint technique, I am also interested in in-depth study of the nanoimprint process, such as the interfacial adhesion and friction between the mold and the polymer materials with the presence of a surface coating (mostly silanes).

Since my research heavily involves polymer materials, I am very happy to become a member of the PTC program and I am looking forward to interacting and collaborating with polymer experts in this program. Nanoimprint is capable of processing both thermoset (patterning precursor and then cure in place) and thermoplastic polymers, and it has the potential to become a powerful technique for polymer processing at micro- and nanometer scales. I would also be very happy to discuss with you how nanoimprint can assist your research if you have intention to create ordered micro- and nanostructures in your material to enhance material performance or for practical applications. Please don't hesitate to contact me through email or phone! I wish to meet you all in the coming PTC activities!



2007 NSF Career Award for “*Development of ‘Smart’ Structural Nanocomposites Based on Interfacial Coupling and Local Field Enhancement.*”

PTC faculty member, Dr. Zoubeida Ounaies from the Aerospace Engineering Department and the Materials Science and Engineering Program, recently received the 2007 NSF Career Award for “*Development of ‘Smart’ Structural Nanocomposites Based on Interfacial Coupling and Local Field Enhancement.*” The prestigious NSF Career Awards are made to outstanding junior faculty members to help them advance their research and teaching activities. This CAREER award recognizes Dr. Ounaies’s previous and current research in smart polymer nanocomposites. Specifically, she will explore the role of dipolar and ionic groups in stabilizing dispersion of nanoinclusions, dictating their orientation and affecting their percolation network in the host polymer. The interaction between nanoinclusions and the polymeric functional groups will be tuned to generate either an induced or a permanent polarization, resulting in coupling between electrical, mechanical, optical and thermal properties. Insights from this research are a step towards the development of “engineered materials” with specially designed properties. The educational component of her CAREER plan has two main projects, one of which is *SMARTGirls*, a multilayered mentoring program that encourages high school girls from underprivileged rural areas to pursue careers in science and engineering and seeks to retain this demographic in materials-related college degrees.

Grunlan wins prestigious NSF CAREER Award for nanoparticle and nanocomposite research

Dr. Jaime Grunlan, an assistant professor in Texas A&M University's Department of Mechanical Engineering, has received a 2007 National Science Foundation (NSF) CAREER award for his research into controlling the microstructure of high aspect ratio nanoparticles (e.g., carbon nanotubes) using stimuli-responsive polymers. Dr. Grunlan’s research will lead to new classes of lightweight engineering composites for applications including microwave antenna substrates; sensing and actuation transducers for biomedical applications; and highly conductive, flexible microelectronic materials. This work is a key step toward achieving the full potential of nanoparticles, such as carbon nanotubes, that have been hindered by a lack of microstructural control.



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MCF LABORATORY BY Dr. Dan Shantz



The Materials Characterization Facility (MCF) is a multidisciplinary user facility supported by the College of Engineering, College of Science, and the Office of the Vice President for Research. The MCF’s mission is to support and enhance the capabilities of researchers on the Texas A&M campus. The center’s initial focus was in microdevice fabrication and in complimentary characterization methodologies (surface studies). The center has a grade 1000 clean room equipped for microcontact printing, metal sputtering, and other conventional methods of characterizing microcontact printed surfaces. The center also has instrumentation for use in surface characterization, including X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM), and a nanoindenter.

More recently, the center has bolstered its capabilities in microscopy and spectroscopy with the acquisition of two confocal microscopes and Raman/IR microscope. Additionally, the center is in the process of acquiring a Dip Pen Nanolithography instrument, an area-imaging ellipsometer, a UV/Vis NIR spectrometer, and a fluorescence instrument capable of performing both steady-state and lifetime measurements. This center is also affiliated with the Microscopy and Imaging Center (MIC) on the Texas A&M campus.

SPE SCHOLARSHIPS



Congratulations to the following students who received Scholarships in Spring 2007.

- **Woong Jae Boo**—Graduate Student research in: “*Structure-Property Relationship of Nano-platelet-Reinforced Polymer Nanocomposites*”
- **Dazhi Sun**—Graduate Student research in: “*Functional ZnO Nanoparticles and Polymer/ZnO Nanocomposites*”
- **Andrew Stephenson**—Undergraduate student majoring in Mechanical Engineering
- **Ick-Chan Kim**—Graduate Student from the Department of Mechanical Engineering

SPE POLYOLEFIN CONFERENCE POSTER CONTEST

On February 25-28 the SPE 2007 Polyolefin Conference was held at Wyndham Greenspoint Hotel, Houston, Texas. TAMU Polymer Student Mr. Jia “Daniel” Liu received 1st place in the Poster Contest, Mr. Dazhi Sun and Mr. Woo-Sik Jang both received honorable mention. PTC Director, Dr. Hung-Jue Sue and Dr. William H. Talbott SPE representative pose with the students.



Grunlan wins prestigious NSF CAREER Award for nanoparticle and nanocomposite research

The \$400,000 grant will continue through 2012.

This CAREER award comes on the heels of a recently published article (Grunlan et al. *Nano Letters* **2006**, 5, 911-915) describing the ability to tailor the microstructure of carbon nanotubes in a water-based suspension and in solid composites. The key to this work is the use of a stimuli-responsive polymer whose interaction with the nanotube changes as the stimulus is changed. Initial work was done with poly(acrylic acid), using pH as the stimulus, but Prof. Grunlan will focus on a variety of stimuli (temperature, light, glucose, etc.) and nanoparticles (silver nanowires, carbon nanotubes, etc.) while carrying out his CAREER-sponsored research. The ability to control the level of nanoparticle dispersion in liquid suspensions and solid composites is one of the largest obstacles preventing the use of these exciting nanoparticles in everyday products. Dr. Grunlan’s work provides a novel method for tuning the properties of nanotubes and nanowires in suspensions and nanocomposites.

This work is already gaining significant international attention. *Nature Materials* has already contacted Dr. Grunlan about doing a “News and Views” article to highlight this work in their June issue. Only the most cutting-edge work is featured in this journal, which is published by Nature Publishing Group (<http://www.nature.com/nmat/index.html>). *Nature Materials* has an impact factor of 13.531 for 2004, which makes it the top journal for materials science and for all primary research journals in physics and chemistry.

In addition to being on the Mechanical Engineering and Materials Science and Engineering faculties, Prof. Grunlan is also a researcher in the Polymer Technology Center of the Texas Engineering Experiment Station, the engineering research agency of the State of Texas and a member of The Texas A&M University System. His research deals with polymer nanocomposites and is focused on transport behavior (electrical conductivity, thermal diffusivity, gas permeation, etc.). Prof. Grunlan’s Polymer Nano Composites Lab is currently developing thick and thin film polymer nanocomposites for a variety of applications that include EMI shielding, gas permeation control, and sensors.

Dr. Grunlan joined the Department of Mechanical Engineering in 2004. He received a bachelor’s degree from North Dakota State University and a Ph.D. degree from the University of Minnesota.

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PTC's Ph.D Graduate Student, Dr. Woong Jae Boo

After I served as Lieutenant J.G. in the Republic of Korea Navy for four years, and after working as a math teacher in a private institute for 2 years, I was finally able to join Texas A&M University for my M.S degree. I worked with Dr. Roger Morgan and received my M.S degree in Mechanical Engineering in December 2003. Then I furthered my studies in the Ph.D. program of

Materials Science and Engineering under the supervision of Dr. Hung-Jue Sue. My research interests include development, characterization and the structure-property relationship of polymer nanocomposites. The title of my dissertation is "*Structure-Property Relationship of Nanoplatelet-Reinforced Polymer Nanocomposites*". From this research, six journal articles have been published or submitted. This achievement would not have been possible without Dr. Sue to whom I would like to express my deepest gratitude and great respect for his guidance, advice and inspiration. Throughout my study, I have greatly benefited from working with my former and current PTC colleagues. Their friendship and unconditional support will always be remembered. Finally, I want to share the happiness of my graduation with my parents and my wife.



PTC's Visiting Scholar from Japan, Hidehito Ikeda

For the past 15 months as a visiting scholar from a Japanese company, Tokai Rubber Industries, Ltd. (<http://www.tokai.co.jp/english/index.html>), I feel very fortunate that I was given the opportunity to learn and gain knowledge of the polymer/filler nano-composite with Dr. Sue's group at Texas A&M University. Thanks to Dr. Sue's frequent advice, I was able to study the fundamental knowledge and techniques, such as dispersion methods, data analysis, and basic formulation for nano-composite. Given this opportunity to study here has been greatly useful for me.

It is true that these techniques would not have been possible without the constant encouragement and helpful support from my colleagues at PTC. Therefore, I would like to express my gratitude to Dr. Sue for his guidance and also to the PTC colleagues and staff for extending their helping hands to me when I needed them.



Since Tokai Rubber has decided to continue collaborations with Dr. Sue and PTC at Texas A&M University, I am looking forward to introducing our next companies researcher to Dr. Sue soon. I believe Tokai Rubber will continue to maintain a very good relationship with Dr. Sue and all the PTC staff at Texas A&M University. Even though I will soon be going back to Japan, I will never forget my experience/memories here at Texas A&M University. Hidehito Ikeda

PTC Seminars

"Fabrication of Polymeric Micro- and Nano-Device Structures by Nanoimprint Lithography: Techniques and Stability Issues" February 9, 2007

Albert F. Yee

**Prof of Chemical Engineering and Materials Science
University of California, Irvine**



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