



# POLYMER TECHNOLOGY CENTER



## PTC Newsletter

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## MARK YOUR CALENDAR FOR PTC'S UPCOMING CONFERENCES!

- April 8th - SCRATCH  
@ Texas A&M University
- April 8th-9th - PTIC  
@ Texas A & M University

- October 6th - SCRATCH  
@ Detroit, MI
- October 28th– 29th - PTIC  
@ Texas A&M University

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Texas A&M University  
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Website: <http://ptc.tamu.edu>

## New PTC Faculty, Dr. Nicole Zacharia

Dr. Zacharia recently joined the Dept. of Mechanical Engineering on August 2009. She received her Ph.D. in Material Science from the Massachusetts Institute of Technology in 2007. Her research interests are as follows:

Responsive soft and colloidal materials.  
Biomimetic properties such as self-healing and self-repair in thin films.  
Polyelectrolyte multilayers and their properties.  
Soft lithographic and other patterning techniques.  
Colloidal systems, especially asymmetric particles such as Janus particles.



## PTC Forms New Consortium on High Performance Thermoplastics in High Temperature and High Pressure Environments

PTC plans to launch a new consortium focusing on high performance thermoplastics in high pressure/high temperature (HPHT) environments. Industrial areas that would benefit from this collaborative research endeavor include the alternative energy, aerospace, automotive R&D, life sciences, and IT fields. Both short-term and long-term objectives have been identified. The detailed plan will be presented at the PTIC Consortium on April 9. The consortium is directed to benefit the oil and gas industry in particular and create well-trained individuals specializing in the field. NSF and other government-funded programs are being sought after and 22 companies have been solicited thus far. The PTC will continue to expand its leadership on various aspects of the industries in Texas.

## Certificate Program Expanded Due to Popular Demand

PTC is pleased to announce that the amendments for the Polymer Specialty Certificate Program have received final approval. See the amended courses on page 4.

## PTC Short Course POSTPONED

The short course on the Scratch and Wear of Polymer Composites has been postponed. If you are interested in this course, please visit the PTC website.

POLYMER TECHNOLOGY CENTER PTIC STUDENT POSTER SESSION APRIL 8-9, 2010 ROOM 301 ENGINEERING/PHYSICS BUILDING	
<b>THURSDAY, APRIL 8, 2010</b>	
6:00–8:30	Participate in the Polymer Technology Industrial Consortium (PTIC) Student Poster Session and earn a chance to become an award recipient. Don't miss this opportunity to meet influential industry members (who may be looking for future employees!) PTIC members are the judges. Posters will be critiqued on the following: 1. technical content 2. relevance to industry 3. presentation For more information and to register for this contest, please contact Isabel Cantu at: <a href="mailto:icantu@tamu.edu">icantu@tamu.edu</a>
<b>FRIDAY, APRIL 9, 2010</b>	
11:50–12:45	Lunch & PTIC Student Poster Session
1:45	Announcement of PTIC Student Poster Session Winners

## PTC Collaborates with the Department of Defense

The Defense Logistics Agency's CORANET Program has awarded funding to the PTC to conduct a study for enhancing packaging in military Meals, Ready-To-Eat, commonly called MREs. The objectives of the study, entitled "MRE Fit", are to optimize packaging materials while continuing to meet all military requirements for rough handling, food safety, nutrition, shelf life, resistance to insect infestation, and functionality by troops who consume the rations in the field.



### Dr. Hung-Jue Sue, Appointed the Linda & Ralph Schmidt Professorship, and Received SPE Fellow

In January, 2010, Dr. Hung-Jue Sue was appointed the inaugural holder of the Linda and Ralph Schmidt '68 Endowed Professorship in Mechanical Engineering. Dr. Sue joined Texas A&M's Mechanical Engineering Department in 1995 and his research has led to five patents with another four pending. His research focuses in the areas of scratch behavior of polymers, nanomaterials, and the mechanical behavior of polymers. Dr. Sue is currently the director of the Polymer Technology Center and is a fellow of the SPE. He has published over 150 peer-reviewed journal papers and book chapters, and has given numerous presentations at international conferences. He has mentored 24 Ph.D. and 14 M.S. students, and many postdocs and visiting scholars. Dr. Sue has also traveled to France, Hong Kong, Singapore, and Japan to conduct both short-term and long-term research during his tenure at TAMU.



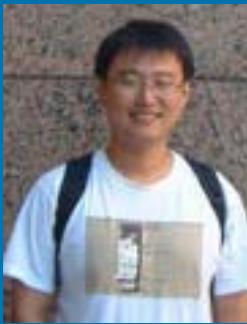
Dr. H.J. Sue, Director of the Polymer Technology Center, received the honor of Fellow of the Society of Plastics Engineers on March 19th, 2010. He will be recognized in Orlando, FL on May 16th, 2010 at the "SPE Celebrates" Banquet at SPE's 68th Annual Technical Conference.



Zhengdong Cheng



Hung-Jue Sue



Dazhi "Peter" Sun

## The discovery of new discotic liquid crystal phase opens directions for polymer nanocomposites

Zhengdong Cheng, Artie McFerrin Department of Chemical Engineering

A new method for manipulating the molecules of liquid crystals in ways previously unachieved could create new opportunity for polymer nanocomposite research. The findings, which appear in the scientific journal "Physical Review E," detail how the team members from Dr. Sue's and our group were able to orient the disc-shaped molecules of liquid crystals into distinct and separate layers - a phenomenon labeled by scientists as a "smectic phase." This layering phase is common with rod-shaped liquid crystal molecules but had never been recorded with their disc-shaped counterparts - until now. For some time, people have been really puzzled as to why the discs don't form layers. The discovery could mean expanded possibilities for the already popular liquid crystalline materials.

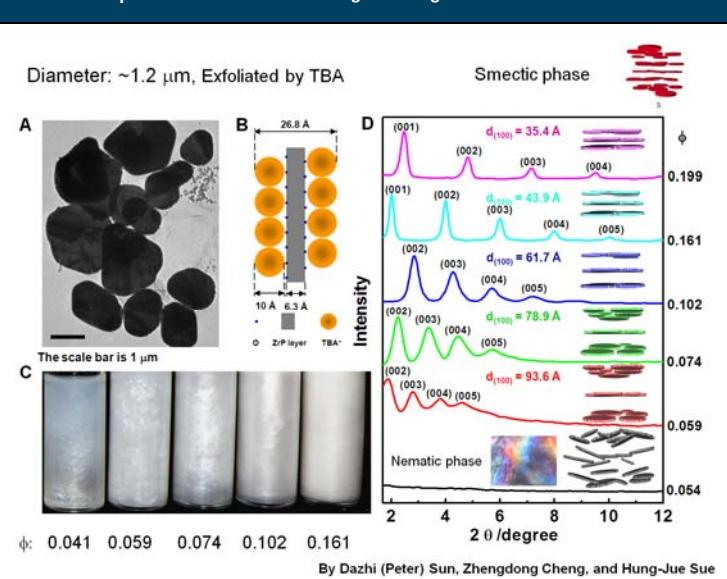
About one year ago, Dr. Sue's graduate student, Dazhi Sun, who is now a postdoctoral fellow at Brookhaven National lab came to my office to discuss the phase behavior of discotic colloids which led to fruitful collaborations between two research groups at Texas A&M university.

Dazhi exfoliated ZrP crystals into individual flakes (we like to call them platelets due to the large size to thickness ratio) which have identical thickness (Fig. 1a &b) and suspended the platelets in water at various concentrations (Fig. 1c). He was surprised to notice the silky appearance of the samples, which was the first evidence we obtained for the discotic smectic phase. Using x-ray, we were able to measure the inter-layer distance of this phase as a function of platelets concentration (Fig. 1d), hence map out the phase diagram.

The disc-shaped nature of the platelets in combination with the layered structure they form help to create a near-impermeable sealant. Such strategy has been utilized by nature for millions of years (Fig. 1). To illustrate this point, let's consider a roof with large sized tiles instead of rod-shaped tiles that leads to better coverage. If the gaps between tiles in different layers are located in different positions, it will take longer for water droplets to find ways to penetrate through the layers. The structure of the discotic smectic phase is similar to the structure of several layers of roof tiles.

Integrating such a sealant into food packaging would translate into foods staying fresher for longer periods of time. What's more, utilizing this liquid-crystal technology in materials such as paint and industrial sealants could produce more effective protections for pipelines, safeguarding them from corrosion. The discovery could also be expanded into the field of fuel-cell technology, preventing the problematic methanol cross-over through a polymer electrolyte membrane in fuel cells.

Through self-assembly, individual discs move around and interact with their neighboring discs due to collisions with surrounding water molecules. After some time, the discs reach a stable state - usually aligning to form column-like structures. However, in our experiment the discs behaved in an atypical manner, assembling themselves into separate layers. It's a behavior that we attributed to three main factors: thickness, aspect ratio and size. The disks needed to have identical thickness, a large aspect ratio and polydispersity in size, i.e a broad range of size, since uniform-sized disks tended to form columnar structures. With these fundamental understanding, we are now seeking industry collaboration to test ideas for practical applications.



By Dazhi (Peter) Sun, Zhengdong Cheng, and Hung-Jue Sue



**Fig.1 Top:** X-ray scattering measures the inter-layer distance in the smectic phase of discotic liquid crystals. **Bottom:** the iridescent internal layer of a sea shell has the structure similar to the discotic smectic phase.

Modified  
POLYMER SPECIALTY  
CERTIFICATE  
Now Applies to Graduate Students

**This program is the first of its kind offered in the state of Texas**

**You can earn a Polymer Specialty Certificate by completing 12 credit hours with a grade of C or above.**

## REQUIREMENTS

1. Be in good academic standing within major department.
2. Obtain a "C" or better in each course taken in the certificate program.
3. Achieve an overall GPR of 3.0 in approved certificate program coursework.
4. Students should take at least 2 courses outside of their department to receive the Polymer Certificate.
5. Submit completed certificate worksheet to the Polymer Technology Center (208 Engineering/Physics Building) upon registering for final course(s) to complete certificate requirements.

## BENEFITS

The value of the certificate to the student will be to broaden his or her exposure to a diverse polymer science and engineering curriculum and thereby differentiate the student from peer institutions.

Industry will value graduates with the Polymer Specialty Certificate because they will have a more diverse background in polymers. Further, the graduates will have a focus that would foster entrepreneurial thinking and expand the employment horizons beyond the traditional industrial jobs.

To apply for the Polymer Specialty Certificate visit:  
[http://ptc.tamu.edu/educ\\_certifprogram.htm](http://ptc.tamu.edu/educ_certifprogram.htm)  
Or <http://essap.tamu.edu/polymer.htm>

## COURSES

<b>CORE COURSES (select 6 credit hours)</b>	
AERO 406	Polymer Nanocomposites and Their Applications
AERO 606	Multifunctional Materials
BMEN 482	Polymeric Biomaterials
CHEM 466	Polymer Chemistry
CHEN 451	Intro to Polymer Engineering
CHEN 641	Polymer Engineering
MEEN 455	Engineering with Plastics
MEEN 458	Processing & Characterization of Polymers
MEEN 607	Polymer Physical Properties
MEEN 635	Flow and Fracture of Polymeric Solids

<b>APPROVED TECHNICAL ELECTIVES (select 6 credit hours)</b>	
MEEN 451	Viscoelastic Solids
MEEN 471	Elements of Composite Materials
MEEN 606	Polymer Laboratories
BMEN 683	Polymeric Biomaterial Synthesis
MEEN 657	Viscoelasticity of Solids and Structure
CHEN 642	Colloidal & Interfacial
*AERO 485 or 491	Individual Research
*BAEN 485 or 491	Individual Research
*BMEN 485 or 491	Individual Research
*CHEM 485 or 491	Individual Research
*CHEN 485 or 491	Individual Research
*ECEN 485 or 491	Individual Research
*MEEN 485 or 491	Individual Research
*AERO 489 or 689	Polymer Related Research
*BAEN 489 or 689	Polymer Related Research
*BMEN 489 or 689	Polymer Related Research
*CHEM 489 or 689	Polymer Related Research
*CHEN 489 or 689	Polymer Related Research
*ECEN 489 or 689	Polymer Related Research
*MEEN 489 or 689	Polymer Related Research
*AERO 685	Polymer Related Research
*BAEN 685	Polymer Related Research
*BMEN 685	Polymer Related Research
*CHEM. 685	Polymer Related Research
*CHEN 685	Polymer Related Research
*ECEN 685	Polymer Related Research
*MEEN 685	Polymer Related Research



**TEXAS A&M**  
UNIVERSITY

Spring 2010 Edition

**TAMU News****Dr. Loftin Becomes A&M President**

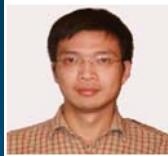
**February 12<sup>th</sup>, 2010 – After acting as interim president since the resignation of Texas A&M University's last president, Elsa Murano, Dr. R. Bowen Loftin is officially named the 24<sup>th</sup> president of the university.**

**28th Annual Big Event**

**Nearly 13,000 participants (primarily students and a few staff and faculty members) participated in Texas A&M's annual Big Event on March 27th, 2010 to help 1,450 residents of the Bryan/College Station area. The Big Event is the nation's largest single-day student run community service project and is a TAMU tradition. For the past 28 years this event has taken place and true to Aggie core values, students have selflessly given back to their community.**

**Random FUN FACTS**

- **111,111,111 x 111,111,111 = 12,345,678,987,654,321**
- Children grow faster in the springtime.
- Every human spent about half an hour as a single cell.

**PTC News**

**Dr. Han Jiang  
Returns to China  
as a Faculty Member**

Dr. Han Jiang received his Ph.D degree in Mechanical Engineering from Texas A&M University in 2009 and has been working with Professor H.-J. Sue as a post-doctoral research fellow at Polymer Technology Center since then. With years of experience in a multi-language/culture environment, his work focuses on the polymer material properties, damage/failure analysis, and finite element numerical simulation involving surface/interface behaviors.

Dr. Jiang will wrap up his research at Texas A&M University and join Southwest JiaoTong University, China as a faculty member this summer. He will continue to work on polymer tribology and pipeline coating integrity, and related research. He is open to the collaboration opportunities in the field of material science/mechanical engineering. He can be reached at:

[jianghantamu@gmail.com](mailto:jianghantamu@gmail.com).

**FUN FACTS ON POLYMERS**

• Synthetic fibers are a part of our everyday life. Which synthetic fiber was discovered first?

**Polyester.** Even though Rayon was first introduced at the end of the 19th century it is not considered a true synthetic fiber as it is derived from naturally occurring cellulose. Polyesters were discovered before nylon and are synthetics but had major drawbacks. They weren't developed to their full potential until later.

**Nylon**, as we know it today, was discovered in 1935 and is considered the worlds first true synthetic fiber. Terylon is just a made-up name.

# PTC Faculty



# SPE Student Chapter News

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## SPE Scholarship & Award Recipients

PTC is pleased to announce the recipients for the SPE Scholarships for 2010-2011.

### SPE Dale Walker Scholarship

- **Melissa Giese, Biomedical Engineering**

### SPE Henry Kahn Scholarship

- **Xi Zhang, Material Science and Engineering**

### SPE Scholarship

- **Brian Anthony Hare, Material Science and Engineering,**
- **Casie Hilliard, Chemistry**
- **Payam Khodaparast, Material Science and Engineering**

### SPE Award

- **Minhao Wong, Material Science and Engineering**

Congratulations to these students!



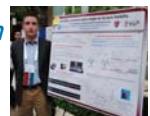
## Poster Contest at the 2010 SPE International Polyolefin Conference

TAMU students placing at the Polyolefin Conference, held Feb. 21-24, 2010.

• 1st Place = Kevin Plumbee poster entitled: *"Novel UHMWPE Composites for Orthopedic Applications"*

• Honorable Mention = Bobby Browning poster entitled: *"The Effect of Illumination Angle on the Scratch Visibility of PVC"*

Congratulations to these students!



TAMU students that helped with 2010 SPE Intern'l Polyolefin Conference, held in Houston, TX



## Polymer Specialty Certificate Updates

Students that have applied for Certificate

15

Students that have received the Polymer Specialty Certificate

11

For more information:

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

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