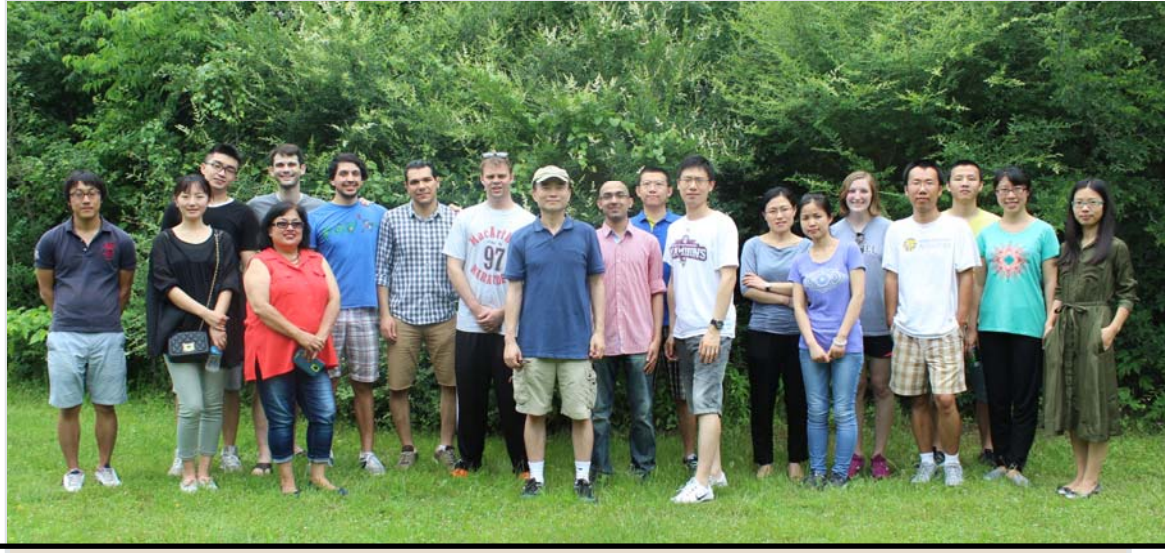
Third Quarter 2016 Newsletter



Polymer Technology Center

Inside the Newsletter

Mark Your Calendars!

Scratch Behavior of Polymers Consortium-SCRATCH	Polymer Technology Industrial Consortium-PTIC
October 5th-Troy, Michigan From noon-4:30 after the TPO Conference	October 13th — 14th College Station, TX Texas A&M University

Formosa Plastics

Please welcome the newest member to the Polymer Technology Industrial Consortium

GHARDA PLASTICS

PBI PERFORMANCE PRODUCTS, INC.

LEHVOSS North America

technical polymers

victrex

Please welcome the newest members to the APPEAL Materials Producers Group

The partnership between Kaneka, a Japanese-based chemical manufacturer, and the Texas A&M Engineering Experiment Station's (TEES) Polymer Technology Center (PTC) dates back to 1999. Kaneka first approached Dr. Hung-Jue Sue, TEES professor and director of PTC, about his research on improving the toughness of epoxy resin. The collaboration that followed was a success. Kaneka commercialized the product, which led to their current partnership.

That partnership led to the establishment of the Kaneka U.S. Materials Research Center (KMR) on the Texas A&M campus in College Station in 2013. It was Kaneka's first corporate research and development center outside of Japan. Current research includes incorporating nanoparticles to improve polymer functionalities, improving nanoparticle dispersion and organization in polymer matrices, and finding new functionalities for polymers.

According to Dr. Masaya Kotaki, general manager of KMR, strengthening the existing relationship between Sue and Kaneka was the primary reason for establishing KMR in College Station. That, combined with PTC's facilities and capabilities, as well as Texas A&M University's proximity to Kaneka's United States headquarters in Pasadena, Texas, made College Station an ideal location for their research and development.

"We have many projects," Kotaki said. "We need equipment, we need people to train to teach the things that we're working on, and everything we need is on campus. The people, the information and the equipment are here. This is a perfect place for us. Texas A&M does a very good job of training students and researchers."

Today, a little more than two years in, the two sides agree that their partnership has been a tremendous success. Kotaki said KMR started with just two researchers in College Station, and are now up to 10. He added that this is just the beginning.

"We definitely want to maintain and improve our relationship with the Polymer Technology Center," he said. "At this moment, we have a few researchers, and we would like to increase the number in that agreement. We want to work on many different topics with different professors. That's the future plan we have."

For Kaneka, the advantage of working with TEES and Texas A&M is the ability to utilize the university's personnel and facilities.

For PTC, one benefit of collaborating with a company such as Kaneka is the ability to commercialize research. Sue said the partnership has worked better than he possibly could have hoped for.

"It is as good as you can dream of as a professor," he said. "You have your research being appreciated by a company, and it's being turned into products and sold globally, and you're a member of that contribution team. That really allows us to go beyond what we could have done by doing it ourselves.

"When you begin to team up with people in the business world, you realize that research is only one factor of success. Without this experience, I wouldn't appreciate how important it is to market and sell, and what kind of information you need to provide in order to succeed."

The collaboration between Kaneka and PTC has resulted in several patents, and Sue also uses the partnership as an example to students about how research can be used to contribute to a company, and how those contributions can make their way into the real world.

Kaneka has provided $20,000 in scholarships to Texas A&M students annually through PTC in the last three years, and has hired several Texas A&M graduates.

Sue emphasizes that the partnership goes beyond the financials and serves as an example of how to conduct research and business.

"Early on in our partnership, I was very clear about our research, including the pros and cons, and advantages and disadvantages of what we do," Sue said. "Once you make it clear to your sponsors, and you get that trust, then everything that follows becomes easy. I think that's one reason that we've been able to work with Kaneka so well, and something we can all learn from."

Sue said another benefit of this type of partnership is that it allows for fundamental research.

"This kind of funding allows us to do long-term, critical research," he said. "We don't have to look at everything short term as an immediate product or immediate result. That kind of relationship allows us to do the best quality research we can."

Kotaki also believes that one of the biggest advantages of the partnership is simply the environment. Working in a collegiate setting allows for what could be described as competitive collaboration.

"I like the environment of a university; it's very different," he said. "I think this environment is good for us. We can be very competitive. Professors at universities work hard on fundamental research. They collaborate, but they also compete, so this kind of environment is very important for us."

Kaneka's Executive Administrators

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Lutkenhaus Engineers Sustainable, Water-Based Thin Films

Associate Prof. Jodie Lutkenhaus
Chemical Engineering

Imagine a cake as large as a billionth of a meter or nanometer. You may end up with a disaster if the layers of frosting are too warm or not spread with precision. The precision, properties and fundamental structure of each layer of frosting would be difficult to measure, much less see or weigh.

Thin film coatings are the layers of frosting in industrial applications across multiple manufacturing sectors. Environmentally sustainable, water-based, solvent-free thin film coatings are the future of high-performance materials.

Dr. Jodie Lutkenhaus, associate professor and William and Ruth Neely Faculty Fellow in the Artie McFerrin Department of Chemical Engineering at Texas A&M University, has received a $405,000 grant from the National Science Foundation to research ultra-thin films of polymers containing bound ions, known as 'polyelectrolytes'.

Lutkenhaus' Organic Thin Films and Nanostructures Lab seeks to evaluate the 'glass-melt' or softening transition of these films using a suite of analytical techniques that will probe it on a molecular level. If successful, this project will shed new light on the role of water and salt in the thermal transition.

The nanocomposite coating is a thin film of polyelectrolyte multilayers or "layer-by-layer assembly" of desired material. Such coatings are commonly used in solar cells, optic and antibacterial, biomedical and temperature-responsive materials. Common layer-by-layer assemblies are made by processing by immersion, spinning spraying, electromagnetic or fluidic deposition of desired material on a variety of application surfaces.

"Any application you can dream of for these coatings, I assure you someone has tried it," said Lutkenhaus. "At one point, researchers were talking about depositing it into hair as a beauty product."

Although thin films have been developed for a while, their exact structure is still not known. This project places a unique emphasis on salt type, where a broad range of salts with varying size, charge and water interactions is examined. Lutkenhaus seeks to investigate the unified relationship between temperature, water and salt as it governs the transition of the thin films.

"This will be of significant importance because this new knowledge will allow fine-tuning of the transition temperature and the physical properties associated with these materials, ultimately leading to possible new advanced applications," said Lutkenhaus.

She explained the phenomenon of thin film glass transitions on a macroscopic scale with an example of a rubber ball. She demonstrated how the ball when dipped in liquid nitrogen solidifies and cracks when dropped on the ground. In real world applications, it is important to know if the film is rubbery or glassy. Continued fundamental research on the structure of the coatings will help Lutkenhaus engineer thin film coatings that adapt to the material to be coated.

Dr. Maria Sammalkorpi, professor of polymer chemistry from Aalto University in Finland, actively collaborates with Lutkenhaus' lab. Her molecular models explain some of the properties in thin films. Yangpu Zhang, doctoral student in the chemical engineering department, is assisting Lutkenhaus, and will be visiting Sammalkorpi for a month in Finland to conduct related research in polyelectrolyte complexes, a cousin of layer-by-layer assemblies.

Four undergraduate students in Lutkenhaus' research group are currently assisting with the research. Lutkenhaus says this research is a good platform to introduce them to lab research as the process is water-based and therefore safe.

"You can pretty much use any material to create a thin film coating which is adaptable, environmentally safe and stimuli-responsive," said Lutkenhaus. "These coatings are so versatile, the consumer wouldn't and shouldn't know they're there."

Molecular understanding of the structure, dynamics, and reactivity of PAEK polymers

Prof. Perla B. Balbuena
Chemical Engineering

High-performance polymers and nanocomposites that can withstand increasingly harsh environments are a critical component of today's emerging energy and infrastructure developments and equally essential in biomedical, aerospace, and telecommunications fields. The general features of superior mechanical strength, corrosion resistance and high service temperatures make the polyaryletherketone (PAEK) family of semi-crystalline thermoplastics, along with polyphenylsulfones and polyimides preferred choices in critical service environments where lifetime is a key value. For example, PAEK polymers are of great interest for extreme service environments in the oil and gas industry. These materials are often exposed to the high pressures (up to 20,000 psi) and temperatures (up to 600ºF) encountered in deep geological formations, to steam, or oil-based drilling fluids, brines, or other corrosive chemical mixtures that are highly acidic, oxidizing, or caustic. Additional uses of high-performance polymers are driven by their biocompatibility properties, and include applications in orthopedic, trauma, spinal, and dental implants which have become increasingly widespread. However, both the biological response and the effects of complex biological environments on the structure and properties of the material are critical to these applications. Moreover, many of the problems associated with biocompatibility are related to tissue integration with the polymer surfaces, and how these solid-solid interfaces react and evolve with progressing corrosion.

Elucidating the mechanisms of degradation and deleterious interactions with the chemical environment to which these materials are exposed to is critical in developing more robust and longer-lived polymer structures. To enable such knowledge, molecular level chemical reaction mechanisms must be understood. Prof. Balbuena's group is using classical and quantum molecular dynamics simulations to understand the interactions of polyether ether ketone (PEEK) polymers with water and acid solutions. Chemical Engineering undergraduate student Leonardo Gonzalez is currently analyzing the detailed molecular level behavior of PEEK surfaces in contact with water and acid aqueous solutions at high temperatures and pressures as found in deep water environments.

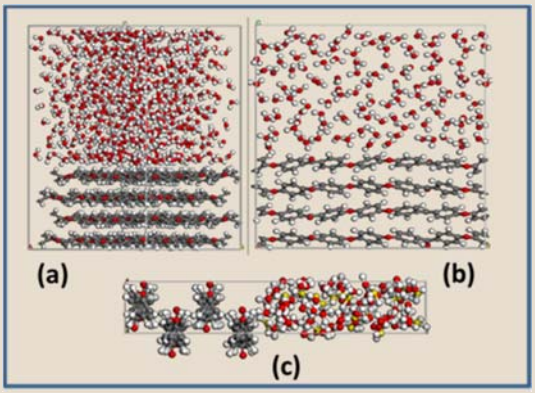
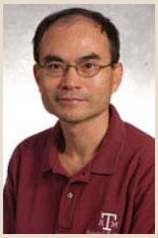


Figure illustrates (a) and (b) PEEK-water interface; (c) PEEK-H_2S/water interface.

Sue receives Lloyd's Register Foundation Grant



Prof. Hung-Jue Sue
Department of Materials Science and Engineering

Dr. Hung-Jue Sue received the Lloyd's Register Foundation research grant to explore the potential of copper/carbon nanotube metal matrix composites in the fabrication of electrically conductive materials with enhanced properties for use in subsea power transmission applications. National University of Singapore, University of Cambridge, Institute of Occupational Safety in Scotland, Kaneka Corporation, and Texas A&M University are jointly conducting this research.

Texas A&M engineering graduate students' startup wins 2016 Rice Business Plan Competition

A student team from Texas A&M University, led by engineering Ph.D. students Blake Teipel and Charles "Brandon" Sweeney won the grand prize at the Rice Business Plan Competition for its startup company TriFusion Devices. The startup has developed customizable, 3-D printed prosthetic leg devices that can be manufactured in hours instead of weeks, and would cost far less than anything on the market.

Full story: http://goo.gl/UilC1w

TriFusion as a team have landed the following wins:

- First place winner of the 2016 Rice Business Plan Competition for startup company: TriFusion Devices
- First place winner of the 2016 Baylor New Ventures Competition for startup company: TriFusion Devices
- First place winner of the 2015 Southeastern Conference (SEC) Symposium's inaugural Student Entrepreneurial Pitch Competition in Atlanta for business TriFusion Materials
- Awarded first place winner of the 2015 Raymond Ideas Challenge at Texas A&M University for business plan pitch titled: "Customizable Prostheses via 3D Printing"

CONGRATULATIONS

Student innovations highlight 2016 Engineering Project Showcase

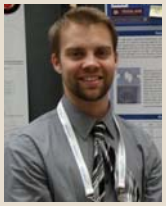
The work of more than 700 students was represented at the Engineering Project showcase on April 29th in the Hall of Champions at Texas A&M University's Kyle Field.

The Engineering Project Showcase provides students an opportunity to demonstrate and display their engineering projects highlighting the ingenuity of engineers solving real-world problems.

Full story: https://goo.gl/UVcePR

PTC Graduate Assistant Research, Dr. Peng Liu

Our congratulations to Dr. Peng Liu for receiving his Ph.D. degree from the Department of Mechanical Engineering at Texas A&M University. Under the guidance of Dr. Hung-Jue Sue, Peng Liu has been conducting research on the development of innovative polymeric materials for engineering applications and quantitatively predicting the behavior of these materials, particularly the mechanical performance. His research in recent years focused on the development of polyaryletherketone (PAEK) polymers aimed at obtaining properties that will lead to further expansion into new application areas. The lightweight, high-strength PAEK-based material is an essential enabling technology for many engineering applications. During his Ph.D. studies, he has published several papers in high-quality journals related to the field of polymer science. After graduation, Dr. Liu will be working at Oak Ridge National Laboratory. His research there will be related to large scale rapid processing of high-performance thermoplastics by using additive manufacturing techniques (3D printing). He will be able to use the knowledge and experience gained during his time at Texas A&M to contribute to the research on this technology that can revolutionize the way products are designed and built.



PTC Graduate Assistant Research, Dr. Kevin Laux

Kevin will be graduating with a Ph.D. in Mechanical Engineering in August 2016. He joined Dr. Sue's research group in August 2012. Kevin is originally from Chicago, IL, and completed a B.S. in Mechanical Engineering from the University of Illinois in 2006 and M.S. in Mechanical Engineering from Texas A&M in 2012. His research has involved the fundamental study of friction and wear in high-performance polyaryletherketone (PAEK) thermoplastics as a part of the APPEAL consortium. Following graduation he will work as materials development engineer for Kuraray in Pasadena, TX.

PTC's Postdoctoral Research Associate Dr. Hongfeng Wang

Dr. Hongfeng Wang developed his interest in Materials Science & Engineering when he was pursuing his B.S. degree in Tongji University (China). In 2007, he received a European Erasmus Mundus scholarship and joined a 2-year International FAME Master Program (Functionalized Advanced Materials and Engineering, FP6 framework proram). The first year of the program, he was in Universität Augsburg (Germany) focused on material physics and the second year in Université de Bordeaux 1 (France) focused on material chemistry. In 2012, he received his Ph.D. degree from Université de Bordeaux 1 (ICMCB-CNRS) on physical chemistry of molecular materials. Before joining Dr. Sue's group, he worked for a joint postdoctoral project in both University of Tennessee and Wuhan National Laboratory for Optoelectronics (China). He joined Professor Sue's group in 2015 as a Postdoctoral Research Associate. His research focuses on the understanding of nanoplatelet self-assembly behavior.

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SPRING 2016 SPE and Kaneka scholarship recipients

Our congratulations goes out to the following students and faculty for being selected the SPE and Kaneka scholarship/award recipients for Spring 2016.

Left to right: Jeniree Flores, CHEM; Thomas Malinski, CHEM; Dr. David Hansen, SPE Liason; Natalie Benner, MSEN; and Mary Layne Harrell, CHEM

Mr. Steve Skarke, Kaneka Vice President, presenting the Kaneka Junior Faculty Award to Dr. Hung-Jen Wu, Chemical Engineering

Left to right: Chih-Gang Chao, CHEM; Shin Hye Ahn, CHEM; Mr. Steve Skarke, KANEKA Vice President; Minxiang Zeng, CHEM; and Yanpu Zhang, CHEM

SPE Student Chapter Officers for 2016-2017

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Please contact any of these officers should any questions arise regarding SPE membership/events, etc.

Polymer Technology Industrial Consortium (PTIC)
Student Poster Session

APRIL 7-8, 2016

	Student Name	Student Poster Title
1	Kevin Laux	"The Influence of Frictional Heating on The Tribological and Wear Behavior of PEEK"
2	Joseph Baker	"Zinc Bromide Concentration Effects on PEEK Degradation Under HP/HT Conditions"
3	Jeniree Flores	"Versatile Magnetically-active Hybrid Networks (MHNs): From crude oil remediation to Pickering Emulsifiers"

CONGRATULATIONS

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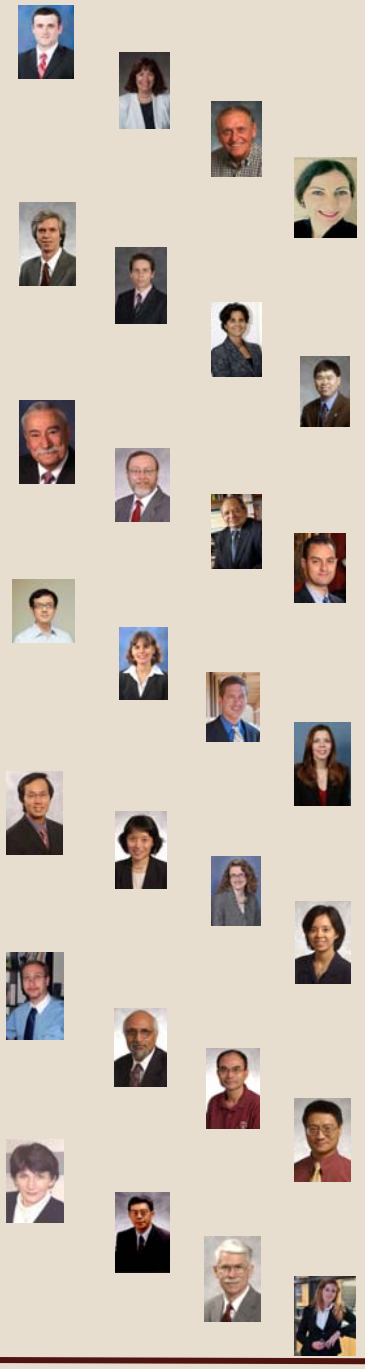

Polymer Specialty Certificate Updates

Students that have applied for the Polymer Specialty Certificate	56
Students that have received the Polymer Specialty Certificate	39

For more information, please visit: http://ptc.tamu.edu/certificate.html

Have Questions?

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