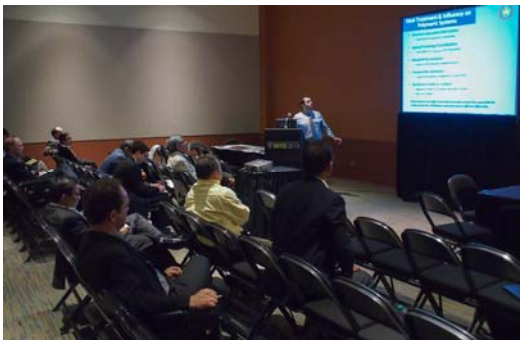
PTC
POLYMER TECHNOLOGY CENTER
TEXAS A&M ENGINEERING EXPERIMENT STATION

Third Quarter 2013
NEWSLETTER

SCRATCH Consortium

The Scratch Consortium was held on April 24th in Cincinnati, OH, with the following companies in attendance:

- ⇒ Advanced Composites, Inc.
- ⇒ Arkema
- ⇒ Avery Dennison
- ⇒ Braskem
- ⇒ Eastman Chemical Company
- ⇒ ExxonMobil
- ⇒ Imerys Talc
- ⇒ MyTex Polymers
- ⇒ PPG Industries, Inc.
- ⇒ Sabic
- ⇒ Sumika Polymers North America



Mark Your Calendars for PTC'S upcoming events:

* APPEAL Consortium = October = tba
  Texas A&M University, College Station, TX
* SCRATCH Consortium = October 24th, 2013
  Texas A&M University, College Station, TX
* PTIC Consortium = October 24th-25th, 2013
  Texas A&M University, College Station, TX

Newest Members to Consortia

The Polymer Technology Center is pleased to welcome and announce our newest member to the Polymer Technology Industrial Consortium, Schlumberger, and newest member to the Scratch Behavior on Polymers Consortium, MyTex Polymers.

Schlumberger

MYTEX POLYMERS
HIGH PERFORMANCE POLYMERS WORLDWIDE

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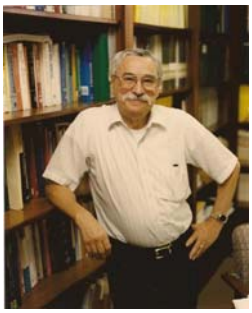
TEXAS A&M UNIVERSITY



Surface Modification and Functionalization of Zirconium Phosphate Nanoparticles

Abraham Clearfield, Chemistry

Our recent work has centered on the use of α-zirconium phosphate nanoparticles, or α-ZrP for short, is a layered compound with a simple formula of $Zr(HPO_4)_2 \cdot H_2O$. Three oxygen atoms from the phosphate group bond to three different Zr_4+ ions from above and below, forming the layer, and the remaining P-OH groups form a double layer between adjacent layers. The surface thus terminates in P-OH groups that can be functionalized with silanes, isocyanates, polyethylene glycols, phosphonic acids, and acrylates.

Initially, the formation of ZrP is as an amorphous powder. Formation of a crystalline solid occurs slowly so that the growth of the layers can be controlled. Currently, we have prepared nanoparticles of less than 50 nm all the way to micron -sized crystals. In addition to functionalizing the surface, we can place a variety of molecules between the layers. This combination of abilities is being utilized to prepare polymer composites, electron conducting polymers, polymers for flame retardation, drug delivery for cancer therapy, electron transfer systems, stabilization of emulsions, and nano-sized organo-metallic catalysts that can be dispersed in a variety of organic solvents. In this endeavor we are collaborating with a number of faculty members of the Polymer Technology Center. The outlook for these systems looks promising.

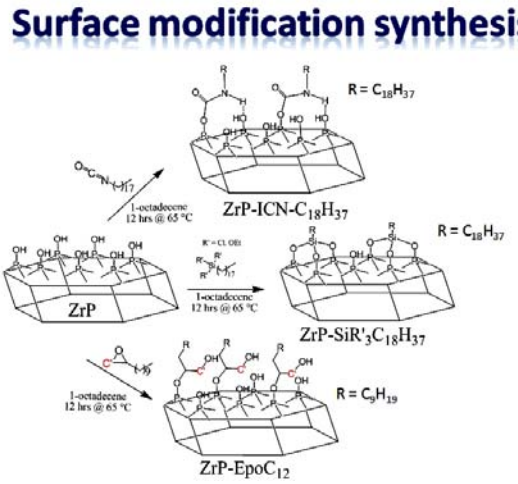


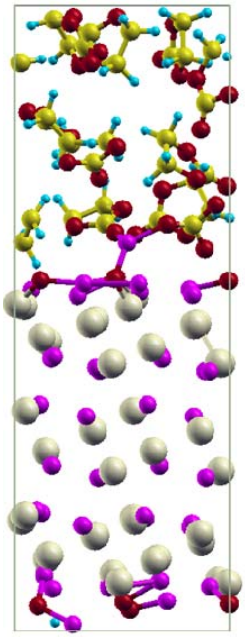
Figure x: Organically surface-modified ZrP was obtained by reacting the surface P–O–H groups of α-ZrP with octadecyltrichlorosilane (OTS). Surface functionalization of α-ZrP with OTS was accomplished using a one-step synthesis producing highly hydrophobic nanoparticles. We show the applicability of this system with a photoinduced electron-transfer reaction in a nonpolar solvent. Using an organically surface-modified α-ZrP previously loaded with tris(2,2′-bipyridyl)ruthenium(II) ($Ru(bpy)_3^{2+}$), the quenching of the luminescence of $Ru(bpy)_3^{2+}$ in the presence of p-benzoquinone was monitored; a static quenching constant (K_s) value of $8.82 \times 10^2 M^{-1}$ and a dynamic quenching constant (K_d) value of $6.99 \times 10^1 M^{-1}$ were obtained.

Diaz, A., et al., *Chem. Mater*, Article ASAP, DOI: 10.1021/cm303610v

Materials for Electrochemical Energy Storage

Perla Balbuena, Chemical Engineering

One of the challenges in the development of devices based on renewable energy sources, such as solar and wind, is the storage of the collected energy. Batteries and capacitors are among the most popular electrochemical energy storage methods. However, one of the most important issues associated with both batteries and capacitors is the chemical instability of the electrolyte material that is used as an ionic conductor and is physically located between the two electrodes. Typical electrolytes include liquid mixtures of nonaqueous solvents and a salt or solid mixtures of a polymer and a salt. The first group has high ionic conductivities, but it is thermally unstable, which poses safety issues. Polymer electrolytes are much safer but have low conductivities. Current Li-ion batteries use the first group of organic liquids, which are unstable and decompose during battery cycling, forming a film at the surface of the electrode. The film is composed of inorganic and organic products and is called Solid-Electrolyte-Interphase. Dr. Balbuena's group has pioneered the understanding of the film formation and possible products, most of them products of polymerization reactions. Using computational chemistry methods, her group is now addressing the same problem for silicon anodes. The figure illustrates the solid/electrolyte interface at the initial stages of reaction when the first products of polymerization start to form.



Dr. Yuntao Li, Visiting Scholar from China

My name is Yuntao (David) Li. I spent three and half months in Spring 2013 in Prof. Sue's group as a visiting scholar. I was so excited that I could have such a wonderful opportunity to come back to TAMU and work in Prof Sue's lab again after almost 10 years since I obtained my PhD degree in MSEN program at TAMU in 2004.

I am currently a professor at Southwest Petroleum University (SWPU) in China. We have strong interests in the research area of high performance polymers and composites for oil & gas and other energy applications. The purpose of my visiting is to learn the state-of-art technologies in Prof. Sue's group on characterization of PEEK structure-property relations, surface modification and dispersion of nanoparticles, and high performance polymer nanocomposites. I would like to further establish some related collaborative research and academic activities between our groups and universities.

I would like to thank Prof. Sue and all PTC colleagues for their advice and assistance during my visit. If you are interested in my research, my university, or opportunities in China, please feel free to reach me at: yuntaoli@swpu.edu.cn

Record graduating class at Texas A&M

More than 7,100 Texas A&M students were scheduled to receive their diplomas on May 11, 2013.

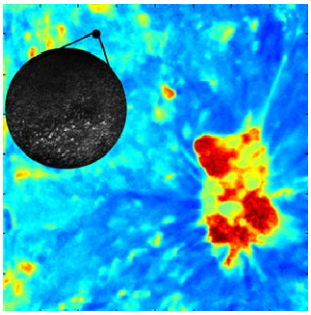
Full story: http://tamutimes.tamu.edu/2013/05/06/record-graduating-class-expected-at-texas-am-during-thursday-saturday-ceremonies/

Texas A&M research using special foams to treat aneurysms

The treatment, which makes use of special plastics called polyurethane-based shape memory polymer foams (SMPs), is the result of research by Duncan Maitland, associate professor in the university's Department of Biomedical Engineering. Its effectiveness in helping to heal aneurysms is detailed in the May issue of the "Journal of Biomaterials Research" and is considered a significant milestone in the continued development of the treatment, Maitland says.

Full story: **http://engineering.tamu.edu/news/2013/06/06/smp-foams?utm_source=tamutimes&utm_medium=email&utm_campaign=2013-06-18**

Texas A&M imaging research advancing detection, diagnosis of oral cancer

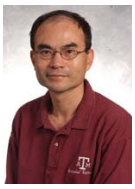


[Fluorescence lifetime imaging with a 16x16 mm² field of view detects tissue biochemical changes on the macroscopic scale, and (inset) confocal microscopy with a 0.4 mm diameter field of view is used to characterize size, shape, and spacing of cell nuclei to detect oral precancer and cancer.]

The imaging technique, which is detailed in the "Journal of Biomedical Optics," is being developed by Kristen Maitland, assistant professor in the university's Department of Biomedical Engineering. It combines two separate technologies -- confocal microscopy and fluorescence lifetime imaging -- to noninvasively evaluate both the structural changes of tissue as well as molecular changes that take place on a cellular and tissue level. These morphological and biochemical changes are key factors in determining if tissue is precancerous or cancerous, Maitland says.

Full story: **http://engineering.tamu.edu/news/2013/05/23/oral-cancer?utm_source=tamutimes&utm_medium=email&utm_campaign=2013-06-11**

Dr. Hung-Jue Sue receives patent awards



On April 26, 2013, at the Patent and Innovation 2013 Awards Luncheon, Dr. Hung-Jue Sue received the following patent awards:

⇒ Water-soluble nanoparticles with controlled aggregate sizes
⇒ Intercalation agent free comositions useful to make nanocomposite polymers
⇒ Dispersion, alignment and deposition of nanotubes

Research team member on C&EN magazine cover

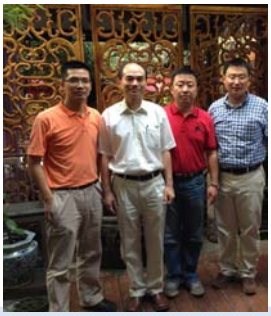
The latest research efforts of Dr. Jodie Lutkenhaus, assistant professor in the Artie McFerrin Department of Chemical Engineering at Texas A&M University, has landed one of her team members on the front cover of the May 6 edition of "Chemical & Engineering News" magazine.

Full story: **http://engineering.tamu.edu/news/2013/05/07/research-team-member-on-cen-magazine-cover**

Minhao Wong Former PTC Graduate Student

Minhao Wong is graduated from the Materials Science and Engineering Program with a doctorate in May 2013. Previously, he obtained an M.S in Mechanical Engineering from Texas A&M University and a B.Appl.Sci. in Materials Engineering from Nanyang Technological University, Singapore. During his time with the Polymer Technology Center working with Professor Hung-Jue Sue, his research interests were in the surface modification of colloidal nanoparticles with oligomers and polymers for the controlled assembly of mesomorphic structures. His work enabled the manufacturing of photonic crystals suspended in organic solvents composing of zirconium phosphate nanoplatelets, creating brilliantly iridescent solutions that show colors spanning the full visible spectrum. Minhao also developed a novel spray-coating method to apply thin coats of epoxy/zirconium phosphate nanocomposites onto surfaces creating a mechanical robust gas-barrier film which showed excellent performance in blocking oxygen transport. The enhanced performance is primarily a result of zirconium phosphate nanoplatelets self-assembling after being spray-coated to form highly ordered arrangements of smectic 2D crystals. Minhao is currently working for Chevron Japan as an automotive engine oil engineer.

Dr. Sue and former students in China



Three former students of Dr. Hung-Jue Sue's, Dazhi Sun, South China UST; Yuntao (David) Li, SW Petroleum University; and Han Jiang, SW Transportation University, are all faculty members in China. Dr. Sue was very happy to be able to be with all of them in one place in China to collaborate on research and enjoy a good dinner and drinks .

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SPE Student Chapter Officers for 2013-2014

Our new officers are listed below:

- **President: Adriana Pavia**
- **Vice-President of Engineering: Spencer Hawkins**
- **Vice-President of Science: Jacqueline Pope**
- **Treasurer: William Guzman**
- **Secretary: Lauren Link**
- **Chair of Industrial Relations: Danielle Policarpio**
- **Web Coordinator: Kevin Laux**
- **Publicity Coordinator: Haiqing Yao**
- **Activity Coordinator: Joseph Puhr**

SPE SCHOLARSHIPS 2013-2014

PTC would like to congratulate the following students for being the SPE Scholarship recipients of 2013-2014.

SPE Scholarship

- **Olivia George**—BMEN, MATH
- **Elva L. Lugo**—CHEN, research title: "Layer-by-Layer Polymer Membrane for Reaction Assisted Gas Separation"

Dale Walker Memorial Scholarship

- **Ayotomiwa Babalolu**—MEEN
- **Haiqing Yao**—MEEN, research title: "Chemical Functionalization of Nano-materials and Their Applications"

Henry Kahn Memorial Scholarship

- **Tatyana Khamatnurova**—CHEM, research title: "Soluble Reusable Polystyrene Supports for Homogeneous Catalysis"

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

TAMU/SPE Student Chapter

To find out more about the TAMU/SPE Student Chapter, please contact Adriana Pavia at:
adriana.pavia@chem.tamu.edu

Visit the SPE Student Chapter website at:
http://plastics.tamu.edu

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Edited by: Ayotomiwa Babalola & Megan Nicholson

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Q-3 2013