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POLYMER TECHNOLOGY CENTER
TEXAS A&M ENGINEERING EXPERIMENT STATION
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Fourth Quarter 2015
NEWSLETTER
TEXAS A&M UNIVERSITY

Mark Your Calendars for PTC'S upcoming events:

* SCRATCH Consortium = October 7th, 2015, at Troy, Michigan, immediately after TPO Conference
* PTIC Consortium = October 22nd-23rd, 2015 at Texas A&M University, College Station
* APPEAL Consortium = November 5th, 2015 at TEES Office Houston, 15835 Park Ten Place, Suite 160, Houston, TX

Inside the Newsletter...

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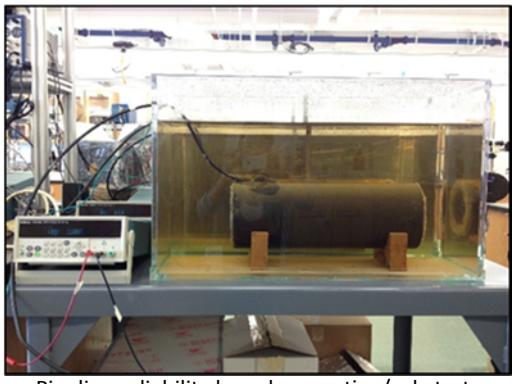
National Corrosion & Materials Reliability Center (NCMRC)
Dr. Homero Castaneda
Materials Science & Engineering

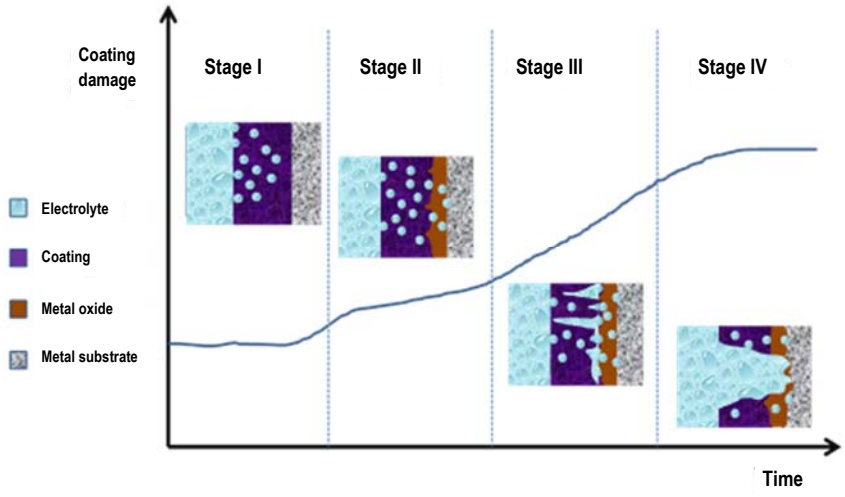
The National Corrosion and Materials Reliability Center (NCMRC) is leading its research and technology efforts for materials degradation and reliability. Corrosion is considered the "trillion dollar problem", turning a natural process into a strategic area for mitigation, control actions, and solutions. NCMRC focuses on research and development in corrosion science and engineering by providing materials selection, mitigation strategies, and lifetime prediction tools through research, education, training, and testing of materials.

The NCMRC partnership with the PTC will combine academic and expert leadership in corrosion protection and mitigation. Both centers are dedicated to preserving infrastructure by developing top-notch technology and establishing strong connection with industry. Joint efforts will leverage ongoing and new advanced materials research. The centers' collaboration will harness the technical and academic strengths of corrosion control and prevention capabilities. Both centers include state-of-the-art facilities that host high-skill personnel in corrosion and materials characterization, selection, and development. The collaboration of the centers will:



Pipeline reliability based on coating/substrate damage evolution

- **Produce world class corrosion education and research**
- **Bridge the gap between fundamental research (science) and technology (engineering)**
- **Give unique solutions and high value to the energy industry**



Damage evolution concept for coating/substrate in corrosive environments

Superior Bacteria-Repellent Surfaces Inspired from Rice Leaves

Dr. Mustafa Akbulut
Dept. of Chemical Engineering

Bacterial fouling is responsible not only for the functional deterioration of numerous surfaces and devices but also for the transmission of infection and disease through such surfaces and devices. Ways to prevent bacterial attachment to material surfaces in the absence of antibiotic agents are currently in great demand due to the growing prevalence of antimicrobial resistant strains. Dr. Akbulut's group has recently demonstrated that surfaces inspired from rice leaves can provide a solution for this demand (Fig. 1). "Rice leaf-like surfaces" (RLLS) were fabricated by facile and templateless self-masking reactive-ion etching (SM-RIE) approach. Bacterial attachment on RLLS was determined under both static and dynamic conditions using Gram-negative *Escherichia coli* O157:H7 and Gram-positive *Staphylococcus aureus* pathogenic bacteria. RLLS surfaces show exceptional bacterial anti-adhesion properties with higher than 99.9% adhesion inhibition efficiency. Furthermore, the optical properties of RLLS were investigated using UV-Vis-NIR spectrophotometry. Different from most other bacterial anti-adhesive surfaces, RLLS demonstrates optical grade transparency (i.e., ≥ 92% transmission, Fig. 2). Dr. Akbulut anticipates that the combination of bacterial anti-adhesion efficiency, optical grade transparency, and convenient single-step method of preparation makes RLLS very attractive candidate as surfaces for biosensors; endoscopes; and microfluidic, bio-optical, lab-on-a-chip, and touchscreen devices.

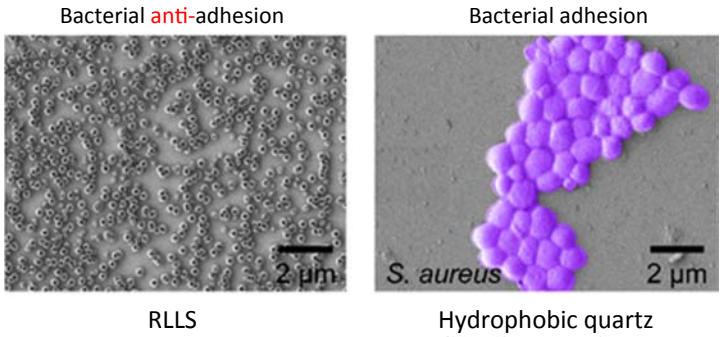


Figure 1. Surfaces inspired from rice leaves demonstrate excellent bacterial repellency.

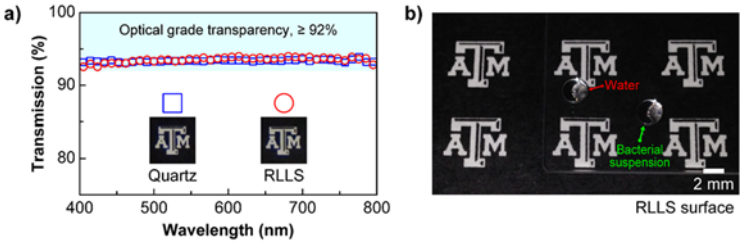
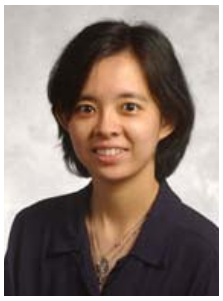


Figure 2. (a) Transmission spectra of pristine quartz (Blue Square) and RLLS (Red Circle) obtained by UV-Vis-NIR spectrophotometry. Inset: photographs of pristine quartz and RLLS surfaces. (b) Wetting behavior of water and bacterial suspension on transparent RLLS surface.

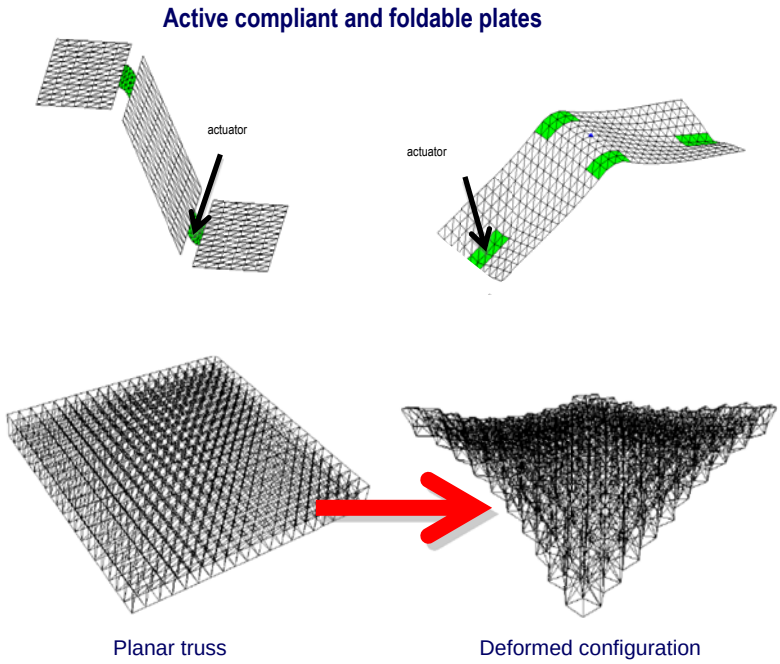
Nonlinear Responses of Polymers and Polymeric Structures

Dr. Anastasia Muliana
Dept. of Mechanical Engineering



Dr. Anastasia H. Muliana is a Professor in the Department of Mechanical Engineering at Texas A&M University. Her research is in the area of mechanics of polymers, composites and multifunctional materials and structures, particularly on nonlinear modeling of coupled heat conduction, moisture diffusion, and deformation in solids, mechanics of electro-active composites, aging and durability of polymers and composites under complex loading and extreme environments, and large-scale nonlinear analysis of active flexible and compliant systems.

Current highlights of her research activities are on developing theoretical and computational models for simulating shape reconfigurations of compliant and foldable structures, activated by non-mechanical (electric field, light, solvent, and thermal) stimuli; and understanding fatigue behaviors in polymers, sandwich composites and piezoelectric materials. Two types of active compliant structures are considered, which are thin/slender planar structures with integrated active materials and truss structures with electro-active members. By stimulating the active components in these compliant structures, various 3D shape reconfigurations can be achieved, which are relevant to many engineering applications, such as biomedicine, morphing air vehicles, deployable space structures, and flexible robots. The important aspects in achieving desired shape reconfigurations are not only in formulating governing equations that describe the deformations of these compliant structures, but also incorporating proper constitutive material models for the different components in the active complaint structures. In this study, nonlinear and time-dependent constitutive models are considered for the constituents under coupled mechanical and non-mechanical stimuli. In addition, her research group is studying creep and cyclic responses of polymers and polymeric composites, including piezoelectric composites, under various elevated temperatures and moisture conditions. The objective is to develop models that are capable of predicting life performance of these materials under various histories of loadings.



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Q-4 2015

Texas A&M Engineering rises to global top 10

Texas A&M Engineering was ranked as one of the top 10 engineering programs worldwide by the Academic Ranking of World Universities compiled by Shanghai Jiao Tong University.

"Global rankings such as this are important because they put an international spotlight on the excellence of our faculty and their research," said John Sharp, chancellor of The Texas A&M University System. "We recognize the importance of engineering in our increasingly technological society and are committed to supporting our faculty as they address the global challenges of tomorrow."

Full story: **goo.gl/VuX9za**

Texas A&M 3rd In "Contribution To The Public Good" Poll

Texas A&M University ranks among the top three colleges in the nation—and first in Texas—in Washington Monthly's new poll, which takes into major consideration factors such as research and service to the nation, as well as academic standing.

In the magazine's 2015 rankings released this week, Texas A&M advanced one place higher than in the magazine's previous annual ranking and is now headed only by the University of California at San Diego and the University of California at Riverside. The University of California at Berkeley and Stanford University round out the magazine's list of the top five institutions based on its editors' assessments.

Full story: **goo.gl/DQ6M44**

Texas A&M Academic Programs Rank Among Best In Worldwide Survey of Universities

Several Texas A&M University academic programs rank among the best in the world out of tens of thousands of universities, according to a widely watched survey compiled by Shanghai Jiao Tong University, which focuses on the top 100 universities globally — with Texas A&M being one of them.

In addition to listing the top 100 universities around the world, the 2015 Academic Ranking of World Universities provides various rankings at the college/discipline level, with Texas A&M faring well in several categories — headed by engineering, in which it is ranked 10th. Texas A&M's Dwight Look College of Engineering has risen rapidly in this prestigious survey, being ranked 15th last year and 22nd in 2013.

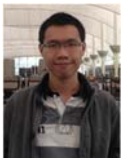
Full story: **goo.gl/IBEYtA**

Dr. J.N. Reddy honored for NAE induction

Dr. J.N. Reddy, professor in the Department of Mechanical Engineering at Texas A&M University, was recently honored by friends, family and colleagues for lifetime professional achievements and induction into National Academy of Engineering (NAE).

Reddy has published 19 books, 530 journal papers, and has received professional awards, including the Mindlin Medal and Distinguished Visiting Professor recognitions from universities in Finland, Brazil, Spain, New Zealand, Hong Kong, and China.

Full story: **goo.gl/IJ466S**



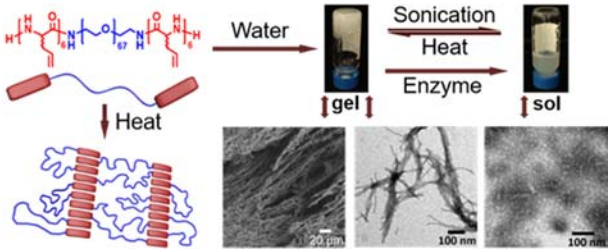
Stimuli-responsive supramolecular hydrogels

Xun He
Department of Chemistry
Polymeric Smart Materials

Xun He, a graduate student under the supervision of Prof. Karen L. Wooley at Texas A&M University, has developed a responsive hydrogel system that exhibits sol-gel transition behavior in response to a variety of stimuli.

Gels with stimuli-triggered sol-gel transitions have found broad applications in controlled drug release, tissue engineering, and selective sensing fields, because the stimuli-triggered sol-gel transition process enables the localization and breakdown of the soft materials with spatial and temporal precision, which is of high significance for controlled material fabrication, implantation and degradation.

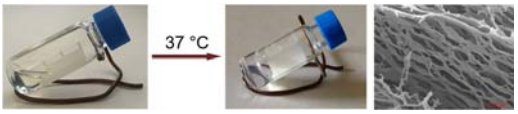
To prepare a stimuli-responsive hydrogel, a triblock polymeric gelator has been designed and synthesized. The reversible macroscopic sol-to-gel transitions triggered by heat were correlated with the formation of nanofibrils driven by supramolecular assembly of oligopeptide into β-sheets and dehydration of poly(ethylene glycol). On the other hand, the reversible gel-to-sol transitions triggered by sonication were correlated with the formation of spherical aggregates, due to the disruption of long-range interactions of nanofibrils by sonication.



Scheme was adapted with permission from The Royal Society of Chemistry

Particularly, a thermo-triggered gelation system has attracted intense interest for injectable biomedical applications via a minimally invasive administration. For example, drugs or cells can be mixed into the polymer aqueous solutions at lower temperature. After being injected into the targeted site, the increase of temperature triggers the gel formation and promotes the cohesion of the mixture, which can act as a drug release system or a cell growing matrix.

In order to be suitable for injectable bio-application, the sol-to-gel transition temperature (Tgel) of the above system was successfully and finely optimized recently through structural control, and the Tgel can be controlled at a precise degree in the range between 25 °C and 37 °C. This hydrogel system has demonstrated the capability to keep cells alive in the gel matrix for over a month after gelation in-situ at 37 °C. More detailed investigations for nerve repair and photolithography applications are currently underway.



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SPE South Texas section

Howdy! The SPE student chapter at TAMU has an exciting and eventful year planned that began with a room-packed meeting held on September 7 where Dr. Robertson presented an insight and interesting talk on biorenewable polymers for energy and the environment. In addition to amazing speakers, we have also planned fun outreach events and plant tours for our SPE members this upcoming year. We would like to thank the SPE South Texas Chapter and Dr. David Hansen for the continued support through donations and scholarships. Additionally, we are excited to announce we were awarded a 2015 Outstanding Student Chapter Award at ANTEC this past March. Our chapter will continue to strive for this prestigious award for the 2015-2016 year. Please join us in our upcoming meetings and activities.

Upcoming events:

- October 5th: Seminar by Dr. Ling Zhang-Watson, Dow Chemical
- October 24th: Chemistry Open House & Science Exploration
- October 30th: Ineos plant tour (SPE national members only)
- November 2nd: Seminar by Dr. David Jack, Baylor University
- December 5th: Expanding Your Horizons
- December 10th: Halliburton plant tour (SPE national members only)

All of our monthly meetings will be held in the chemistry building (CHEM), room 2122, at 6 pm and are open to all students, staff and faculty. For more information, feel free to contact me at:

jennifer.summerhill@mail.chem.tamu.edu

Thanks and Gig 'em!
Jenn Summerhill Zigmond
SPE President
TAMU Student Chapter

Polymer Specialty Certificate Updates

Students that have applied for the Polymer Specialty Certificate	45
Students that have received the Polymer Specialty Certificate	31

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

PTC Newsletter prepared by: Isabel Cantu
Edited by: James Chrisman & Megan Nicholson

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