PTC
POLYMER TECHNOLOGY CENTER
TEXAS A&M ENGINEERING EXPERIMENT STATION
Phone: (979) 458-0918 Website: http://ptc.tamu.edu

Second Quarter 2015
NEWSLETTER
TEXAS A&M UNIVERSITY

Mark Your Calendars for PTC'S upcoming events:

* APPEAL Consortium = TBA at Texas A&M University, College Station, TX
* SCRATCH Consortium = October 22nd, at Texas A&M University, College Station, TX
* PTIC Consortium = October 22nd-23rd at Texas A&M University, College Station

Inside the Newsletter...

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SCRATCH Consortium

The 29th Scratch Behavior of Polymers consortium meeting was held on March 25th, 2015 at the SPE ANTEC in Orlando, Florida. Representatives from 3M, Advanced Composites, Apple, Avery Dennison, ExxonMobil, Imerys Talc, Kaneka, Nissan and SABIC attended the meeting. Recent research efforts carried out by the Polymer Technology Center on scratch and mar behavior of polymeric materials, films and coatings were presented. Extensive analysis on scratch and mar behavior of polymers, and multi-layered polymeric coatings *via* FEM modeling was presented to gain fundamental knowledge of the different mechanisms involved. A recent study on scratch behavior of polymeric films and laminates was discussed, as well. A quantitative characterization method for evaluating mar visibility resistance in polymers was proposed. Development of a physics-based model on polymer scratch behavior and design of scratch resistant polymers were also presented in the meeting. Research priorities were set for the next consortium meeting to be held in November 2015 at Texas A&M University.

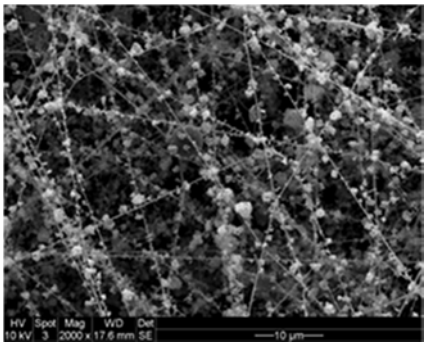
Dr. Yossef Elabd
Department of Chemical Engineering
Advances in Fuel Cell Car Technology

Dr. Elabd, professor in the Artie McFerrin Department of Chemical Engineering at Texas A&M University, has developed two fuel cell vehicle platforms for both present day enhancements and future innovation.

Electrochemical energy and polymer research unite in new ways to deliver best-case power scenarios behind the wheel, specifically under the hood. Environmentalists and road aficionados alike have applauded the production of fuel cell vehicles, but to sustain the appeal and increase the market, production costs need to fall.

A fuel cell is a device that produces electric energy as the direct result of a chemical reaction. The fuel cell car is powered by the constant chemical interaction of hydrogen fuel from the tank and oxygen that is pulled from the air. Using positive (anode) and negative (cathode) electrodes, protons are moved by an electrolyte and ultimately converted into energy. The source and form of the electrodes and electrolytes can vary and this is the basis of Elabd's findings.

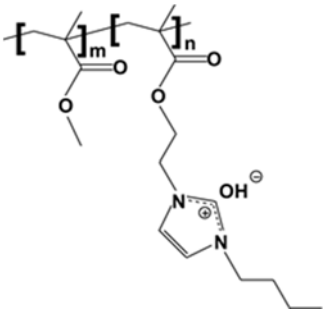
The fuel cell car manufactured today uses a proton exchange membrane (PEM) electrolyte for its platinum-based electrodes, the same design that was used in previous Gemini space missions.



Caption: Ultra-low platinum nanofiber-nanoparticle electrode

Elabd has discovered that the amount of platinum needed for electrode manufacturing can be significantly reduced, and thus the production costs dramatically minimized. His patent-pending research establishes that a fuel cell can perform optimally with only 16 percent of its previous platinum requirements. New polymer nanofiber-platinum nanoparticle electrodes are reliable and enduring, he said.

Another course of action, Elabd envisions, is the creation of a fuel cell that does not require platinum. This would be "the holy grail of portable power."



Caption: Robust, stable hydroxide conducting AEM

The alkaline exchange membrane (AEM) fuel cell model uses a polymer material as its electrolyte. Past developers encountered roadblocks (chemical degradation) in the introduction of a polymer to an AEM fuel cell, yet Elabd's research group has achieved a patented breakthrough in developing a polymer electrolyte that is chemically stable to the hydroxide ions, highly conductive in moving the ions across the fuel cell and very robust.

"The same material if modified a little bit can be used in batteries as a replacement to current lithium-ion charged batteries, making it a solid state with the benefit of longer stability and much increased safety," Elabd said.

Whether the approach is to reduce platinum requirements or to implement a polymer electrolyte, both solutions appear to have passed the proof of concept phase.

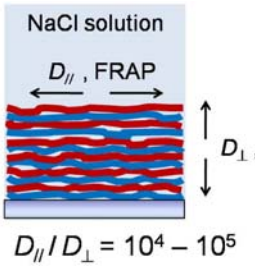
"I just want to drive my car with water vapor coming out the back of it," Elabd said.

Environmentalists everywhere agree.

Dr. Svetlana Sukhishvili
Department of Materials Science and Engineering
Stimuli-Responsive Polymer Assemblies

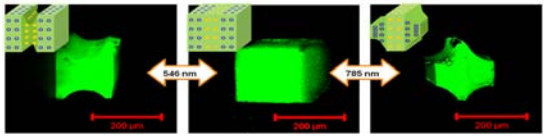
Our research is focused on new responsive materials with programmed response to environmental stimuli (pH, temperature, light, or the presence of biological molecules). Such materials are of growing interest in biomedical, sensing and actuation applications. In our approach, we go all the way from synthesis of polymers and polymer-inorganic hybrid building blocks to their rational assembly using the layer-by-layer (LbL) technique.

We explore the principles of layering polymers and nanoparticles at surfaces and mobility of assembled chains in assembled structures. One exciting finding is an unexpectedly strong (factor of 104 -105) anisotropy in chain motion within linearly deposited polyelectrolyte multilayers. Chains also disentangle during assembly within stratified LbL films, and demonstrate Rouse-like mobility even for polymers with extremely high molecular weights. These findings are good news for applications of LbL that involve long-term exposure of films to salt solutions, as they illustrate robust persistence of film layering.

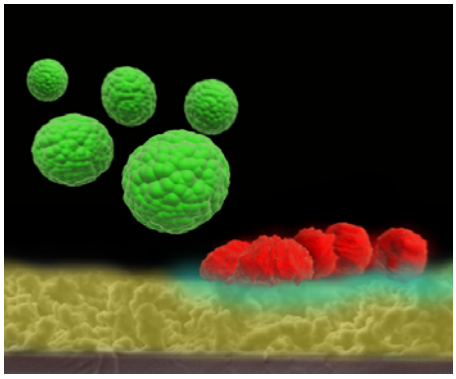


Anisotropic diffusion of polyelectrolytes within LbL films.

Inclusion of inorganic particles (such as plasmonic nanoparticles and clay nanosheets, among others) enables nanocomposite assemblies with properties not achievable with all-polymer assemblies, such as improved mechanical, permeability properties and/or optical responses properties. Assembly of polymer-modified solid and hollow shell gold nanoparticles within different material strata affords a new type of responsive nanocomposite materials with optical controlled shape, useful for controlled delivery and actuation.



An important application of responsive all-polymer and polymer nanocomposite assemblies is in controlled drug release. A new generation of smart antibacterial films is being developed using LbL responsive coatings. These films respond to the presence of bacteria, i.e. the fact that hospital-relevant infection-related bacteria, such as *Staphylococcus aureus* and *Staphylococcus epidermidis*, produce lactic acid and acidify the environment. The local drop in pH in the vicinity of bacteria triggers release of antibacterial agents from our "self-defensive" coatings. These coatings deliver antimicrobial agents only where and when needed and provide highly efficient antibacterial protection of biomedical devices.



Besides fundamental studies of LbL films and the development of types of responsive coatings, we pursue research on surface modification for controlled adhesion and sensing applications, and explore polymer assembly in bulk solutions.

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TEXAS A&M UNIVERSITY

Michael K. Young Sole Finalist for President of Texas A&M

Michael K. Young

"With Mike Young as our President, Texas A&M will make great strides toward our goal to become the best public university in the country," said Chancellor Sharp. "His stature as one of the top 10 university presidents in America and his background at major research universities will help take us to new heights, and I am honored to have Mike and his wife, Marti, become part of the Texas A&M family."

Full story: **http://today.tamu.edu/2015/02/03/michael-k-young-named-sole-finalist-for-president-of-texas-am/**

Texas A&M AgriLife Retains No. 1 Ranking

For the second year in a row, Texas A&M AgriLife Research was ranked No. 1 in agricultural sciences expenditures according to the National Science Foundation.

Full story: **http://today.tamu.edu/2015/02/18/texas-am-agrilife-retains-no-1-ranking-in-agricultural-research-expenditures/?utm_source=today&utm_medium=email&utm_campaign=2015-02-25&utm_content=Texas%20A&M%20AgriLife%20Retains%20No.%201%20Ranking**

Texas A&M Among Top Four "Go Green" Universities

Texas A&M University ranks among the nation's top four "go green" institutions, according to a survey conducted by SaveOnEnergy.com that assessed the sustainably efforts of the 25 universities that were included in the Associated Press' initial 2014 football rankings.

Full story: http://today.tamu.edu/2015/01/23/texas-am-among-top-four-go-green-universities/?utm_source=today&utm_medium=email&utm_campaign=2015-02-04&utm_content=Texas%20A&M%20Among%20Top%20Four%20%22Go%20Green%22%20Universities

Compound found in broccoli may successfully treat prostate cancer

Broccoli is frequently touted as a food that can help prevent cancer, but could it also be used to treat it?

Full story: http://research.tamu.edu/2015/01/16/compound-found-in-broccoli-may-successfully-treat-prostate-cancer/?utm_source=today&utm_medium=email&utm_campaign=2015-02-04&utm_content=Compound%20Found%20In%20Broccoli%20May%20Treat%20Prostate%20Cancer

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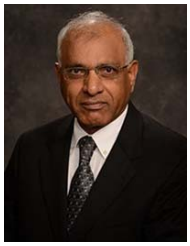
Dr. J.N. Reddy elected to prestigious National Academy of Engineering



The National Academy of Engineering (NAE) has named Dr. J.N. Reddy, professor in the Department of Mechanical Engineering at Texas A&M University, among its 2015 class of new members. Reddy, a Distinguished Professor, Regents Professor and holder of the Oscar S. Wyatt Endowed Chair, was recognized for his contributions to composite structures and engineering education.

Reddy came to Texas A&M as an endowed chaired professor in 1992, bringing his passion for education and research to enrich the Department of Mechanical Engineering. He is the author of nearly 500 journal papers and 18 books (several with second and third editions) on energy principles, variational methods, plates and shells, composite materials, mechanics of solids, and the finite element method and its applications. He has delivered more than 120 plenary, keynote or general invited lectures at international conferences and institutions, taught over 90 short courses, and advised 32 postdoctoral fellows and research visitors and over 100 graduate theses.

Full story: http://engineering.tamu.edu/news/2015/02/09/reddy-elected-to-prestigious-national-academy-of-engineering

Dr. Chunxia Zhao Visiting Scholar from China

Howdy, my name is Chunxia Zhao. I am currently a teacher at Southwest Petroleum University (SWPU) in Chengdu, China. I joined the Polymer Technology Center (PTC) on May 2014 as a visiting scholar and have been working here for almost one year.

I have been conducting collaborative research with Prof. Sue and involving Polymer Toughening and other research. We our currently working the synergistic effect between organic modified graphene oxides and nylon microspheres in the toughening of thermosetting resins. I am so excited that I can learn new skills, and master so many new polymer testing methods during my research here. This work experience is very important for my career, and my research group back home.

I would like to thank Prof. Sue and all of my PTC colleagues for their advice and assistance during my stay. I also want to acknowledge the financial support of the China Scholarship Council (CSC) for providing the necessary funds for this valuable opportunity.

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SPE ANTEC-Orlando, FL

The Texas A&M Student Chapter of SPE received 3rd place for the 2015 Outstanding Student Chapter Award at ANTEC in March. The award was accompanied by a $150 donation.

(left to right) Kevin Laux, Lauren Link, Adriana Pavía-Sanders, Jeniree Flores, Haiqing Yao, Joseph Baker

Polyolefin Conference—Houston, TX

SPE student chapter members attended the Polyolefin Conference, February 22nd—25th.

Kevin Laux received honorable mention for his poster titled "Wear of High Performance Polymers under Multidirectional Fretting Conditions"

Kevin Laux, and Daria Reid also received scholarships at the Polyolefin conference.

From Left to Right: Daria Reid (Chemical Engineering); Lauren Link (Material Science); Kevin Laux (Mechanical Engineering); Jeniree Flores (Chemistry); Jenn Summerhill (Chemistry)

Society of Plastics Engineers (SPE) Automotive TPO Global Conference 2014 Scholarship

"Marouen Hamdi, a PhD student in the Department of Mechanical Engineering, won the Society of Plastics Engineers (SPE) Automotive TPO Global Conference 2014 Scholarship. After being qualified amongst the finalists, Marouen won the first $5000 scholarship award in the second round of the competition. He will give a presentation at the 2015 SPE Automotive Global Conference held in Troy, Michigan in October 4-7 2015. Under the supervision of Dr. H.J. Sue, Marouen's research focuses on scratch and mar resistance of polymeric surfaces, including TPOs."

Polymer Specialty Certificate Updates

Students that have applied for the Polymer Specialty Certificate	35
Students that have received the Polymer Specialty Certificate	31

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

TAMU/SPE Student Chapter

To find out more about the TAMU/SPE Student Chapter, please contact Lauren Link at:

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

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