



### Mark Your Calendars for upcoming events:

- \* Scratch Consortium = October 3rd  
Detroit Michigan
- \* APPEAL Consortium = November 1st  
Texas A&M University, College Station, TX
- \* PTIC Consortium = November 1st-2nd  
Texas A&M University, College Station, TX

#### Predicting Nonlinear Viscoelastic Response of Biodegradable Polymers

Anastasia H. Muliana, Mechanical Engineering

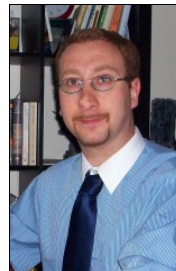
Using biodegradable implants eliminates the need for additional surgical interventions to remove the implants at the end of their functional life. Continue on page 2 for complete story.



#### Multifunctional Carbon Nanofiber based Hierarchical materials

Mohammad Naraghi, Aerospace Engineering

In Dr. Naraghi's lab at Texas A & M University, (Multifunctional Nanomaterials lab), CNFs are fabricated by thermal stabilization and carbonization of electrospun polymeric nanofibers. See page 2 for full story.



PTC is pleased to announce the newest APPEAL Consortium member, please welcome RTP Company.



### Inside the Newsletter...

Page 2

PTC Faculty Research Highlights

Page 3

TAMU News / PTC News

Page 4

SPE Scholarships

SPE Student Officers for 2012-2013

Faculty Directory

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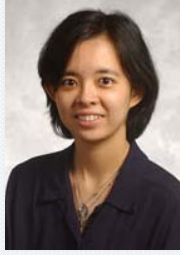
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### Predicting Nonlinear Viscoelastic Response of Biodegradable Polymers

Anastasia H. Muliana, Mechanical Engineering



Biodegradable polymers such as poly-glycolic acid (PGA) and poly-lactic acid (PLLA) are appealing in many biomedical applications such as sutures, stents, and tissue engineering. Some sutures and stents are kept in place temporarily in order to provide mechanical support for the wounded tissue until it heals. In such cases, using biodegradable implants eliminates the need for additional surgical interventions to remove the implants at the end of their functional life. Another advantage of using biodegradable polymers is that it is possible to control the rate of degradation by altering the macromolecular structure of the polymers. The degradation mechanism in these polymers is primarily due to hydrolysis: Water diffuses through the biodegradable implants, breaking the long polymer chains, which reduces the molecular weight, and eventually leads to loss of mass from the solid polymers into water soluble materials. For sutures and stents that provide mechanical support for the wounded tissue, it becomes necessary to understand and predict the continuous changes in the mechanical performance of the biodegradable polymers over a period of time.

We study the effect of time-dependent and field coupling response on the degradation of biodegradable polymers and develop a constitutive model of viscoelastic biodegradable polymers. Figure 1 illustrates the uniaxial tensile quasi-static and stress relaxation behaviors of PLLA at dry condition. The nonlinear integral model is used to capture the response of the PLLA polymer. The main intention is to examine the effect of viscoelasticity on the degradation of polymers undergoing diffusion of water. Thus, the polymers are subject to three different types of loading histories: due to prescribed mechanical loading, diffusion of water, and degradation that occurs over a period of time, with a strong coupling between the deformation, degradation, and diffusion response. We also examine the effect of viscoelastic arterial wall on the degradation response of polymeric stent. Figure 2 depicts the degradation responses of PLLA stent with and without considering the effects of viscoelastic the arterial wall during cyclic loading. The maximum stage of degradation is one, which indicates complete degradation. Figure 3 illustrates a time-dependent degradation in a polymeric stent of a mesh tubular structure. The regions with a high degradation level (red color) are critical that could lead to stent collapses. While the stress, strain, strain rate and other mechanical fields in the stents depend on the material properties and loading condition, these mechanical inputs accelerate the degradation in the stent, changing the properties of the stents at several locations and eventually changes the stress, strain, strain rate and other mechanical fields as the stent degrades.

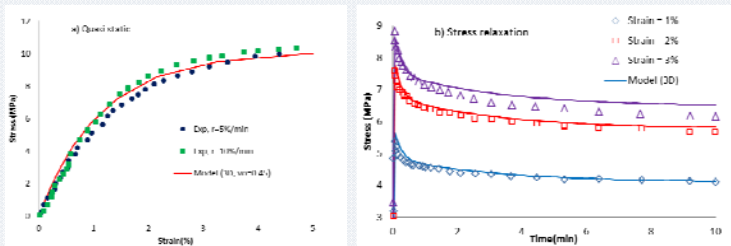


Figure 1 Uniaxial tensile quasi-static and stress relaxation behaviors of PLLA at dry condition (Experimental data are obtained from Soares, JS (2008) "Constitutive Modeling for Biodegradable Polymers for Applications in Endovascular Stents," PhD Dissertation, Mechanical Engineering Texas A&M University).

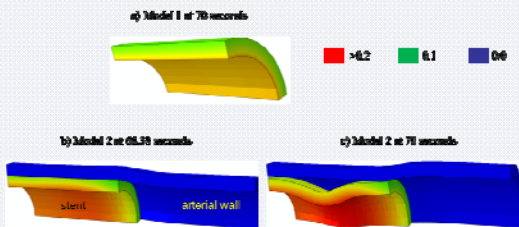


Figure 2 Degradation behavior in PLLA tubular stent in contact with the viscoelastic arterial wall (see Muliana and Rajagopal, 2012 "Modeling the Response of Nonlinear Viscoelastic Biodegradable Polymeric Stents," Int. J Solids and Structures, 49(7-8), pp. 989-1000)

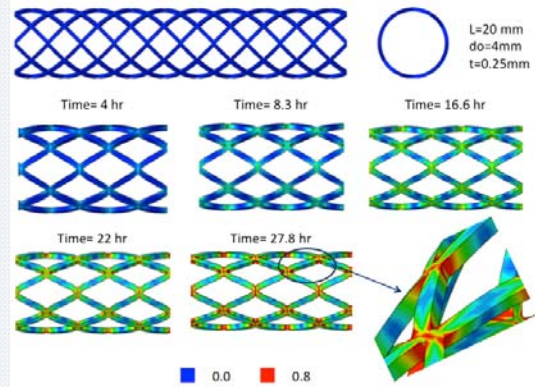


Figure 3 PLLA stent (Palmez design) at different stage of degradation

### Multifunctional Carbon Nanofiber based Hierarchical materials

Mohammad Naraghi, Aerospace Engineering



Dr. Naraghi's research efforts are aimed at developing the next generation of advanced multifunctional nanocomposites with exceptional mechanical performance, by incorporating carbon nanofibers (CNFs). In Dr. Naraghi's lab at Texas A & M University, (Multifunctional Nanomaterials lab), CNFs are fabricated by thermal stabilization and carbonization of electrospun polymeric nanofibers. Through their highly stable crystalline structures, formed at high temperatures (as high as +1000°C), these materials offer remarkable mechanical properties and thermal stability, and excellent electrical conductivity. Dr. Naraghi has developed techniques to fabricate weavable CNF yarns and nanocomposites with controlled CNF alignment and length, which are suitable for a wide range of applications from interceptor body and vehicle armors to thin films with tailorable configurations for micro air vehicle wings. His research includes multiscale material synthesis and characterization by utilizing Nanomechanical characterization techniques and in situ experiments.

Carbon nanofibers with diameters of 100 nm to 1 μm are fabricated in the Multifunctional Nanomaterials Lab by carbonization of electrospun PAN nanofibers

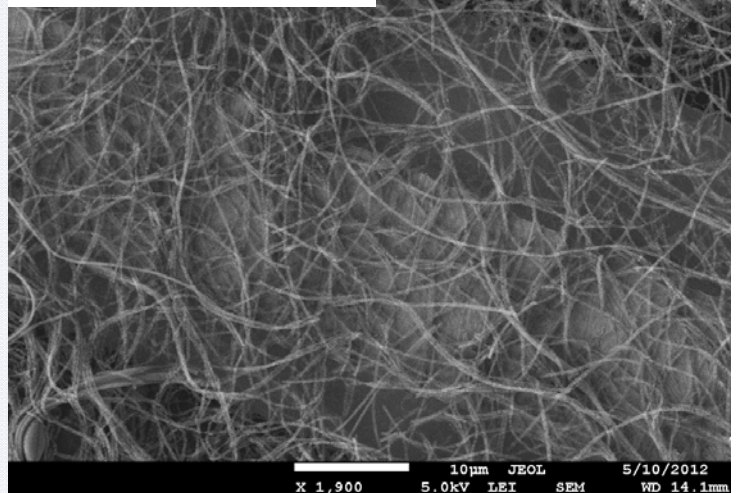


Figure 1



## TAMU NEWS

### Spring Graduating Class Projected to set Record

A record graduating class – expected to total approximately 7,300 - is being reported for Texas A&M University this spring, with the institution scheduling five commencement ceremonies in Reed Arena May 11-12 to accommodate all the degree candidates.

Read the full story at:



[http://tamutimes.tamu.edu/2012/04/30/record-spring-graduating-class-projected-for-texas-am-about-7200/?utm\\_source=tamutimes&utm\\_medium=email&utm\\_campaign=2012-05-11](http://tamutimes.tamu.edu/2012/04/30/record-spring-graduating-class-projected-for-texas-am-about-7200/?utm_source=tamutimes&utm_medium=email&utm_campaign=2012-05-11)



### Texas A&M To Launch '14 Days of SEC' Social Media Campaign

Texas A&M will officially join the Southeastern Conference on July 1, but the weeks leading up to the move will be filled with a social media campaign that celebrates the storied athletic conference and its member institutions.

Read the complete story at:

<http://tamutimes.tamu.edu/2012/06/12/texas-am-to-launch-14-days-of-sec-social-media-campaign/>

### TAMUG Ships Have Colorful History

Thousands of Sea Aggies from Texas A&M University at Galveston have earned their sea legs on different training vessels through the years, and several of those ships had colorful histories.

The latest version is the General Rudder, named June 6 for legendary Texas A&M graduate James Earl Rudder, who commanded the fabled Army Rangers during their scaling of Pointe Du Hoc on D-Day, June 6, 1944, on the French coast. Rudder went on to become president of Texas A&M from 1959 until his death in 1970. He is widely credited with taking the school to new heights, such as allowing women to attend the formerly all-male college and making membership in the Corps of Cadets voluntary.

Full story: <http://tamutimes.tamu.edu/2012/06/06/tamug-ships-have-colorful-history/>



The General Rudder, named for Texas A&M graduate James Earl Rudder, who commanded the Army Rangers during their scaling of Pointe Du Hoc on D-Day

### Aggies Send 19 Swimmers to Olympic Trials

Seeking spots on the 2012 U.S. Olympic team and a trip to the London Olympic Games will be sophomore Ashley Adams, sophomore Camille Adams, senior John Ariens, freshman Kelli Benjamin, senior Alyssa Conner, junior Meagan Hairston, senior Anna Heller, sophomore Sarah Henry, sophomore Breeja Larson, senior Megan Latone, sophomore Caroline McElhany, junior Maureen McLaine, freshman Emily Neubert, junior Christine Regone, junior Jaclin Rehiring, 2011 senior Maria Sommer, senior Megan Onstott, freshman Sammie Bosma and sophomore Wylie Escobedo.



Full story at: [http://www.aggieathletics.com/ViewArticle.dbml?DB\\_OEM\\_ID=27300&ATCLID=205461463](http://www.aggieathletics.com/ViewArticle.dbml?DB_OEM_ID=27300&ATCLID=205461463)

## PTC NEWS

The PTIC Student Poster Session received 15 entrees for the competition. The recipients to the competition are listed below with their respective poster titles. PTC would like to congratulate these students and all the students that participated in this event. For those that did not place, there will be another opportunity in the Fall.



### Polymer Technology Industrial Consortium (PTIC) Student Poster Session April 19-20, 2012

Place	Name	Poster Title
1st	Sandani Samarajeewa	"Development of degradable shell crosslinked nanoparticles for the delivery of nucleic acids"
2nd	Mohammad Hossain	"Effect of Asymmetric Constitutive Behavior on Scratch-induced Deformation in Polymers"
3rd	Casie Hilliard	"Polymer-Coated and Modified Silica: A Solid-State NMR Study"

PTC held its semi-annual meetings for the following Consortia with the respective attendance as follows:

- Advancing Performance Polymers in Energy Applications (APPEAL) - April 18, 2012

- \*Baker Hughes
- \*Cameron
- \*Hoerbiger
- \*RTP Company
- \*Single Buoy Moorings (SBM)

- Scratch Behavior of Polymers Consortium (SCRATCH) - April 19, 2012

- \*Advanced Composites, Inc.
- \*Dow Chemical Co.
- \*ExxonMobil
- \*Imerys Talc
- \*KANEKA
- \*MyTex Polymers
- \*SBM Atlanta
- \*Surface Machines

- Polymer Technology Industrial Consortium (PTIC) - April 19-20, 2012

- \*Advanced Composites, Inc.
- \*Baker Hughes
- \*Dow Chemical
- \*ExxonMobil
- \*Flint Hills Resources, LP
- \*Imerys Talc
- \*Kaneka
- \*MyTex Polymers
- \*Polymics, LTD
- \*Natural Composites Inc.
- \*Spartech Color & Specialty Compounds
- \*SPE
- \*The Research Valley Partnership, Inc.
- \*Total American Services, Inc.
- \*Toyo Inc. America, LLC
- \*Westlake



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## SPE SCHOLARSHIP RECIPIENTS FOR 2012-2013

### Dale Walker Memorial Scholarship

- **Timi Ogunbekun, MEEN**
- **Bagrat Grigoryan, BMEN**

### Henry Kahn Memorial Scholarship

- **Amanda Cain, MSEN** — "Antiflammable Behavior of Nanostructured Thin Films Using Layer-by-Layer Assembly"
- **David Hagen, MEEN** — "Gas Barrier of Layer-by-Layer Thin Film Assemblies"

### SPE Scholarship

- **Kevin Laux, MEEN** — "Mechanics of Multidirectional Wear and Transfer Film Deposition in Polyetheretherketones (PEEK)"
- **Danielle Policarpio, CHEM** — "Fundamental Investigation of Crystalline Polymers When Confined Nanoscopically Within Various Supramolecular Assemblies"



## 2012-2013 SPE Student Officer Nominations

Position	Name	Dept	E-Mail
President	Jacqueline Pope	CHEM	<a href="mailto:jacqueline.pope@mail.chem.tamu.edu">jacqueline.pope@mail.chem.tamu.edu</a>
Vice-President	Kevin Laux	MEEN	<a href="mailto:laux.kevin@gmail.com">laux.kevin@gmail.com</a>
Secretary	Adriana Pavia	CHEM	<a href="mailto:adriana.pavia@mail.chem.tamu.edu">adriana.pavia@mail.chem.tamu.edu</a>
Treasurer	Casie Hilliard	CHEM	<a href="mailto:chilliard@mail.chem.tamu.edu">chilliard@mail.chem.tamu.edu</a>
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MSEN (G)	Amanda Cain	<a href="mailto:amandacain@gmail.com">amandacain@gmail.com</a>

*PTC would like to congratulate the new SPE officers and scholarship recipients for 2012-2013!!!*

### Polymer Specialty Certificate Updates

Students that have applied for Certificate	26
Students that have received the Polymer Specialty Certificate	20
For more information: <a href="http://ptc.tamu.edu/certificate.html">http://ptc.tamu.edu/certificate.html</a>	



Jacqueline Pope, SPE Student Chapter President

### TAMU/SPE Student Chapter

To find out more about the TAMU/SPE Student Chapter please contact Jacqueline Pope at: [jacqueline.pope@mail.chem.tamu.edu](mailto:jacqueline.pope@mail.chem.tamu.edu)

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

