

## THERMAL ANALYSIS EXPERT SETS EXAMPLE IN SENSITIVITY, SPEED AND SERVICE

### COMPOSITES UPDATE

When selecting a lab to perform chemical characterization studies, Stephen J. Bennison, Ph.D., of Kuraray America, Inc., says it was the "3 Ss," that convinced him to bring Kuraray's polymers to the University of Delaware's Center for Composite Materials (CCM) for testing.

Those three Ss stand for sensitivity, speed and Steve.

Steve Sauerbrunn, Ph.D., that is.

A leading expert on thermal analysis, Bennison considers Sauerbrunn a "tremendous resource" for his ability not only to run the equipment needed to analyze Kuraray's materials, but to interpret that data and help re-design the experiment, as needed, in order to understand the materials' behavior fully.

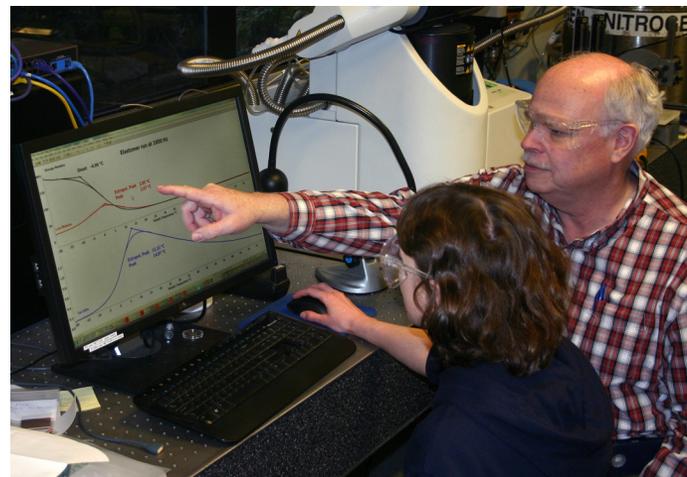
Bennison appreciates Sauerbrunn's sensitivity to the accuracy of data that comes out of his chemical characterization lab at CCM. In fact, Sauerbrunn asserts he is committed to only good, accurate data leaving his lab and won't charge for bad data.

He produces results, quickly, too, adds Bennison, which leads to the S for speed. Sauerbrunn's team typically turns around results in days, which Bennison describes

as "unheard of" in the field. Sauerbrunn recognizes that research can't progress until the client receives results from the last batch of samples.

Says Bennison, "Steve has accelerated our project deliverables by over one year."

Although he only officially joined the CCM staff two years ago, Sauerbrunn is no stranger to campus. He earned his Ph.D. in chemistry from UD in 1984. And, in his previous position as a technical manager with Mettler Toledo, he



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## TOP STORY

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taught UD students how to use the CCM equipment as part of the company's consortium membership.

### 4TH "S" – SERVICE ON INDUSTRY BOARDS

Sauerbrunn is widely published and nationally renowned in the field of thermal analysis through his volunteer leadership positions with leading industry-related professional organizations, including the American Society for Testing Materials (ASTM), the North American Thermal Analysis Society (NATAS), the Society for the Advancement of Material and Process Engineering (SAMPE) and the Thermal Analysis Forum of the Delaware Valley (TAFDV).

As chair of ASTM's subcommittee E37.01 on calorimetry and mass loss, he is responsible for all standards related to differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). Standards are reviewed every seven years and he writes test methods for new equipment that become ASTM standards.

"Many professionals don't realize they can participate in ASTM this way," says Sauerbrunn, encouraging others to get involved. "I can see the test measures improve over time because I'm responsible for them."

At the upcoming SAMPE meeting in May, Sauerbrunn will teach a hands-on tutorial session, with a twist in format.

"The challenge in training people hands-on with analytical instruments is that running tests takes a long time," he explains. Participants will leave Sauerbrunn's three-hour lecture armed with a

checklist they'll use to visit vendors in the exhibit hall who have already run the tests ahead of time, saving participants from having to wait for data.

"We're not only giving them a lecture, but the chance to put their hands on the equipment, learn how to produce the experiment, hit "run," and analyze the data all at a three-day conference," says Sauerbrunn.

A NATAS member for 25 years, and now treasurer for that organization, Sauerbrunn is proud to have convinced the organization to bring its annual conference to UD's Clayton Hall in 2017. A unique feature of this conference is that, because it will be held in August when campus is relatively empty, participants will have the low-cost option of renting dormitory rooms to cut down on travel expenses.

"We hope to get a lot more students to join us this way," explains Sauerbrunn, who projects a large undergraduate turnout from regional colleges and universities, leading many to consider UD for graduate studies once they see the campus and capabilities.

Through TAFDV, a regional subset of NATAS, Sauerbrunn is also helping to coordinate a short course at UD this summer, offering a variety of speakers and hands-on opportunities, again at reasonable cost for students and those from companies with smaller budgets.

While not a professor, Sauerbrunn is always looking for the opportunity to teach—whether undergraduate or graduate students, or industry professionals—and to advance the field of thermal analysis.

## TOP STORY

(Continued)

"CCM is truly a center of education," he says. "We're not just educating students here on campus, but we're broadening our sphere to educate undergrads and graduate students, as well as those just starting out in industry who have been handed a lab and told 'You're now responsible for this!'"

"We look for any chance to teach!" he says. And the many hats this thermal analytical expert wears both within CCM for students and industry clients and consortium partners—as well as for colleagues regionally and nationwide through his volunteer leadership efforts—only serves to underscore that fact.

For more information on how Sauerbrunn's chemical characterization lab can bring sensitivity and speed to your data analysis with such thermal-analytical capabilities as DSC, TGA, Dynamic Mechanical Analysis, hot stage microscopy, thermal diffusivity, rheology and even the chemical analysis tool Fourier Transform Infrared Spectroscopy, contact him through CCM at 302-831-8149 or by email at [sauerbru@udel.edu](mailto:sauerbru@udel.edu).



# Visit CCM at Booth L35



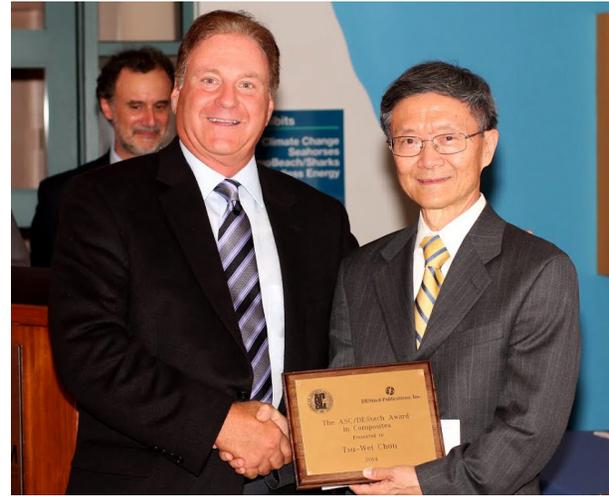
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## NEWS

### 2014 AMERICAN SOCIETY FOR COMPOSITES HONORS

#### ASC/DESTECH AWARD IN COMPOSITES

The American Society for Composites recognized Tsu-Wei Chou, Pierre S. du Pont Chair of Engineering, with the 2014 ASC/DEStech Award in Composites during the society's 29th Annual Technical Conference Sept. 8-10. Held at the University of California, San Diego, in La Jolla, the conference was a joint meeting between the ASC and the Japan Society for Composite Materials and marked the continued collaborative research efforts between the United States and Japan. Chou, who joined the UD faculty in 1969, is known worldwide for his pioneering composites work. A founding member of the Center for Composites Materials (CCM), he has worked with a wide variety of materials, including hybrid composites, textile structural composites, flexible composites and nanocomposites. He also is noted for his research team's development of novel applications for carbon nanotube-based continuous fibers in energy storage devices and composites.



#### RESEARCH SCHOLARSHIP PROGRAM

The American Society for Composites awarded University of Delaware mechanical engineering doctoral student Subramani Sockalingam the 2014 Ph.D. Research Scholarship. The scholarship is awarded based on the nominations from faculty advisors who are also ASC members. The first part is a grant of \$1000 to the student to support the student's research. The second part is reimbursement of travel expenses up to \$1250 including conference registration to help the student attend the annual ASC Technical Conference and accept the award at the conference banquet.

Sockalingam, a fourth-year doctoral student studying mechanical engineering, conducts research at CCM focused on modeling high performance polymer fibers and fiber-matrix interface subjected to high velocity impact and bridging length scales from fibers to yarns. He hopes to pursue a research career in the automotive or aerospace industry, or at a national laboratory, and said "ASC is one of the premier societies in the field of composites and I feel honored to receive this award. I would like to thank my advisors Dr. Gillespie and Dr. Keefe for nominating me".



## NEWS

### THE STUDENT SIMULATION CHALLENGE

The second ASC student simulation challenge was conducted at the 29th ASC conference at San Diego. Two University of Delaware mechanical engineering doctoral students working in the Center for Composite Materials, Subramani Sockalingam and Raja Ganesh, took second prize which included a certificate and \$500 cash prize. The challenge this year was the analysis of damage in mechanically joined laminates.

The UD team was advised by Jack Gillespie, director of the Center for Composite Materials (CCM) and Donald C. Phillips Professor of Civil and Environmental Engineering, and professor of Materials Science and Engineering and Mechanical Engineering; Bazle Haque, assistant professor of Mechanical Engineering; and Michael Keefe, associate professor of Mechanical Engineering.



### NORMAN WAGNER ELECTED TO NATIONAL ACADEMY OF ENGINEERING

Norman J. Wagner, a University of Delaware engineering professor noted for his groundbreaking research in fluid mechanics and molecular thermodynamics, has been elected to the prestigious National Academy of Engineering.

Wagner, the Robert L. Pigford Chaired Professor of Chemical and Biomolecular Engineering at UD, is among NAE's 67 new members and 12 foreign members.

Election to the National Academy of Engineering is among the highest professional distinctions accorded to an engineer.

Academy membership honors those who have made outstanding contributions to engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature, and to the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education.



[Click here to read the full article on](#) **UDaily**

## NEWS

## LEADER IN GREEN CHEMISTRY UNIVERSITY'S RICHARD WOOL ELECTED A FELLOW OF THE ROYAL SOCIETY OF CHEMISTRY

Richard Wool, professor of Chemical and Biomolecular Engineering at the University of Delaware, has been named a fellow of the Royal Society of Chemistry, the United Kingdom's professional society for chemical scientists and one of the largest such groups in the world.

"I remember growing up in Ireland, and in my chemistry studies at University College Cork, being in absolute awe of people who were both members and fellows of the Royal Society of Chemistry," says Wool.

Now that he's helped prove a Nobel Prize-winning theory in polymer physics and transmuted chicken feathers into circuit boards, "It's a very nice accolade to have."

Although 78 percent of the society's members are based in the British Isles, Wool's leadership in the field of green chemistry led to his nomination for membership as a fellow.

Wool came to the University of Delaware 20 years ago from the University of Illinois at Urbana-Champaign, drawn by a directorship at the Center for Composite Materials and a chance to work more closely with industry. At the center, and now in his [Affordable Composites from Renewable Sources](#) (ACRES) laboratory, he and his colleagues and students have created revolutionary industrial materials with reduced impact on the environment and human health.

"Any time we see a major pollution issue in chemicals, we basically go after it," he says.

The chromium salts used for curing ordinary leather are highly carcinogenic, so Wool's lab invented Eco-Leather, a plant-based textile that he hopes will become a standard in the fashion industry.

"We're [also] targeting some major plastics out there that are contributing in a significant way towards global pollution," he says. "A lot of these chemicals, in very small quantities, can wreak havoc with your hormonal systems, and are carcinogenic. We design new molecules that are not only derived from renewable resources but they're also nontoxic. We're the first to build tractors for John Deere out of soybeans; we're the first to make printed circuit boards for the electronic materials industry out of chicken feathers; we're the first to make Eco-Leather. So there's a whole bunch of firsts, here at Delaware."



Richard P. Wool is a Professor of Chemical and Biomolecular Engineering at the University of Delaware. His specialties include: ACRES (Affordable Composites from Renewable Sources), Polymer physics, interfaces, composites, dynamics, fracture, biodegradation, and materials science.

[Click here to read the full article on](#) **UDaily**

## A Short Course on Progressive Composite Damage Modeling in LS-DYNA Using MAT162

**Bazle Z. (Gama) Haque, PhD**

*Senior Scientist, University of Delaware Center for Composite Materials (UD-CCM)  
Assistant Professor of Mechanical Engineering, University of Delaware, Newark, DE 19716  
P: (302) 831-6805 | E: gama@udel.edu*

**Tuesday, March 31st, 2015** | 9am-5pm

**Cost:** \$595 per person

*Includes: Coffee, Lunch, Parking, CD with course Content*

### **Description:**

Progressive damage modeling of composites under low velocity impact and high velocity impact is of interest to many applications including car crash, impact on pressure vessels, perforation and penetration of thin and thick section composites. MAT162 rate dependent progressive composite damage model in LS-DYNA is considered as the state of the art. This short course will include the theory and practice of MAT162 composite damage model with applications to low and intermediate impact velocities, understanding the LS-DYNA programming parameters related to impact-contact, damage evolution, perforation and penetration of thin- and thick-section composites with and without curvature. The following topics will be covered in this one-day short course with illustrative examples. A CD with content of the course will be provided.

### **Topics Covered in this Short Course:**

#### **Introduction to LS-DYNA**

Writing a structured LS-DYNA keyword input deck from scratch for a unit single element (USE) under tension, compression, and shear

#### **Introduction to Continuum Mechanics and Composite Mechanics**

Concepts of large deformation finite strain theory

Deformation gradient

Cauchy-Green strain tensors

Piola-Kirchhoff and Cauchy stress

Stiffness matrix for orthotropic and anisotropic composite materials

#### **Composite Material Models in LS-DYNA for Shell and Solid Element**

#### **Theory and Practice in MAT162 Progressive Composite Damage Model**

Unit Single Element analysis

#### **Low Velocity Impact (LVI) and Compression after Impact (CAV) Applications**

For Shell and Solid Elements

#### **Perforation Mechanics of Thin-Composites with MAT162 and Solid Elements**

#### **Penetration Mechanics of Thick-Composites**

Depth of Penetration Experiments

Ballistic Impact Experiments

#### **Application of MAT162 in Engineering and Research Problems**

Impact on Composite Cylinders and Spheres with and without Internal Pressure and/or Blast Pressure

Penetration and Perforation of Sandwich Composites

Normal and Oblique Impact

Multi-Hit Ballistics

Meso-Mechanical Modeling of Woven and 3D Composites

[CLICK HERE TO REGISTER](#)

JOB  
OPPORTUNITIES

1

The [Department of Mechanical Engineering](#) at the University of Delaware (UD) invites nominations and applications for a tenure-track faculty position at the **ASSISTANT PROFESSOR** level. We are seeking ambitious, creative, and innovative individuals in the area of mechanics of materials who have demonstrated excellence in research, interdisciplinary spirit and vision and the drive to become leaders in their field while maintaining high-quality teaching and

For additional information and application procedures about this position and all other open positions please visit the UDJOBS website at: <http://apply.interfolio.com/26779>

2

The [Department of Mechanical Engineering](#) (ME) at the University of Delaware invites applications for a full time non-tenure track **ASSISTANT PROFESSOR** of Instruction faculty position.

Responsibilities will include teaching and curriculum development related to all aspects of the undergraduate mechanical engineering program; for example, teaching engineering fundamentals courses, teaching design - ranging from freshman to senior level courses, mentoring undergraduate students, and developing new courses in target areas such as mechatronics and industrial design.

The ME Department offers a Bachelor of Mechanical Engineering (BME) degree accredited by the Engineering Accreditation

For additional information and application procedures about this position and all other open positions please visit the UDJOBS website at: <http://apply.interfolio.com/27090>

mentoring activity. Exceptional candidates in other areas of interest to the department will also be considered.

Applicants must hold a Ph.D. in mechanical engineering, or closely related field. To ensure full consideration, applications should be received before December 15, 2014. However, the search will continue until the position is filled.

Commission of ABET. The BME Program is designed to produce graduates with a strong foundation in engineering fundamentals enabling them to lead a successful career in industry or government and/or obtain an advanced degree and to contribute to engineering knowledge, the profession, and the community. Curricular details can be found at <http://www.me.udel.edu>.

Applicants should hold a Ph.D. in mechanical engineering, or closely related field. Successful candidates are expected to have demonstrated excellence in teaching and curricular development in mechanical engineering, with particular interest in mechatronics and industrial design. Industrial experience in mechanical engineering design will be viewed favorably.

THE DEPARTMENT OF MECHANICAL ENGINEERING CONSISTS OF 21 FULL-TIME FACULTY MEMBERS ACTIVELY ENGAGED IN THE CORE RESEARCH AREAS OF BIOMECHANICS, CLEAN ENERGY AND ENVIRONMENT, COMPOSITE AND ADVANCED MATERIALS, NANOTECHNOLOGY, AND ROBOTICS AND CONTROLS; ANNUAL RESEARCH EXPENDITURES ARE \$9.7 MILLION. IN ADDITION TO HOSTING THE CENTER FOR FUEL CELL RESEARCH AND THE CENTER FOR BIOMECHANICAL ENGINEERING RESEARCH, THEY HAVE STRONG TIES TO SEVERAL STRATEGIC CAMPUS-WIDE INSTITUTIONS SUCH AS THE CENTER FOR COMPOSITE MATERIALS, THE CENTER FOR CARBON-FREE POWER INTEGRATION, THE DELAWARE BIOTECHNOLOGY INSTITUTE, THE DELAWARE ENVIRONMENTAL INSTITUTE, THE DELAWARE REHABILITATION INSTITUTE, THE INSTITUTE FOR ENERGY CONVERSION, AND THE UD ENERGY INSTITUTE.

NEW  
PUBLICATIONS

## JOURNALS

Cender, T. A., P. Simacek, and S. G. Advani, "A Method to Determine Open Pore Volume with Pulse Decay," *Applied Physics Letters*, 105, 134101 (2014),  
<http://dx.doi.org/10.1063/1.4896854>

Bhargava, S., M. Kubota, R. D. Lewis, S. G. Advani, A. K. Prasad, and J. M. Deitzel, "Ultraviolet, Water, and Thermal Aging Studies of a Waterborne Polyurethane Elastomer-based High Reflectivity Coating," *Progress in Organic Coatings*, 79, pp. 75-82, February 2015.

## CONFERENCES

Sauerbrunn, S. and J.M. Deitzel, "Void Level in Composites by Thermal Diffusivity" 42nd Annual Conference of NATAS, Santa Fe, NM, Sept 15, 2014.

Sauerbrunn, S. and J.M. Deitzel, "Flash DSC: UHMWPE during Extremely Fast Heating and Cooling" 42nd Annual Conference of NATAS, Santa Fe, NM, Sept 15, 2014.

Sauerbrunn, S. and J.M. Deitzel, "Maximum Temperature of UHMWPE for Analytical Testing" 42nd Annual Conference of NATAS, Santa Fe, NM, Sept 15, 2014.

Sauerbrunn, S. and D. Heider, "FTIR Spectroscopy – a Non-Destructive Inspection (NDI) Method for Measuring Thermal Degradation of Aircraft Composites in Situ", Hi Temp 2014 Conference, Santa Fe, NM, Sept.19, 2014.

# CONSORTIUM NEWS

We would like to thank [Airbus Group Innovations](#), Paris France, on becoming our newest consortium member.

We would also like to thank [Arkema, Inc.](#), [The Boeing Company](#), [Composite Sourcing Solutions](#), [Cytec Engineered Materials, Inc.](#), JML Engineering, LLC, [Materials Sciences Corporation](#), [SABIC Innovative Plastics](#), and [Warrior Sports, Inc.](#) for their recent membership renewal and all our current members for continuing to participate in CCM's research and development activities.

To learn more about the benefits of becoming a member, please visit us on the web at <http://www.ccm.udel.edu/industry/industry-partnerships/>



CELEBRATING 41 YEARS  
OF SIGNIFICANT  
CONTRIBUTIONS TO  
COMPOSITES SCIENCE  
AND TECHNOLOGY,  
THE EDUCATION OF  
STUDENTS, AND THE  
CREATION AND  
TRANSFER OF  
TECHNOLOGY TO  
INDUSTRY.



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201 COMPOSITES MANUFACTURING  
SCIENCE LABORATORY  
UNIVERSITY OF DELAWARE  
NEWARK, DE 19716-3144  
P: 302.831.8149  
F: 302.831.8525  
W: [WWW.CCM.UDEL.EDU](http://WWW.CCM.UDEL.EDU)