



TOP STORY



The 2014 Medal of Excellence award will be presented SEPT. 8-10, 2014, DURING THE AMERICAN SOCIETY FOR COM-Posites' 29th Annual Technical Conference in La Jolla, CALIFORNIA, HELD THIS YEAR IN CONJUNCTION WITH THE **16TH US-JAPAN CONFERENCE ON COMPOSITE MATERIALS AND** ASTM-D30 MEETING.

ρράγε September 2014

We are pleased to congratulate the 2014 Center for Composite Materials Medal of Excellence winners:



Isaac Daniel

Northwestern University Walter P. Murphy Professor of Theoretical and Applied Mechanics Director, Center for Intelligent Processing of Composites



Karl Schulte

Hamburg University of Technology Professor and former Director of the Institute of Composite Materials



Ignaas Verpoest

Katholieke Universiteit Leuven Toray Chaired Professor Emeritus of Composite Materials Department of Materials Engineering



The Medal of Excellence in Composite Materials, created to honor those who have achieved outstanding leadership in the field of composites, was established in 1984 in conjunction with the Decennial Celebration of the Center for Composite Materials. It recognizes individuals with demonstrated scholarly endeavor, invention, and/or economic enterprise over a sustained period of time.

For more information, visit our website: http://www.ccm.udel.edu/Intro/medalofexc.html

University of Delaware

COMPOSITES UPDATE September 2014

X NEWS

A Tribute to Professor Anthony Kelly, CBE, DL, FRS, FREng By Professor Tsu-Wei Chou

I had the honor and pleasure of learning from and interacting with Professor Kelly for well over four decades. During his long and illustrious career, Kelly made a major impact on the global materials scene and a pioneering contribution to the field of advanced composite materials. It is indeed humbling to recall my personal experiences with this intellectual giant and to realize that I had a front-row seat to his amazing accomplishments.

The science and engineering of modern composites date back to the early 1960s and the discovery of carbon fibers. From his deep understanding of atomic bonding in carbon materials, Professor Kelly long believed in the potential to develop highly stiff carbon fibers. His vision became a reality with the invention of carbon fiber by Roger Bacon, Akio Shindo and William Watt. Professor Kelly's knowledge of methods to calculate the ideal strength and his research on the strength of metals led to the publication of Strong Solids in 1966. This book introduced readers to the scientific framework for the development of modern composites. As a doctoral student in the 1960s, I was not only enormously fascinated by this book but also profoundly influenced by it in my later research career.

The 1970s witnessed the beginning of active composites research in the UK and US. Perhaps one of the most important discoveries of the era was the multiple fracture of polymeric matrix composites, which enhances the toughness of composites in a controlled manner. The paper published by Aveston, Cooper and Kelly in 1971 on their pioneering experimental and modeling work laid the physical foundation of multiple fracture for numerous related studies and continues to be influential even today.

Also, in the 1970s at the University of Delaware, my colleagues and I were very excited about the immense potential, both in research and in industrial applications, of fiber composites. Our Center for Composite Materials was established in 1974, and it rapidly became a focal point of interaction among academia, government and industry in composites research. In 1984, to commemorate the tenth anniversary of the Center, the Medal of Excellence in Composite Materials was established. The visages of the four initial medal winners – Anthony Kelly, Stephen Tsai, Zvi Hashin, and Tsuyoshi Hayashi – are depicted in the circular bronze casting. For researchers and engineers in composite materials worldwide, it is a privilege to stand on the shoulders of pioneering giants like Professors Kelly, Hashin, Hayashi and Tsai.

Professor Kelly's research interests were very broad, and it is particularly noteworthy that he made fundamental contributions to composites encompassing all type of matrix materials: metal, polymer and ceramic. But his influence on the world composites scene was not limited to scholarly work. Professor Kelly played a pivotal role in initiating and



Photo by courtesy of Prof. Sergei Mileiko

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supporting early international composite conferences in Europe, he was among the founders and the honorary President of European Society for Composite Materials, and throughout the world. He also edited a major encyclopedia, the Concise Encyclopedia of Composite Materials (published in 1989 and revised in 1994), that is immensely valuable to researchers and practicing engineers. The publication of Comprehensive Composite Materials in 2000 was truly a herculean effort by Professor Kelly, who served as co-editor and was largely responsible for its success. The six volumes cover fiber reinforcements and general theory; polymer matrix composites; metal matrix composites; carbon/carbon and ceramic matrix composites; test methods and non-destructive evaluation; and design and applications. This monumental publication of over 5000-pages documents the knowledge base of advanced composites developed over three decades. As the editor of Volume 1, I gained some insight into Professor Kelly's tremendous effort. I was convinced that it was only because of his intellectual capability, comprehensive knowledge of the field and sheer dedication that the vision of a comprehensive encyclopedia became a reality.

In the past half century, the field of composite materials has witnessed many contributions to scientific discoveries and productive scholarship by notable scientists, but the depth and breadth of Professor Kelly's work is unmatched. In my presentation at the Kelly Symposium celebrating his 80th birthday in 2009 at ICCM-17 in Edinburgh, I fondly spoke of him as "my teacher, my friend." I have no doubt many others in the composites community share my respect and affection for Professor Kelly.

(As Published in Editorial / Composites Science and Technology 100 (2014) iii-iv)

CCM to Participate in NIST-Funded Manufacturing Technology Consortium

A new partnership that includes engineers, industry and national laboratories is collaborating to study long-term industrial research challenges in an effort to advance U.S. manufacturing of composite materials.

Led by researchers at the University of Massachusetts Lowell, the University of Delaware's Center for Composite Materials is among the five universities and more than 50 companies and organizations that have joined forces to launch the Facilitating Industry by Engineering, Roadmapping and Science (FIBERS) Consortium.

The work is funded through a \$496,439 grant from the National Institute of Standards and Technology's (NIST) Advanced Manufacturing Technology Consortia (AMTech) program.

Now a \$20 billion global industry, composites manufacturing is expected to grow at rates that outpace the global domestic product



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over the next decade. While U.S. universities and government laboratories already conduct basic research on composite materials, efforts to capitalize and translate these efforts into commercial production technologies have lagged.

The industry-led polymer composites consortium will develop a technology roadmap to identify shared technical obstacles and define pathways toward manufacturing advances that will enable scale-up of cost-effective, high-volume production processes.

"Nations with industries that succeed in increasing the scale and improving the repeatability of manufacturing processes, thereby reducing costs and improving material reliability, will be best positioned in a promising global market," explained Suresh Advani, George W. Laird Professor of Mechanical Engineering and department chair and lead principal investigator for UD.

According to Jack Gillespie, CCM director and co-principal investigator on the project, advantages of using composite materials include weight and energy savings, lower maintenance costs and greater design flexibility.

These advantages, however, often are overshadowed by high materials costs, due largely to manufacturing limitations, and manufacturing cycle time and yield. Processes are difficult to scale up and usually are implemented through trial-and-error methods, making new approaches critical to long-term success.

As part of the FIBERS consortium, over the next 18 months Advani and Gillespie will help:

- · Develop a detailed technology roadmap for polymer composites manufacturing;
- · Establish a shared understanding of critical manufacturing challenges; and
- Initiate sustained efforts to tackle these challenges.

Other desired outcomes include a collaborative environment that encourages current and future consortium members to work together to improve the functionality and reliability of composites, to introduce automation to enable high-volume production, and to reduce overall material costs.

The grant, awarded under project No. 70NANB14H057, is one of only two composites manufacturing grants awarded under AMTech and one of 19 total grants selected from more than 80 proposals.

Article by Karen B. Roberts

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SAMPE Students Inspire Next Generation of Engineers

During the second and third weeks in July, some 20 SAMPE volunteers, including both undergraduate and graduate students affiliated with CCM, participated in demonstrations, tours, tutorials, live chats, and poster sessions at two engineering-oriented summer camps: Engineering Cool Stuff and Delaware Aerospace Academy.

Serving students from elementary through high school, the two camps are designed to motivate young students to pursue science, technology, engineering, and mathematics (STEM) majors and careers.

Sponsored by Engineering Outreach, Engineering Cool Stuff shows 12 to 16-year-olds how to use basic engineering principles to design and build a variety of structures including composite beams. Melissa Jurist, Academic Program Manager, UD K-12 Engineering says "SAMPE helps develop the pipeline of engineering through their real-world challenges. SAMPE engaged my students in dynamic, fun and educational activities that use authentic materials, help them experience what it's like to be an engineer with realistic constraints and give them a true sense of the field. Their facility with students, knowledge of their field and enthusiasm are unparalleled."

The Delaware Aerospace Academy provides hands-on training and experiences in aerospace-related activities and fields for students in grades 1–10 using Earth and Space themes as the unifying framework. "On behalf of the staff, we are very appreciative of the Space Beam Challenge learning experience provided for the Destination Moon cadets at the Delaware Aerospace Academy. For years, the SAMPE engineering students have continued to inspire and motivate our young and rising engineers through the tour of the Composite Center, providing materials for the challenge, putting the beams together and testing for strength. It is one of the best highlights of the academy."

For the Engineering Cool Stuff and Delaware Aerospace Academy campers, those activities included designing, building, and testing composite beams.

As president of UD's Society for the Advancement of Material and Process Engineering (SAMPE) student chapter, Alex Vanarelli has had plenty of opportunities to organize K-12 outreach activities at the Center for Composite Materials (CCM).

"All of these programs package key engineering concepts in a way that reinforces what kids are taught in the classroom and that lets them have fun while they're learning," Vanarelli says. "The feedback we've received tells us that the activities we offered were effective—the kids were enthusiastic and engaged."

"Learning about why their beams fail is a real 'CSI-type' experience for the kids," Vanarelli says. "It's all about understanding what went wrong so you can build a better beam next time. They also learned about teamwork and deadlines—two important skills for the workplace."



"I can't say enough about the outreach efforts of our SAMPE students," says CCM director Jack Gillespie. "These camps cover the entire range of K-12 students, and our volunteers represent all levels at CCM, from interns to professionals, working as a team. Through the SAMPE effort, we offered meaningful hands-on activities to these young students so they could learn what engineers actually do. The impact of these activities is tremendous—it lets the participants see that becoming an engineer is a viable option for them."

For Vanarelli, delivering presentations on the Composite Beam Challenge and the SAMPE bridge competition brought everything full circle.

"This is what SAMPE is all about," he says. "We start small and start young with the camps, and it's just a few years and a few steps—doing research, preparing posters, and writing papers—before they're competing and networking at the national level. CCM, as a major research center that is fully integrated into academic activities like these camps, provides the perfect environment to make this happen."

UD Students Win Big at SAMPE Conference

The 2014 Society for Materials and Process Engineering (SAMPE) international symposium and exhibition was held in Seattle, WA June 2-5. A team of 7 University of Delaware students collaborated to submit four entries to the bridge competition. In addition to their second-place overall finish, they received the following top division awards:

- 1st place: Carbon Fiber I-Beam
- 2nd place: Natural Fiber I-Beam
- 3rd place: Glass Fiber I-Beam
- 3rd place: Natural Fiber Box Beam
- 2nd and 3rd place: Beam Poster Competition

"This is one of UD's best showing ever, with success in both the academic and application-oriented aspects of the student competitions," says Alex Vanarelli, president of the SAMPE-UD student chapter.

"We received tremendous support from CCM faculty and staff, the College of Engineering, and SAMPE," Vanarelli says. "We also have access to a wide range of state-of-theart equipment and materials here at the center. It's a great environment for carrying out these kinds of projects, and we continue to pass along what we've learned to the next generation of students through SAMPE."



SAMPE-UD Bridge Team

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OTHER

Teachers participate in Materials Camp

On June 26th the Center for Composite Materials hosted 36 educators from middle and high schools throughout Delaware attending the ASM Materials Camp.

The program was collaboration between UD's Department of Materials Science and Engineering and the Brandywine Valley Chapter of ASM, an international association of materials scientists and engineers. Teachers learned the basics of materials science technology, focusing on instruction at a high school level, and worked hands-on with such materials as ceramics, metals, polymers and composites.

CCM Scientists Dr. Joseph Deitzel and Dr. Steve Sauerbrunn led a tour of the CCM facilities where the teachers got to see how composites are made and tested. The tour focused on the 'real world' applications of composites. One highlight of the tour was a truck hood that was designed by CCM for the Army. The composite hood is lighter weight than the standard metal hood. The composite hood supports more weight than the metal hood and does not deform under load. The teachers were all invited to stand together on the composite hood and jump up and down like an 8th grader. The composite hood survived and the teachers were all smiles.

Participant Roger Holt said, "In the past 18 years of time, this is by far the absolute best continuing education professional development opportunity

ASM Materials Camp®-Teachers University of Delaware - Newark, DE June 23-27, 2014 Thank you Center for Composite Materials Think you for taking the true to show ut your area of expertise. Law matter Grat tour! Mainer Mainer That you Excellent Internet Fun to see - Deen W. How Looking forward to bringing out stude toor a tour. ESS That's to Everyting! Cool tour. Thanks for your trive. Oursdow Thank you for the tour and demonstrations and information about student internahips! I Thank your for your tour and detailed explanation! Alugen Soon cool ... I want to be you suys when I grow or Thank for your time and sharing your "Stuff!" Bob EtMan Such a cool "field trip"! Youka It Varaa Thanks for letting us jump on the car houd! Look forward to seeing how we can partner in the future dinda J. Muyny Great Thank you for the fescinating your Mean One see as Thank you for the fescinating your Mean One see as Thank you for the rate to give us the offe SEN HER Atthing" ETTEL BURNER Thank you for your time and the interesting and informative tour! Thank you for showing is what the lab does! Alyssa wright Thank you for Shuns us ever this, it was

that I have ever had. This is the most professional group of individuals and the best learning opportunity that I have ever experienced. Being an alum of the University of Delaware, I had pretty high expectations and this met every one and went beyond that. I had a blast."

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Advanced Manufacturing Technology Immersion Courses

Additive Manufacturing (3D Printing) and Composites Technology Tracks

The Technology Immersion course will introduce participants to the principles and practices of modern manufacturing methods focusing on composite materials and 3D printing technologies. In both tracks, participants will also be introduced to materials selection methodologies associated with these technology areas.

Curriculum Overview and Description

The Technology Immersion courses are three-day programs that provide intensive hands-on work and instruction in a technology lab setting where participants will be immersed into the technology and potential real world applications in modern advanced manufacturing.

The Technology Immersion Course offers two tracks: 3D Printing or Composites Technology.

The Advanced Manufacturing Technology Immersion Courses are funded by a grant provided by the U.S. Department of Labor Employment and Training Administration and in cooperation with our Advanced Manufacturing Accelerator Partners.

Additive Manufacturing (3D Printing) Track

The additive manufacturing track will provide an introduction to additive processes and additive manufacturing techniques, followed by a survey of part design, applications and equipment for additive manufacturing. Each day will be divided into classroom sessions and laboratory sessions.

During the laboratory sessions, participants will design a part using CAD software, make the part and test a prototype part using additive manufacturing equipment. All courses will be taught by Dr. Evan Malone, Ph.D., President of NextFab and his team of instructors.

Date: 09/08-09/10/2014	8:30am - 4:30pm
Location: NextFab	
Fee: No Cost	
or	
Date: 10/06-10/08/2014	8:30am - 4:30pm
Location: NextFab	
Fee: No Cost	

Composites Technology Track

The composite materials track will provide an introduction to composite materials and composite processing techniques, followed by a survey of composite part design and composite applications. Each day will be divided into classroom sessions and laboratory session.

During the laboratory sessions, participants will design a part with composite software, make the part and then test the part and verify that the part meets the design specifications.

All courses will be taught by University of Delaware Center for Composite Materials staff.

Date: 09/23-09/25/2014 8:30am - 4:30pm Location: University of Delaware, Composite Center Fee: No Cost

Date: 11/11-11/13/2014 8:30am - 4:30pm Location: University of Delaware, Composite Center Fee: No Cost

For more information or to register please visit <u>www.dvirc.org</u> or call DVIRC at 215-552-3827.

or

NEWS

6th World Conference on 3D Fabrics and Their Applications



It is our pleasure to announce that **The 6th World Conference on 3D Fabrics and Their Applications** will be held during 26 to 29 May 2015 at North Carolina State University (NCSU), Raleigh, NC, USA, coordinated with TEXCOMP-12 at the same location. Professor Jack Gillespie, Center for Composite Materials, University of Delaware, is Chair of the International Advisory Committee.

This series conference on 3D Fabrics started in 2008 at the University of Manchester, UK and has since gained the reputation as an effective and important forum for the researchers, industrialists, designers and end users in this attractive and challenging area to report the latest developments, exchange development ideas and discuss future strategic issues. As the organizers, we are looking forward to another successful conference in NCSU next May. Your continued support will be the key to the success of the conference and the success of the conference series.

The 6th World Conference on 3D Fabrics and Their Applications is organized by TexEng Software Ltd, Manchester, UK and North Carolina State University, Raleigh, USA in association with The University of Manchester and supported by The Textile Institute, UK and The Fiber Society, USA.

The organizer's invite authors to submit a one-page abstract for each paper that they wish to be considered for inclusion in the oral and/or poster program for the conference. The abstract should contain sufficient information for a valid decision to be made on the merits of the paper and its relevance to the aims of the conference. Authors should indicate whether they prefer an oral or a poster presentation. **Closing date for submissions intended for oral presentation is January 15, 2015.** Poster abstracts can also be considered at a later date. Please submit your abstract online at http://www.texeng.net

We would like to take this opportunity to announce the use of our new website for TexEng Software Ltd, which will be the official website for announcing the TexEng events, including all conferences. The address of this new website is: <u>http://www.texeng.net</u>, where the first announcement and call for papers of **The 6th World Conference on 3D Fabrics and Their Applications are now made available.**

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MEMBER NEWS CONSORTIUM

We would like to thank **DVIRC Delaware Valley Industrial Resources Center**, Philadephia, PA on becoming our newest consortium member.

To learn more about the benefits of becoming a member, please visit us on the web at www.ccm.udel.edu/Consortium/benefits.html



Celebrating 40 years of significant contributions to composites science and technology, the education of students, and the creation and transfer of technology to industry.



1974-2014

Please visit us on the web at http://www.ccm.udel.edu

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