SPE COMPOSITES

APRIL 2016

Composites Connection™

Official Newsletter of the SPE Composites Division

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Advancing Composites Technology Worldwide
SPE COMPOSITES
April 2016

Chairman's Message:

Michael Connolly

Amazingly, it has been nearly a year since I took over as Composites Division (CD) Chair at ANTEC 2015. It is easy to start out with a lot of enthusiasm and plans, but then reality with "real world" work and personal commitments gets in the way. I wish I could say we made more progress on my goals of:

- Recruiting new BOD members with diverse and international backgrounds
- Improving internal communication and operating practices for the BOD, and
- Increasing engagement and accountability of the BOD members

We have made progress on all fronts but not at the rate I would have liked. New(ish) members Jack Gillespie of the University of Delaware and Ian Swentek of Hexion (formerly at Fraunhofer Project Centre) are already significantly contributing the CD through the Education and Awards committees, respectively. But while I'm still looking for international candidates, none have formally been asked to join the BOD to support "internationalization" of our group as yet. However, Ray Boeman of ORNL has stepped up to serve as both Membership Chair and, more importantly, as Chair-Elect to follow me as Chair in 2017-2019. Several committee chairs have done a good job in the past year to create "standard operating procedures" (SOP's) for their group that will serve as a template for future activity and other committees to follow. But, a lot of work remains to be done on SOP's for good succession planning and better operations of each committee and the BOD as a whole.

At ACCE last year, the CD honored Dan Buckley with a Lifetime Achievement Award for his many, many contributions to the CD and composites community. Unfortunately, in the interim, Dan has had some health problems. That was clearly concerning to the CD as he was our division's founder and critical to our growth to the strong group it is today. But now, I am happy to inform our community that Dan is doing much better and later this year is heading into full retirement in good health. We will miss you, Dan, and wish you the best in retirement. Please remember that you will always be welcome at any of our events.

We have a busy year going for the Composites Division. Jim Griffing has organized a great CD session at ANTEC with over 35 technical papers, 5 keynote speakers and a panel discussion. We expect to present numerous awards and scholarships at ANTEC (thanks to Ian Swentek and Dale Grove) as well as fund part of the new Jackie Rehkopf Scholarship and ACCE Student Scholarship at ACCE in September. Of course, there is our biggest event, the Automotive Composites Conference itself, which is off to a **roaring** start with >65 abstracts already submitted and very strong sponsorship by mid-April. I expect records for technical contributions (thanks Creig for being Co-TPC with me) and attendance at ACCE this year given the high interest in our signature event

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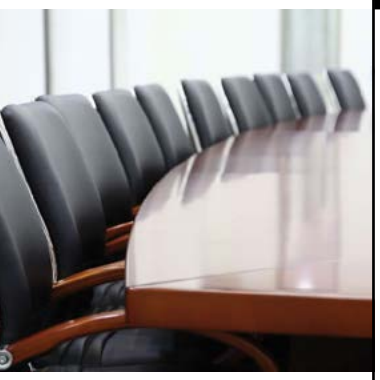
Chairman's Message continued...



in the early spring already!! And right after ACCE in September, the CD will be contributing to the CAMX 2016 technical program in Anaheim (thanks to John Busel for organizing). And, to end the year, Creig Bowland is chairing the Cyclitech 2016 event in California with our partner JEC Composites. That's a full plate by organizations standards! Thanks to all on the BOD for their sometimes un-sung efforts to making these activities come to pass.

The next face-to-face BOD meeting is scheduled to take place on Tuesday, May 24 during ANTEC from 5-7:30 PM. If any CD member is interested in participating in the meeting, please contact me so that I can send you the conference call number and, of course, you are welcome to join the BOD meeting in person. Hope to see you at ANTEC in Indianapolis!!

Regards,
Michael Connolly
2015-2017 Chair

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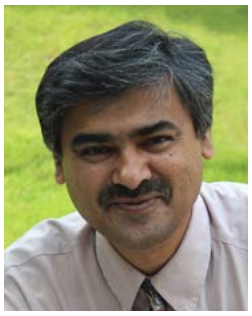

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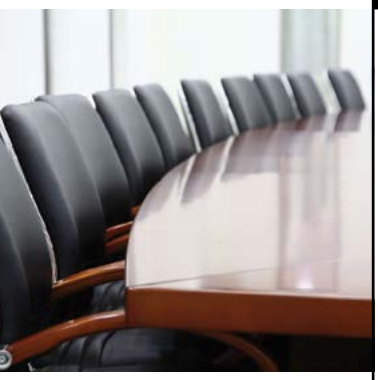

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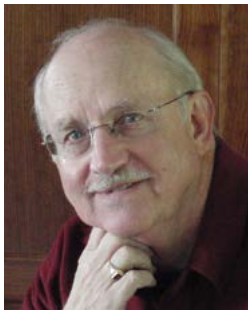

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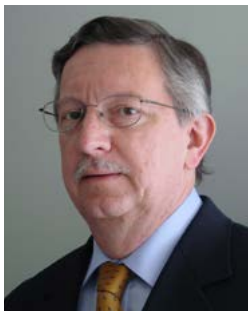

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This Issue:

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Board Meeting Minutes March 23, 2015

By: Antoine Rios

ACCE 2015, Novi, MI
Tuesday, September 8, 2015
The Suburban Collection & Diamond Center, Amber Conference Room

Attendees:

Ray Boeman	Creig Bowland
Dale Brosius	John Busel
Rich Caruso	Michael Connolly
Fred Deans	Klaus Gleich
Enamul Haque	Frank Henning
Ian Swentek	Tim Johnson
Nippani Rao	Andy Rich
Uday Vaidya	
By phone:	
Jack Gillespie	Dale Grove
Antoine Rios	Dan Buckley

Meeting started at 5:10pm
Chair: Michael Connolly

- It is difficult to know what each committee needs to work on. He noted Dale Grove created a good model for SOP (Standard Operating Procedure) that other areas need to work on. He asked all the area leaders to create a SOP.
- Wants to do more outreach to other areas of SPE. He asked the international members to perform a similar type of outreach in their respective regions.

Secretary: Antoine Rios

- Last meetings minutes reviewed.
  - o MOTION: Dale Grove moves to approve minutes. Klaus Gleich seconds. Motion passed.
- Investigated if the Chain is a viable way to communicate amongst the Board. Klaus reported that some companies do not allow for access on social network and therefore access to the Chain does not work for him in his company.
- The group discussed that the Chain is a good place to keep things in one place that everyone can access.
- **ACTION: *Michael Connolly asked all members experiment with the Chain and the Board will have a discussion at the next meeting to see if this works.***
- **ACTION: *Michael Connolly asked the secretary to maintain a list of the Board members and changes that take place during the year.***

Chair-Elect: Michael Connolly

- Michael Connolly stated that there is no elected chair-elect. This vacancy needs to be filled. He indicated that he has not found any volunteers to take the position.
- J Busel nominated Rich Caruso for Chair-elect. Caruso agreed to work on Pinnacle first.
- Michael Connolly stated that documentation for the Pinnacle Award needs to be done. He reported that Dale Brosius and Rich Caruso will lead the task group to develop the materials for the Pinnacle Award.
- The date for submission was unknown but thought to be in early December.

Communications: A. Rich

- Contacted Dawn Stevens for updates to the website. He added that Dawn will have time to start working on this now that ACCE is done. Michael Connolly stated that updates to the website needs to be done ASAP.
  - o Michael Connolly noted that the Board members need to be updated.

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This Issue:

Board Meeting Minutes continued...

- ***ACTION:** Michael Connolly asked Dale Grove to update the past award winners.*

Membership:

- Michael Connolly reported that there is no report from membership.
- The group discussed the lack of information.
- Michael Connolly indicated that the lack of reporting in this area by Aaron Bartel, indicates a new change needs to be made and asked the group for a volunteer to take over this area.
- Ray Boeman volunteered to take the lead role to organize the membership activities.
- Tim Johnson stated that we really have not done well with student chapters
- Michael Connolly reiterated that developing a SOP, and especially for this area, is really important.
- The group felt that with all the changes at SPE, there might be different procedures to undertake an effective membership data gathering, reporting, and recruitment. The group asked the question of what is the retention of the sponsored memberships from past ACCE students, as well as the reasons as to why members have dropped their membership.
- **ACTION:** ***Michael Connolly asked Ray Boeman to gather all the information possible to report at the next board meeting.***

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Board Meeting Minutes continued...

Councilor Report: C. Bowland

- Reported that recent discussions focused on changes to the bylaws. He noted the changes made and hopes that the changes will make the process easier. Other changes are electronic voting on various issues. This was implemented with several divisions requesting a name change that resulted in the process moving faster. He reported a discussion that took place on how to govern the society. The approach will be to create a smaller body to make decisions for the society. He stated that the procedures need to be worked out. He reported that you can only work as a councilor to two terms. He indicated that some councilors have rotated amongst the divisions and this was intended to stop the process. He added that there is a lot of work associated with this position. He reported that this is his fourth year in this position. Dale Brosius stated that he felt it takes a little while for this position to be effective and two terms might be too short.

Craig Bowland reported that SPE overall membership is dropping although revenues were good.

Treasury Report: Tim Johnson

The number one change was awards. The significant issue on the table was that $10,000 was allocated for the scholarship but nothing happened until June of this year. The foundation has been structured better now. He learned that you do not have to fully endow a scholarship at the inception. He added that the automotive division did not have to come up with the full amount. Tim Johnson added that the $10K will come out of this year's budget. He stated that the Harold Giles scholarship was the only one that existed but further investigation found that the account is not in good shape. He noted that there is a positive balance of $18K. He noted that the composites division has only put in $8,500 over the years. The automotive division has contributed a little. Most of the contribution came from the Giles family.

- Dale Brosius felt that putting in $1,000 per year towards the scholarship is inadequate.
- MOTION: Craig Bowland moved to approve $4,500 towards the scholarship fund SPE foundation. Seconded. Motion passed.

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This Issue:

Board Meeting Minutes continued...

- The group discussed how to restructure the award winnings to best reflect the best results.
- MOTION: Craig Bowland moved to change the Harold Giles award to be $2500, given to two winners, one for graduate and one for undergraduate and put in $3000 to the SPE foundation to catch up from the past. Fred Deans seconded. Motion passed.
- Dale Grove stated that two awards are given at ANTEC.
- Tim Johnson reported that a portion of the monies should be invested into a special account.
- **ACTION: *Michael Connolly to lead a task group to look into options for investment.***

Awards: Dale Grove

- Michael Connolly commended Dale Grove for documenting the information related to the awards.
- An awards report was sent to the Board members.
- The Perkin Elmer award has to be worked on. The Educator of the Year award also needed help with resources to reach out the right community. He thanked Jack Gillespie for helping in populating the list. He reported on the winners. Nominees are needed for fellows.
- **ACTION: *Antoine Rios to follow-up with the* HSM *application.***
- Jackie Rehkopf Scholarship needs more structure to create the criteria for this award and this is still outstanding.
- The group discussed people to nominate for the various awards focusing on fellow and HSM. Several people were suggested. The fellow criteria are very rigorous. Uday Vaidya and Jack Gillespie were recommended for the various awards.
- Dale Grove asked the Board if he could hand off the activities. Haque volunteered to help. Haque volunteered to chair the awards. Ian Swentek will assist on the awards committee to help Haque. There are now 3 people forming the Awards Committee.

Education: U. Vaidya

- Uday Vaidya reported that this is the 10th year running the poster awards. This year no travel funds were distributed to the students. He noted that some funds were covered. There are 20 posters in the competition. He asked for help for judging that needs to take place on the first day of ACCE because the awards will be presented later in the day. The funding comes from the ACCE budget and not the division.

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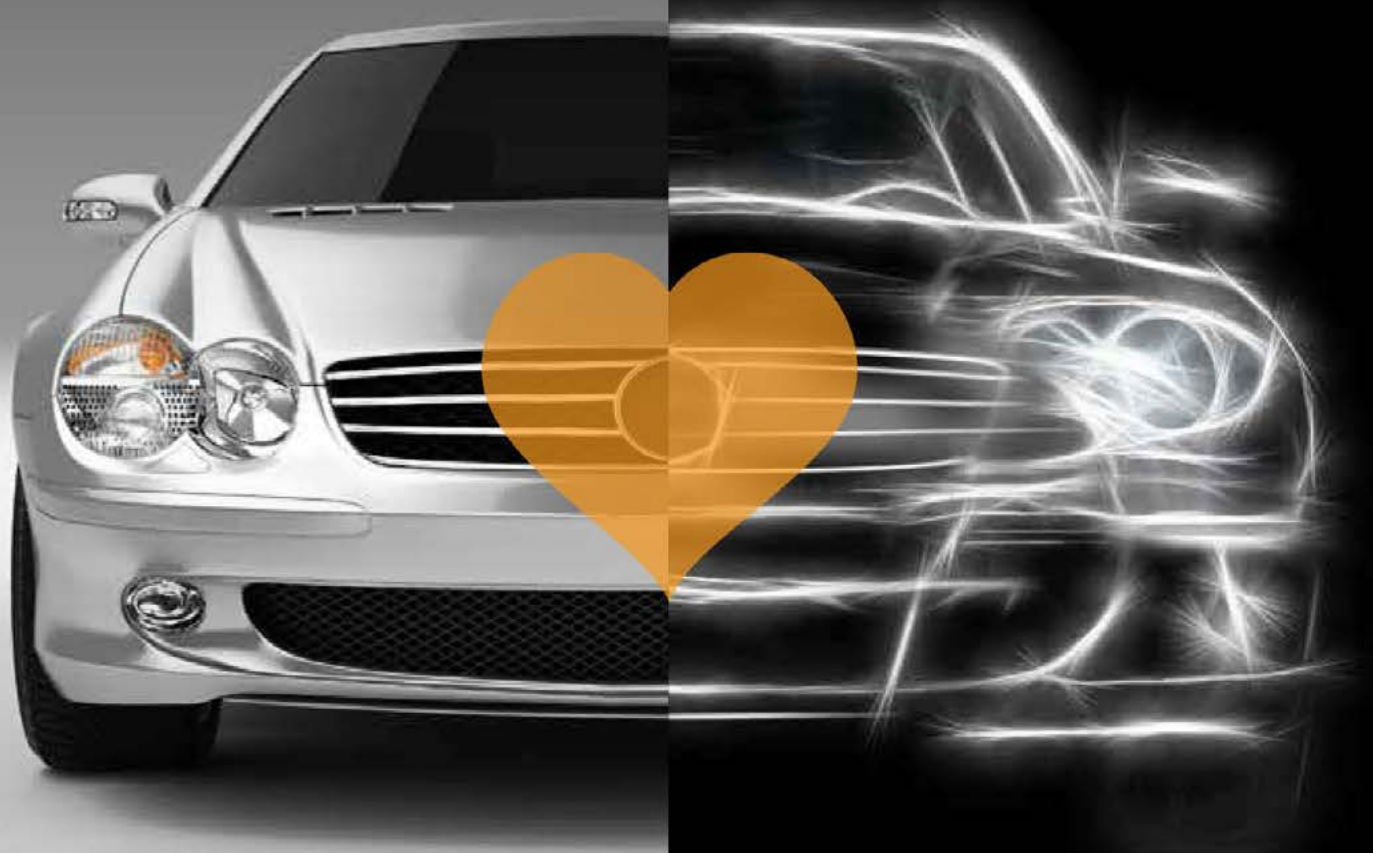
This Issue:

We create chemistry that lets beauty love brains.



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Board Meeting Minutes continued...

- The group talked about various awards to be created along the lines of education. Various ideas were shared.
- **ACTION: *Michael Connolly asked the Education committee to create a proposal for the Board to review and make a decision. The proposal needs to include a budget for sustaining a program.***
- Uday Vaidya reported on industry training and the need to identify companies that need further education. Jack Gillespie shared experiences that were done at UDel with lectures from BMW and other industry people which created a workshop along the lines of composites for automotive. Michael Connolly felt that more work can be done along these lines and details will need to be figured out.

Technical Conference Report: Jim Griffing

- Michael Connolly reported on the Technical conference report. Jim is looking for ideas for presentations and panel discussions.

Inter-Society: John Busel

- No SOP has been created to date but a draft will be done by the next meeting.
- Very little follow-up made to those organizations presented at ANTEC. A conversation was conducted with Marc Imbrogno who is the chair of the SPE Thermoset Division. This was just an initial discussion to communicate the desire to do more collaboration. John Busel suggested to the Board that we should consider giving a presentation on an overview of the ACCE 2015 to be included in the technical program at the Thermosets TOPCON. This would be good to provide the trends and opportunities unveiled at ACCE as well as promoting the show to TOPCON attendees. The Board agreed. Dale Brosius noted that TOPCON recently put out a call for papers so the timing is good.
- **ACTION: *John Busel to communicate to Marc Imbrogno the intent of the* COMDIV *giving a presentation.***
- A SPE special session that will take place at CAMX on Monday, Oct. 26, 2015 from 2-5 pm. He stated that the COMDIV can do whatever it wants for the program and length of presentations.
  - i. Klaus Gleich is one presentation
  - ii. Ian Swentek is one presentation
  - iii. Dale Brosius to give an overview of ACCE
- **ACTION: *John Busel to work with the two other speakers to secure titles and abstracts and work with the* CAMX *committee to promote the event.***

ACCE: Dale Brosius

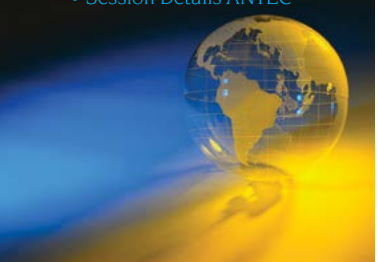
- The layout was restructured to make the presentations, keynote, and exhibits much better than years past.
- 732 registrations to date. 117 OEMs registrations. 92 have renewed memberships because of the ACCE
- Revenue: $404K in sponsorships and $46K in paid attendance. Expenses about $300K.
- It is expected that the Composites Division will receive about $50K+.
- There is a portion that goes to SPE. Dale Brosius suggested that the SPE portion not take into account the monies going to students.
- There was a problem with reviewing papers and this became a tracking nightmare. There needs to be more help to make this process go better.

Newsletter:

- Michael Connolly reported on the newsletter. It was distributed to the Board for review. He thanked everyone

Meeting adjourned at 7:38pm

This Issue:



2016 ACCE Update

Innovations in Automotive Composites: from Motor City to the World

Work is well underway for the 2016 SPE Automotive Composites Conference & Exhibition (ACCE). This year's show returns **September 7-9, 2016** to **The Diamond Banquet & Conference Center at the Suburban Collection Showplace** in Novi, Mich. in the Detroit area. Now in its sixteenth year, the ACCE is the *world's leading forum for automotive composites* and draws over 1,000 exhibitors, speakers, and attendees from 15 countries on five continents to the Detroit area, inspiring organizers to select this year's theme of *"Innovations in Automotive Composites: from Motor City to the World."*

"Based on the continued growth of the SPE ACCE, it's an exciting time to be involved in automotive composites," notes 2016 SPE ACCE event chair, Rani Richardson, composites & additive manufacturing business experience consultant, Dassault Systèmes. "With less than a decade to go before really challenging emissions and fuel-economy standards kick in for automakers in some of the world's largest economies, the pressure's on to take mass as well as cost out of vehicles without compromising safety, functionality, aesthetics, and customer satisfaction. The ACCE is a great place to discover many of the innovations driving these changes and to network with those passionate about transportation composites."

16th-Annual

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World's Leading Automotive Composites Forum

SOCIETY OF PLASTICS ENGINEERS
AUTOMOTIVE & COMPOSITES DIVISIONS

September 7-9
2016

Call for Papers

Those interested in speaking at this year's event should go to **http://SubmitACCEpapers.com** and upload abstracts by **March 31, 2016** and full papers or non-commercial presentations by **May 31, 2016.** Authors who submit full papers (not presentations) in the proper format will be considered for the conference's *Dr. Jackie Rehkopf Best Paper Awards*, which are presented during the event's opening ceremony. Questions for the peer review committee may be addressed to **ACCEpapers@speautomotive.com**.

Call for Nominations for Conference Parts Competition

The committee also issued a call for nominations for its fifth-annual ACCE parts competition. Prizes for the *Most Innovative Composites Application* will be awarded in three categories — *Materials Innovation* and *Process Innovation* (selected by media and members of the SPE ACCE planning committee), and *People's Choice* (selected by conference attendees) — with winning teams receiving recognition and a trophy after lunch on the last day of the show.

There is no cost to enter the competition. Any registered conference participant (speaker, sponsor/exhibitor, or attendee) may nominate original equipment or aftermarket composite parts on passenger cars or light trucks from any geography. The only requirement is that parts must be on a vehicle available for commercial sale and that the vehicle producer must give permission. Nomination instructions are at **http://speautomotive.com/comp**. Preliminary descriptions and photos about the application's innovations are due **July 31, 2016** and should be eMailed to **ACCEpapers@speautomotive.com**. Physical parts must be brought to the SPE ACCE for final review by judges during a formal walk-through at the show.

Last year, the *Materials Innovation* award went to the nomination jointly submitted by Bright Lite Structures, LLC and Huntsman Polyurethanes for the carbon composite chassis system on the *Zenos E10* street-legal track car by automaker, Zenos Cars Ltd. The *Process Innovation* and *People's Choice* awards both went to the first composite coil spring on 2015 *Audi A6 Avant* 2.0-L TDI Ultra sedans by Audi AG nominated by Hexion Inc.

In 2014, the *Body Exteriors* award went to Mitsubishi Rayon Co., Ltd., which nominated the carbon fiber-reinforced composite decklid made via the prepreg compression molding process on the *Nissan GT-R* supercar by Nissan Motor Co. Ltd. The event's new *People's Choice* award (chosen by conference attendees) went to then Momentive Specialty Chemicals Inc. (now Hexion Inc.) for its nomination of the lightweight carbon fiber-reinforced composite door structure with Class A appearance on the *Porsche 911 GT Cup supercar* produced by Porsche AG.

In 2013, Plasan Carbon Composites swept the competition in all three categories. The company's nomination of the hood for the *Corvette Stingray* sports car from General Motors Co., produced in carbon fiber-reinforced composites via Plasan's new out-of-autoclave pressure press technology, won the *Body Exterior* category. And Plasan won both *Body Interior* and *People's Choice* awards with its nomination of the engine X-brace on the *SRT Viper* from then Chrysler Group LLC (now FCA US LLC (Fiat Chrysler Automobiles)) produced in autoclave-cured carbon composites.

In 2012, the first year that the SPE ACCE featured a parts competition, Asahi Kasei North America won the *Best Part* award with its nomination of the twin-sheet thermoformed glass-reinforced polypropylene composite on the Ram Box assembly with lid on *Dodge Ram pickups* from then Chrysler Group LLC.

Dale Brosius (*left*), chief commercialization officer, Institute for Advanced Composites Manufacturing Innovation and 2015 SPE ACCE conference co-chair presents the Materials Innovation trophy to Antony Dodworth (*right*), chief technology and manufacturing officer at Bright Lite Structures.

Dale Brosius (*left*), presents the Process Innovation trophy to Cedric Ball (*right*), business development & global marketing-Automotive at Hexion.

Call for Student Scholarship Applications

Since supporting students is an important activity of SPE, conference organizers have issued an annual call for applications for three SPE ACCE scholarships and two awards from a new endowed scholarship still in the process of being funded in honor of the late Dr. Jackie Rekhopf, a long-time SPE Automotive Division board member, SPE ACCE volunteer, and automotive composites expert. Winners will be selected from a pool of qualified applicants and announced in July prior to the 2016 SPE ACCE show.

All three ACCE scholarships are in the amount of $2,000 USD. Two of the scholarships (given annually since 2007) are for full-time graduate students anywhere in the world who are pursuing degrees in Polymer Science, Composites, Plastics or a related Engineering discipline. A third ACCE scholarship is available for a graduate or junior or senior undergraduate student pursuing similar academic programs at a university or college in the US state of Michigan. In addition to a letter of recommendation from an advisor or mentor, students must provide a succinct 2-page essay explaining how their planned work will benefit polymer composites usage in the automotive or other ground-transportation industry. Winning students are required to submit a formal paper on the work by June the following year and are expected to present their results in person at that next year's SPE ACCE conference.

In just five months, the new Dr. Jackie Rehkopf scholarship is approximately half-way to its $100,000 USD goal to reach full endowment, but contributions from the SPE Automotive and Composites Divisions, who have co-organized the ACCE show since 2001 and provided seed money to get the endowed scholarship started, have agreed to contribute funds to allow two scholarships to be given in 2016. The scholarships are available to either full-time graduate or junior or senior undergraduate students anywhere in the world pursuing degrees in Polymer Science, Composites, Plastics or a related Engineering discipline, with preference given to female students, although the best candidates will be selected. Up to two $5,000 awards each will be awarded to qualified graduate students, or up to two $2,500 awards each will be awarded to qualified undergraduate students if no graduate applications are received, or a combination of one $5,000 graduate award and one $2,500 undergraduate award for the 2016-2017 academic year. As with the ACCE scholarships, a letter of recommendation from the student's advisor/mentor and a 2-page essay is required showing planned work and how it benefits composites usage in the automotive or other ground-transportation industry. Work supported by the scholarship must be formally written up and either presented at an SPE technical conference like the SPE ACCE or published in an SPE technical journal.

Applications for ACCE, Rehkopf, and many other SPE scholarships for the 2016-2017 academic year may be found on the SPE Foundation® website at **http://www.4spe.org/Foundation**. Deadline for submission is **May 1, 2016.**

Those interested in contributing to the Dr. Jackie Rehkopf endowed scholarship should send a check (made out to The SPE Foundation) to:

The SPE Foundation - Rehkopf Scholarship
Attn: Gene Havel
6 Berkshire Blvd, Suite 306
Bethel, CT 06801 USA

PLEASE mark in the Notes section of your check that the funds are for the Rehkopf Scholarship so they are applied to the correct fund. Then please send an eMail to **News@SPEAutomotive.com** and let us know how much you have contributed so we can keep track of the scholarship. For more information, call +1 203.740.5457 or email **foundation@4spe.org**. Donations made by U.S. citizens are tax deductible.

Call for Entries for ACCE Student Poster Competition

The ACCE team also issued an invitation for entries on innovative composites technologies for automotive and ground transportation for its eight-annual *student poster competition*. Judges made up of media, industry experts, and SPE board members will review all posters with student authors on the first day of the conference. First-, second-, and third-place awards will be presented to winners in graduate and undergraduate categories during a special ceremony after lunch on the event's second day.

Students and their posters will be ranked according to the following criteria:

- Content (student and poster demonstrate clarity of topic, objectives, and background);
- Motivation for research and technical relevance to conference theme;
- Methodology and approach to problem;
- Quality of proposed research results/findings;
- Conclusion are supported by information presented;
- Presentation (display aesthetics are pleasing and there is a logical flow between sections);
- Knowledgeable (presenter has a good grasp of the subject);
- Understandability (poster is effective even without student being present to explain it); and
- Overall rank vs. other posters and presenters.

Since 2008, the SPE ACCE poster competition has been organized annually by Dr. Uday Vaidya, chief technology officer, Institute for Advanced Composites Manufacturing Innovation (IACMI) and professor and governor's chair-Advanced Composites Manufacturing at University of Tennessee-Knoxville. He is supported by Dr. David Jack, professor, School of Engineering & Computer Science, Baylor University.

Students interested in participating in the 2015 competition should contact Vaidya at **ACCEposters@speautomotive.com.** Abstracts are due by **March 31, 2016** and digital copies of posters are due by **August 20, 2016**. Students will need to bring physical copies of their posters with them to the conference.

In 2015, the winning students in the Graduate category were Shatori Meadows from Tuskegee University (first place), Ermias Gebrekidan Koricho and David DR from Michigan State University (second place), and Christopher Boise from Baylor University (third place), who also is an SPE ACCE graduate scholarship award winner for 2015-2016. In the Undergraduate category, winning students included Ronald Koslakiewicz from University of Michigan-Dearborn (first place), Michael Biancaniello from University of Guelph (second place), and Josh Caudhill from Michigan State University (third place).

Shatori Meadows from Tuskegee University (left) accepts her plaque for the First Place Graduate Student category from Patrick (Pat) Szaroletta (right), president, Faurecia Automotive Exteriors North America, the 2015 student poster competition sponsor.

Ermias Gebrekidan Koricho from Michigan State University (*left*) receives his plaque for the Second Place Graduate Student category from Szaroletta (*right*).

About the SPE ACCE

Held annually in suburban Detroit, the ACCE draws over 1,000 speakers, exhibitors, sponsors, and attendees and provides an environment dedicated solely to discussion and networking about advances in transportation composites. Its global appeal is evident in the diversity of exhibitors, speakers, and attendees who come to the conference from Europe, the Middle East, Africa, and Asia / Pacific as well as North America. Fully one-third of attendees indicate they work for automotive and light truck, agriculture, truck & bus, or aviation OEMs, and another 25% represent tier suppliers. Attendees also work for composite materials, processing equipment, additives, or reinforcement suppliers; trade associations, consultants, university and government labs; media; and investment bankers. The show has been jointly sponsored by the SPE Automotive and Composites Divisions since 2001.

Learn more at: **http://speautomotive.com/comp.htm** or **http://specomposites.com**.

Award Winning Paper

Selective Dispersion and Compatibilizing Effect of Cellulose Filler In Recycled PA6/ PP Blends

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Abstract

The use of sustainable composites is becoming increasingly favorable in the auto industry. By using combinations of recycled polymers and natural reinforcements to replace traditionally unfilled, glass filled, and talc filled polymeric components, the environmental impact of each vehicle can be reduced. The objective of this study was to develop composites containing recycled polypropylene (PP), recycled polyamide 6 (PA6), and cellulose, with physical properties consistent with unmodified polymers. This study investigated the material properties of PA6/PP blends with the following variables: a) the addition of a compatibilizer, b) the addition of cellulose, and c) the order in which components were mixed. The samples produced for this study had a fixed composition of 70:30 PA6:PP. Certain samples also contained 10 wt% cellulose and/or 6 wt% compatibilizer. The composites were produced using a twin screw extruder and injection molding. The resulting properties were investigated on a microscopic (SEM) and macroscopic scale (mechanical and thermal properties). The miscibility of PP and PA6 improved with the addition of a compatibilizer. Polymer blends containing a coupling agent exhibited the highest strengths and elongations, while cellulose-filled composites containing compatibilizer exhibited the highest stiffnesses. The mechanical and thermal properties of the composites generated were compared to physical requirements for composite components used in thermally challenging areas, such as under-the-hood in automotive applications.

1. Introduction

Because of legislative and consumer demand for more fuel efficient vehicles, the use of polymers and composites to develop lightweight automotive components has been increasing every year. The amount of polymer used per average vehicle has increased from 6% in 1970 to 16% in 2010, and is expected to reach 18% by 2020 [1]. A vehicle weight reduction of 10% results in a 3-7% improvement in fuel economy [1]. As polymer use per vehicle is increasing, so is post-consumer plastic waste. In 2012, the United States generated approximately 32 million tons of plastic waste but only recycled 2.8 million tons, or 3.2%, of the waste [2]. Finding new ways to reuse otherwise disposed polymeric materials in the automotive industry could reduce cost, while decreasing vehicle weight and the carbon footprint of each vehicle.

In the automotive industry, glass fibers and talc fillers are common polymer reinforcements due to their low cost and good

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mechanical properties. Many cellulosic natural fibers have been proven as good replacement for glass fiber reinforcement including kenaf, hemp, sisal, jute, and others. [3, 4] Naturally-occurring cellulose has a much lower density (~1.5g/cm^3) than glass fibers (~2.5 g/cm^3). Weyerhaeuser, pulp and paper industry leader, in collaboration with the Ford Motor Company, found that cellulose reinforced plastic composites can be produced 20-40% faster (less cycle time), weigh 10% less, and consume less energy during processing than fiber-glass based materials [5].

The use of polymer blends is also becoming more common in the automotive industry. A blend of two or more polymers is capable of providing intermediate properties of the neat polymers. In this article, we have chosen recycled PA6 and recycled PP and tried to produce a polar-nonpolar hybrid materials. A blend of polyamide-6 (PA6) and polypropylene (PP) yields a material which is easier to process than neat PA6, is low cost, has high thermal and mechanical performance and is stable in the presence of moisture. However, due to the opposing polarities of the two materials, a compatibilizer is generally required to improve the miscibility of the blend. Polypropylene grafted maleic anhydride (PP-g-MA) has been proven as a suitable compatibilizer for these two materials by reacting with the amine groups on PA6 during melt processing [6-9]. In this study, cellulose fibers were incorporated into a recycled PA6/PP blend in the absence or presence of PP-g-MA via four different blending processes. The main objective was to study the dispersion of cellulose fibers in the recycled PA6/ PP blend, and examine the effect of the cellulose fibers on the morphology, mechanical, and thermal properties of this polymer blend.

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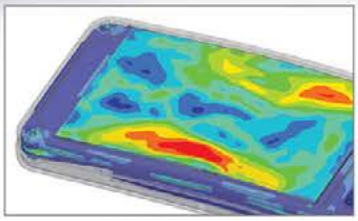
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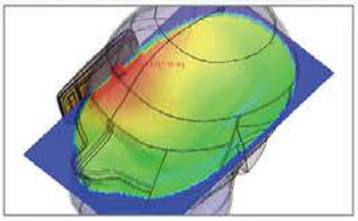
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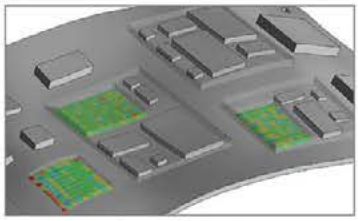
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2. Experimental

2.1 Materials and Generation of Composites/Blends

Post-consumer recycled (PCR) polyamide-6 (PA6) and polypropylene (PP) were kindly supplied in the form of homopolymer pellets from a commercial source. Polypropylene-graftedmaleic-anhydride (PP-g-MA) was also supplied in bulk pellet form and short cellulose fibers (~150 µm x 20 µm x ~2 µm) were supplied in the form of bulk powder. The supplied PA6 and PP had melting points of approximately 220°C and 160°C, respectively. Seven composites and four polymer blends were produced as indicated in Table I. Each blend/composite contained a ratio of PA6:PP of 70:30 wt%. Polypropylene grafted maleic anhydride (PP-g-MA) composed 6 wt% of applicable blends and composites, and cellulose composed 10 wt% of composites. The blends/composites varied by the order in which the components were mixed, not in composition. For example, Batch 1 of composite 1A mixed cellulose with PP via extruder. In a separate extrusion, PA6 was mixed with Batch 1 to complete the composite. All blends and composites lacking PP-g-MA are designated with an "A"; all blends containing PP-g-MA are designated with a "B". Table II indicates the final composition of each blend/ composite.

Prior to extrusion, cellulose fibers and recycled polymers were dried to reduce moisture content to less than 1% using an oven at 80°C for at least 6 hours before the extrusion process. The dry polymers and cellulose were separately starve-fed into a twin screw extruder (ThermoHaake Rheomex Model PTW25) from K-Tron gravimetric feeders. After extrusion, the materials were immediately quenched in a water bath kept at room temperature. The compounded materials from the twin screw extruder were granulated using a lab scale grinder/chopper. The ground particles were also dried to reduce moisture content to less than 1% using a conventional oven at 80°C for 6 hours before injection molding (Boy Machines Model 80M) into ASTM test specimens.

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Award Winning Paper continued...

Table I: *Experimental design for preparation of composites and blends. Batch* 1 *was mixed via twin screw extruder and chopped into pellets. After drying pellets, additional materials were mixed with Batch* 1 *(if applicable).*

Sample Name	Batch 1	Mixed with Batch 1
Neat Polymers		
PA6	PA6	--
PP	PP	--
Polymer Blends		
Blend A (PA6 + PP)	PA6	--
	PP	--
Blend B (PA6+ PP + PP-g-MA)	PA6	--
	PP	--
	PP-g-MA	--
Cellulose-Filled Composites with Varied Mixing Order		
1A (Cellulose + PP first)	PP	PP + Cellulose (Batch 1)
	Cellulose	PA6
1B (Cellulose + PP first)	PP	PP + Cellulose (Batch 1)
	Cellulose	PA6
	--	PP-g-MA
2A (All mixed at once)	PP	--
	PA6	--
	Cellulose	--
2B (All mixed at once)	PP	--
	PA6	--
	Cellulose	--
	PP-g-MA	--
3A (Cellulose + PA6 first)	PA6	PA6 + Cellulose (Batch 1)
	Cellulose	PP
3B (Cellulose + PA6 first)	PA6	PA6 + Cellulose (Batch 1)
	Cellulose	PP
	--	PP-g-MA
4B (Polymers mixed first)	PA6	PA6 + PP + PP-g-MA
	PP	Cellulose
	PP-g-MA	--

Table II: *Final composition of blends and composites. The ratio of* PA6:PP *remained constant at* 70:30 *for all composites/blends.* PP-*g*-MA *consisted of* 6% *of a composite/blend and cellulose consisted of* 10% *of a composite (when applicable).*

Material	Blends without PP-g-MA (Blend A)	Blends with PP-g-MA (Blend B)	Composites without PP-g-MA (A's)	Composites with PP-g-MA (B's)
	[wt%]	*[wt%]*	*[wt%]*	*[wt%]*
PP	30	28	27	25
PA6	70	66	63	59
PP-g-MA	0	6	0	6
Cellulose	0	0	10	10

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2.2 Testing Procedures

2.2.1 Mechanical Testing

Tensile, flexural, and impact tests were performed according to ASTM standards D 638- 10, ASTM D 790-10, and ASTM D256-10, respectively, in an environmentally conditioned room at 23 ± 2°C and 50 ± 5% RH. Tensile tests were performed using a 5kN load cell in an Instron 3366. At least six specimens were tested per sample. The displacement was measured using a 50 mm extensometer and the specimens were tested at a rate of 5 mm/ min. The stress at maximum load, strain at maximum load, strain at yield, and Young's modulus were gathered from the stress-strain curves generated. Flexural tests were conducted with a 5kN load cell attached to the same Instron. At least 6 specimens were tested per sample. Flexural tests were run at a rate of 1.25 mm/min and the dimension of support span was set at 50 mm. Flexural strength and flexural modulus were determined using this method. Impact strength was determined by notched Izod pendulum impact testing performed on a Testing Machines Inc. 43-02-03 model impact test machine. A 10 lb. pendulum was used to hit the notched sample and at least 14 specimens were tested per sample.

2.2.2 Thermal Testing

Thermal analysis of the composites was performed using a Mettler-Toledo Differential Scanning Calorimeter (DSC). Specimens were first heated from room temperature to 300°C at a rate of 20°C/min and held at 300°C for 5 minutes to remove the thermal history of the sample. Then the samples were cooled to 0°C at a rate of -10°C /min, held at 0°C for 5 minutes, and heated to 300°C at a rate of 10°C /min. The enthalpy of melting and crystallization as well as the melt and crystallization temperatures were determined from the curves of heat flow vs. temperature.

2.2.3 Microscopy

Morphological characterization was performed using a Scanning Electron Microscope (SEM) to examine the impact fracture surfaces of the samples.

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3. Results and Discussion

3.1 Mechanical Properties

3.1.1 Tensile Properties

Figure 1 illustrates the tensile strengths of the polymer blends and composites. The PA6 sample exhibited the highest tensile strength of all of the blends and composites. The addition of PP-g-MA (compatibilizer) improved the strengths of the composites and the polymer blends. Specifically, sample 1B exhibited an average tensile strength of 44.0 MPa while sample 1A (without PP-g-MA) exhibited an average tensile strength of 39.6 MPa. Chow et al. observed a similar increase in strength upon the addition of PP-g-MA to PA6/PP blends and organoclay nanocomposites [6]. The addition of cellulose did not improve the tensile strength of the samples. Blend B (PA6 + PP + PP-g-MA) exhibited a tensile strength of 48.6 MPa while the PP-g-MA-containing composites (1B, 2B, 3B, and 4B) exhibited an average tensile strength of 42 MPa. A similar result was found by Arsad et al. in a study of the properties of kenaf reinforced PA6/PP composites; the tensile strength of 10 wt% kenaf reinforced composites was lower than an unreinforced PA6/PP blend [3].

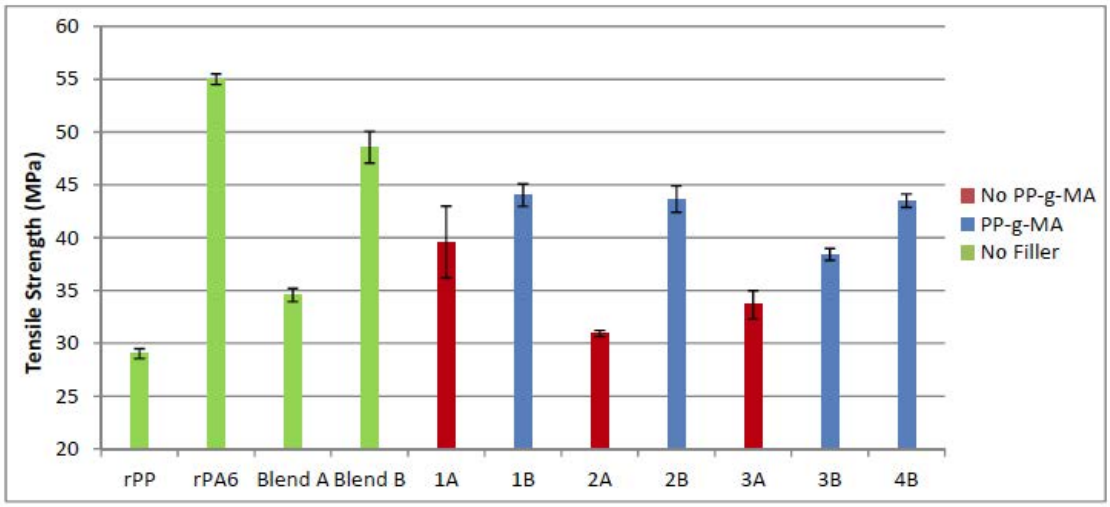

Figure 1: Ultimate tensile strength of unfilled polymer blends and cellulose reinforced composites. 1A & 1B mixed cellulose into PP prior to the addition of PA6 (and PP-g-MA for 1B); 2A & 2B mixed all components in one batch, 3A & 3B mixed cellulose into PA6 prior to the addition of PP (and PP-g-MA for 3B); and 4B mixed the polymers together (PA6 + PP + PP-g-MA) prior to adding cellulose.

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The addition of PP-g-MA significantly increased the maximum strain in polymer blends: Blend A and Blend B (Figure 2). However, PP-g-MA did not significantly affect the maximum strain of the composites. Additionally, cellulose did not improve the maximum strain of the samples.

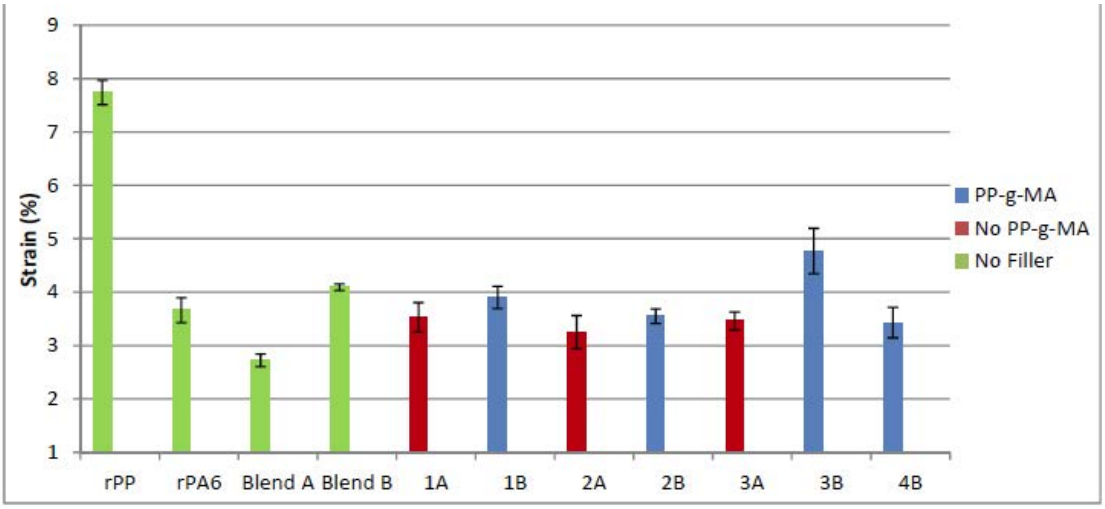

Figure 2: Tensile strain at maximum load of unfilled polymer blends and cellulose reinforced composites

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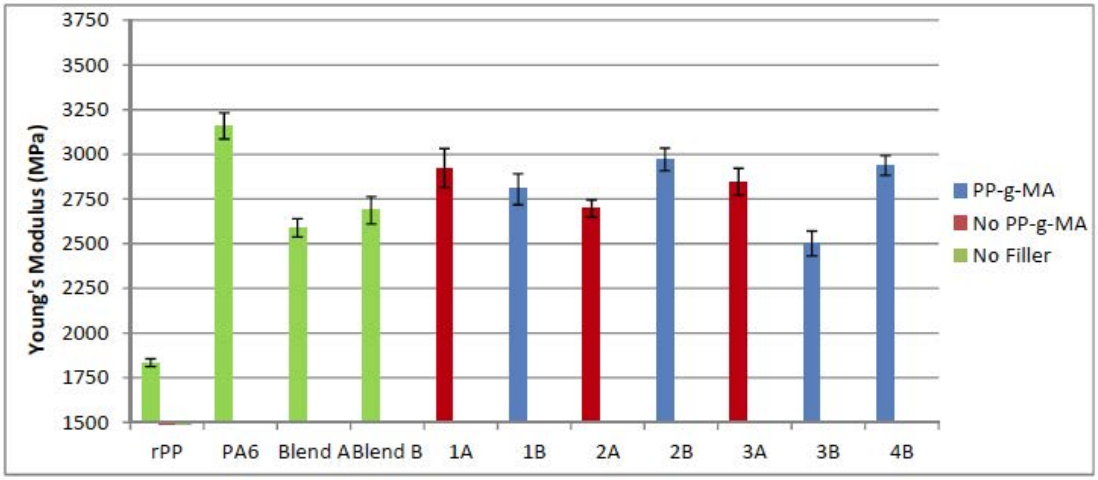

Figure 3: Young's moduli of unfilled polymer blends and cellulose reinforced composites

Figure 3 illustrates the Young's moduli of the samples. Neat PA6 was the most rigid sample, with a Young's modulus of 3.16 GPa, while the 100% PP sample was the least rigid, with a Young's modulus of 1.83 GPa. The addition of PP-g-MA had no effect on the rigidity of the samples. However, cellulose increased the stiffness of the composites. For example, Blend B had an average modulus of 2.69 GPa while 1A had a modulus of 2.92 GPa and 2B had a modulus of 2.97 GPa. The moduli of both samples were higher than Blend B's modulus, as a result of the addition of 10% cellulose. This observation is similar to other studies which have reported that Young's modulus increased with cellulose content [5,10]. One unique sample, 3B, exhibited a modulus that was approximately 15% lower than the other composites. Also, the elongation of 3B was 30% higher than the other composites (Figure 2). These results suggest that the mixing method may have had an impact on stiffness and elongation.

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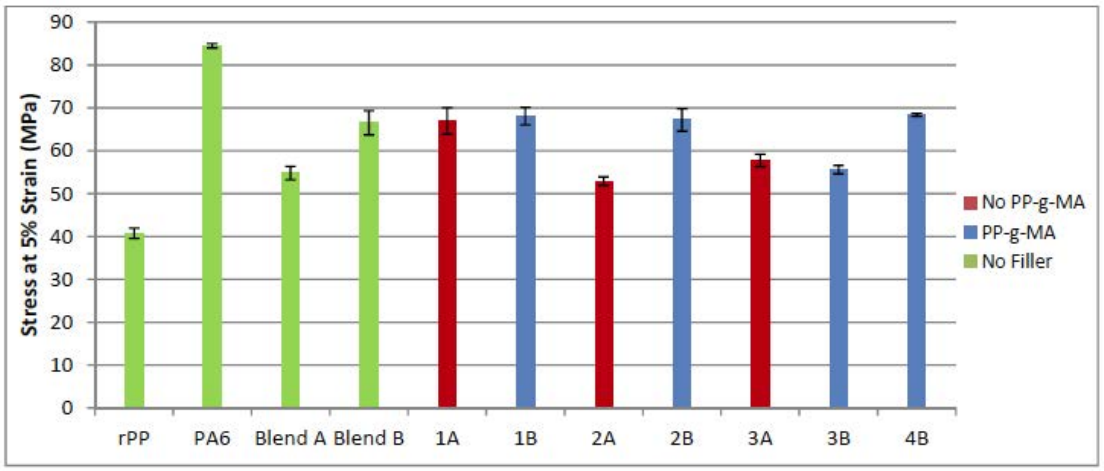

Figure 4: Flexural strength of unfilled polymer blends and cellulose reinforced composites

3.1.2 Flexural Properties

Figure 4 shows the flexural strength (stress at 5% strain) of the samples. Neat PA6 exhibited the highest flexural strength (84.5 MPa), while sample 4B exhibited the highest flexural strength of the composites and blends (67.3 MPa). The addition of PP-g-MA improved the flexural strength of the blends, but did not appear to improve the flexural strength of the composites. Chow et al. observed a similar phenomenon, as PP-g-MA increased the strength of PA6/PP blends [6]. Cellulose did not have an impact on the flexural strength of the composites. PP-g-MA containing composites exhibited strengths that were not significantly different than the strength of Blend B. This result is similar to the influence of kenaf fiber on the flexural strength of PA6/PP blends, found by Argus et al [3].

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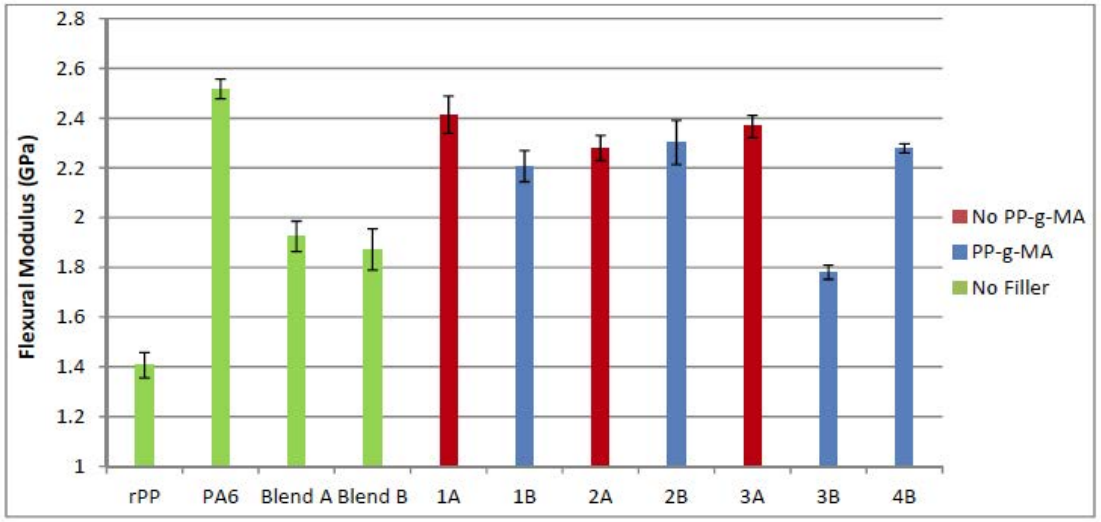

Figure 5: Flexural modulus of elasticity of unfilled polymer blends and cellulose reinforced composites

The flexural moduli of the samples are shown in Figure 5. The addition of PP-g-MA had no effect on the flexural modulus of elasticity (FMOE) of the samples. However, the addition of cellulose significantly increased the stiffness. While the polymer-only blends (Blends A & B) exhibited flexural moduli less than 2 GPA, most of the cellulose containing blends had moduli greater than 2.2 GPA. A similar result was found in a study performed by Kiziltas et al. when incorporating cellulose fibers into polyamides, as well as a study by Xu, when incorporating alpha cellulose into PA6 and PA66 matrices [10-11]. Sample 3B, however, exhibited a flexural modulus that was approximately 25% lower than the other composites.

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3.1.3 Impact Properties

Figure 6 shows the impact strengths of the samples. Blend B exhibited the highest impact strength, and showed significantly higher strength in comparison to Blend A. Therefore, the addition of PP-g-MA improved the impact strength of the unfilled blends. However, there is no significant difference in strength between the composites containing PP-g-MA and the composites lacking PP-g-MA. Additionally, cellulose did not improve the impact strength of the composites. The composites containing PP-g-MA exhibited significantly lower strength than Blend B, while the composites lacking PP-g-MA exhibited strengths similar to Blend A. This finding is in agreement with a study by Arsad et al; the impact strength of PA6/PP blends decreased with the addition of kenaf fiber [3]. The addition of cellulose fibers created stress concentrations within the matrix, near the fibers. The stress concentrations decreased the amount of energy required for crack initiation, and reduced the amount of energy absorbed by the composites upon impact. A similar observation was found in a study of kenaf fiber reinforced PA6/PP blends by Arsad et al.

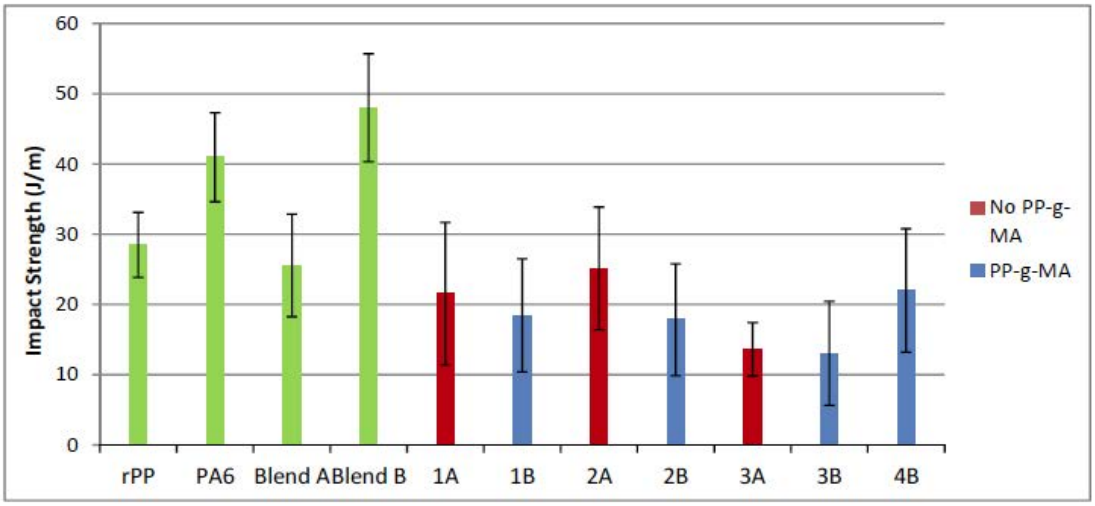

Figure 6: Impact strength of unfilled polymer blends and cellulose reinforced composites

A summary of the mechanical results is shown in Table III. PP-g-MA improved the tensile strength of the polymer blends and the cellulose composites. It also improved the elongation, flexural strength, and impact strength of the polymer blends. However, it has no effect on the stiffness of the samples. The addition of cellulose increased the stiffness of the samples, but not the strength. Overall, the mechanical properties of 1B, 2B, and 4B were higher than the other composites produced. Because sample 3B did not perform in a manner consistent with the other PP-g-MA containing samples, it appears that mixing method affects the mechanical properties of these composites.

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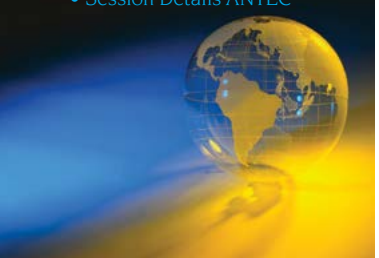

Table III: Effect of PP-g-MA and cellulose on the mechanical properties of samples. Samples containing PP-g-MA were compared to their respective controls, lacking PP-g-MA. Samples containing cellulose were compared to their respective controls, lacking cellulose. Green items (+) exhibited property improvement, white items (o) experienced no significant property change, and red items (-) experienced property degradation.

Property		Blends/ composites containing PP-g-MA		Cellulose Composites	
		Unfilled	*Filled*	*No PP-g-MA*	*PP-g-MA*
Strength	Tensile	+	+	o	-
	Flexural	+	o	o	o
	Impact	+	o	o	-
Elongation	Tensile	+	o	o	o
Stiffness	Young's Modulus	o	o	+	+
	Flexural Modulus	o	o	+	+

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3.2 Thermal Properties

3.2.1 Differential Scanning Calorimetry (DSC)

The effect of cellulose on the thermal properties of the composites was examined via DSC. The melt temperature (T_m), crystallization temperature (T_c), enthalpy of melting (ΔH_m), and enthalpy of crystallization (ΔH_c) of each sample is presented in Table IV [12]. Figure 7 shows the heat flow of the composites throughout heating and cooling ramps (exothermic heat flow is represented as positive data).

The addition of cellulose had a minimal effect on the melting and crystallization temperatures of the samples. However, Table IV illustrates that adding cellulose resulted in smaller crystallization and melting enthalpies. One possible explanation for this observation could be that the cellulose particles were hindering polymer chain movement during heat cycling. Fornes et al. reported this theory for PA6/ clay composites [13].

Table IV: *Summary of* T_m, T_c, ΔH_c, ΔH_m *and* X_c *for polymer blends and cellulose composites*

PP				
Sample Name	T_m [°C]	ΔH_m [J/g]	T_c [°C]	ΔH_c [J/g]
PP	162.7 ± 0.45	-108.5 ± 5.26	120.3 ± 0.33	103.1 ± 6.79
Blend A	160.3 ± 0.10	-34.3 ± 2.40	116.2 ± 0.25	37.2 ± 0.81
Blend B	161.7 ± 0.14	-44.5 ± 3.56	120.3 ± 0.25	45.4 ± 3.0
1A	161.3 ± 0.29	-21.6 ± 1.01	115.5 ± 0.44	25.1 ± 0.77
1B	162.6 ± 0.20	-31.9 ± 1.04	120.2 ± 0.21	34.9 ± 1.90
2A	161.3 ± 0.10	-28.5 ± 0.98	117.5 ± 0.28	31.7 ± 0.35
2B	162.5 ± 0.19	-34.6 ± 2.06	120.7 ± 0.11	35.2 ± 1.61
3A	161.1 ± 0.12	-26.2 ± 1.12	116.1 ± 0.53	30.3 ± 1.79
3B	162.7 ± 0.55	-34.5 ± 5.59	119.7 ± 0.29	40.2 ± 0.86
4B	162.2 ± 0.50	-34.7 ± 2.42	120.3 ± 0.47	37.4 ± 0.99

PA6				
Sample Name	T_m [°C]	ΔH_m [J/g]	T_c [°C]	ΔH_c [J/g]
PA6	217.0 ± 0.11	-56.5 ± 0.72	191.1 ± 0.09	60.5 ± 0.78
Blend A	215.9 ± 0.17	-40.3 ± 0.38	189.8 ± 0.27	43.4 ± 0.47
Blend B	214.0 ± 0.87	-34.1 ± 3.58	190.3 ± 0.35	36.8 ± 3.64
1A	215.8 ± 0.17	-42.1 ± 0.50	188.9 ± 0.20	45.8 ± 0.45
1B	215.0 ± 0.36	-34.8 ± 0.20	186.7 ± 0.01	38.0 ± 0.70
2A	214.1 ± 0.52	-34.8 ± 0.36	187.0 ± 0.53	38.6 ± 0.18
2B	214.8 ± 0.75	-34.0 ± 1.40	187.0 ± 1.47	37.2 ± 1.39
3A	214.2 ± 0.67	-36.6 ± 1.51	187.2 ± 0.92	40.7 ± 1.46
3B	212.5 ± 0.36	-29.8 ± 1.11	183.7 ± 0.86	33.7 ± 0.45
4B	214.8 ± 0.63	-32.9 ± 0.48	186.7 ± 0.84	35.9 ± 1.17

continued on page 31...

This Issue:

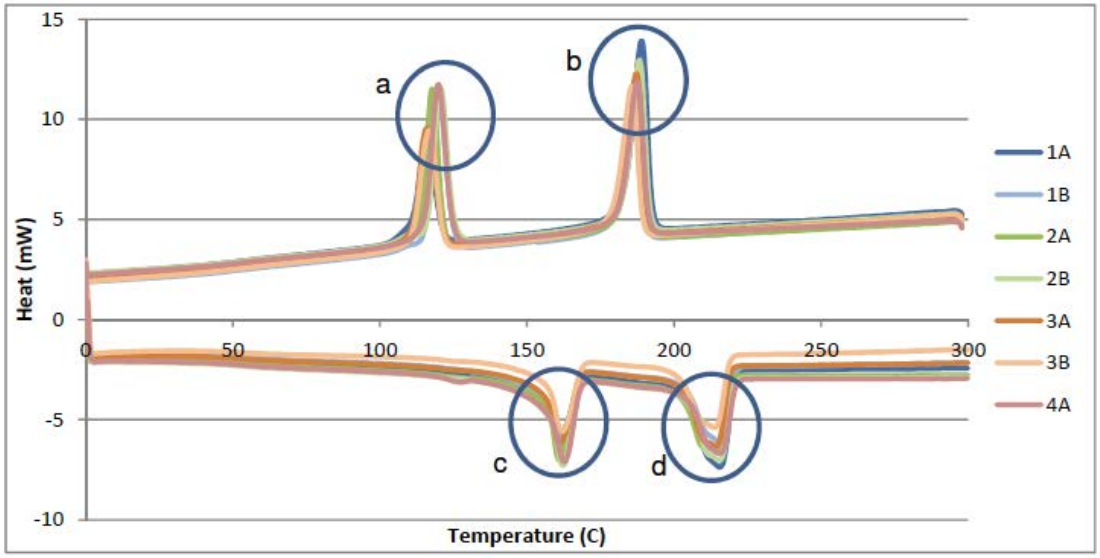


Figure 7: DSC thermograms of polyamide 6 + polypropylene + cellulose composites. Each circled peak shows the melting or crystallization temperature of a polymer component. Peaks (a) and (b) indicate the crystallization temperatures of PP and PA6, respectively. Peaks (c) and (d) indicate the melting temperatures of PP and PA6 respectively.

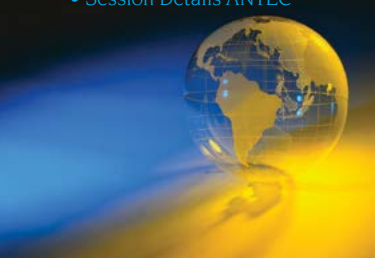
3.3 Morphological Properties

3.3.1 Scanning Electron Microscopy

SEM images in Figure 8 show morphological differences between the polymer blends and composite 4B. The micrograph of Blend A shows a matrix-droplet morphology, with the PP phase separating out of the PA6 matrix. The micrographs of Blend B and 4B show a smooth morphology, suggesting that the addition of PP-g-MA improved the miscibility of PA6 and PP. Figure 8c shows cellulose fibers within a compatibilized matrix (cellulose fibers are circled). The matrix surrounding the cellulose fibers is not cracked, suggesting that adhesion between the fiber and matrix was strong. Figure 8d shows a cluster of cellulose fibers on the surface of sample 4B. In this sample, it appears that cellulose fibers have clumped together instead of being uniformly dispersed within the matrix [4]. An optical microscopy study will be used to further examine the agglomeration of cellulose within the blends.

continued on page 32...

This Issue:



Award Winning Paper continued...

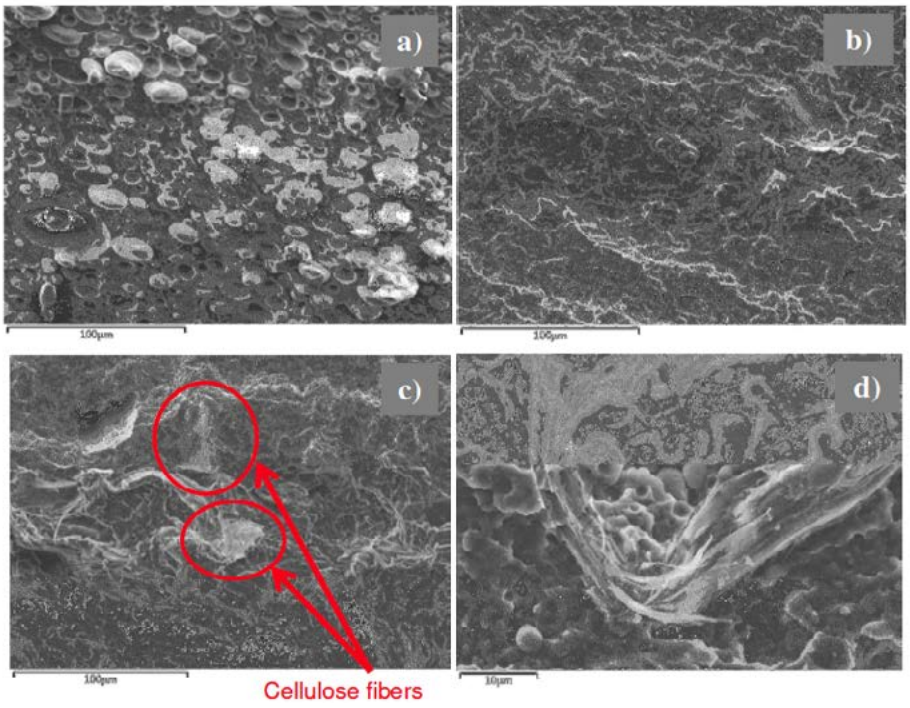


Figure 8: SEM images of the fracture surfaces of a) Blend A, b) Blend B, and c) 4B at 500x and d) a cellulose fiber within 4B at 2200x. The red circles in image (c) indicate the location of cellulose fibers within the matrix.

4. Conclusions

Mechanical properties, thermal properties, and morphologies of recycled PA6/PP/Cellulose composites have been investigated. Samples containing PP-g-MA showed a single phase when examined with SEM. Samples lacking PP-g-MA exhibited a matrix-droplet morphology (two phases), which, in theory, allowed crack propagation to occur more easily by traveling along dislocations clustered at grain boundaries. When mechanical testing was performed, all samples containing PP-g-MA performed with higher strength (both tensile and flexural), than those lacking PP-g-MA. Additionally, cellulose hindered chain movement within the samples. Experimentally, the effect of restricted chain movement was observed as increases in stiffness (Young's and flexural modulus of elasticity) and decreases in the enthalpies of melting and crystallization upon the addition of cellulose.

Based on the data collected, mixing order appears to have an effect on the properties of the composites. Sample 3B exhibited unique properties such as higher elongation, lower Young's modulus, and lower flexural modulus than other PP-g-MA containing composites. Sample 3B mixed cellulose with PA6 prior to the addition of PP and PP-g-MA. It is possible that cellulose is preferentially remaining only within PA6 heavy regions of the polymer due to the similar polarities of cellulose and PA6. This would yield larger polymer-only regions within the composite and allow for higher chain mobility within the sample. Thermogravimetric analysis (TGA), Fourier transform infrared spectroscopy (FTIR) and optical microscopy will be performed to deepen the understanding of selective dispersion of cellulose as well as the potential for these composites to be applied to under-the-hood applications within the automotive industry.

continued on page 33...

Award Winning Paper continued...

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This Issue:

Communication Update

By: Andrew Rich

Update report on the Website

The Compositeshelp.com website is finally up to date, except for possibly a few recently added changes, and a few smaller details. Please notify me of any details that can be fixed or improved. One of the links to Uday is still not updated, but if anything else isn't right, please let me know.

Dawn Stephens has done all the work so far, but her schedule seems to have never opened up for us the way we needed it to. During the ACCE she was busy both before and after the event. Then she was heavily involved in the Automotive Division's Awards Ceremony. Now she has taken on a full time job, her old job at Celanese, and has even less time for the Composites Division, at least until a replacement can be found for her on the Automotive Division. That is now supposed to happen in January. I asked her if once the Automotive Division is all set with her replacement, she would have any time for Composites Division, and she said she believes she will. We are much less work than the Automotive Division, which is up to 30 hours per week. That, in combination with her full time job, was really stressful, and we were always getting shuffled in the mix.

My feeling is that we need a back-up plan for this system. Dawn is going to help me get up to speed on how to make small changes to the site, now that the major changes have been made, that's one part of the plan. I also have someone near me that I can use, and I am planning to use him for other work anyway. It may work out fine that the Automotive Division hires someone new that is immediately competent and gets up to speed quickly, or if not, I want to be able to have this back-up plan.

I also have asked Dawn to submit a bill to the board before the end of the fiscal year, so that we can register the expense on our books.

I will be on the phone meeting to follow up with any questions.

– Andy

Funding Opportunity

By: Dr. Uday Vaidya

SPE COMPOSITES EDUCATION

The SPE Composites Division invites applications for student training and exposure for state of the art in *Advanced Composites Design, Testing, Modeling and Manufacturing*. SPE will entertain proposals that demonstrate high level of student involvement in the areas of -

1) Processing modeling and structural FEA of advanced plastics and composites (e.g., ANSYS, Hypermesh, LS-DYNA, Moldex, Moldflow, PAM-FORM, PAM-RTM, Simulia etc. - but not limited to)
2) Equipment for composites processing (Vacuum Infusion, Flex RTM, Injection molding, Thermoforming, Stamping etc, - but not limited to).
3) Advanced composite characterization methods

Background:

The use of advanced composites is growing rapidly in a number of sectors – defense, automotive, power generation, energy exploration, sporting goods, infrastructure etc. The next generation engineers are in urgent need of comprehensive training in the design, modeling, manufacturing and characterization of advanced composite materials and products. The SPE Composites Division is making significant efforts in enabling young engineers to enter the work force with relevant training and experience that aligns with industry needs. Modeling tools for FEA and process simulations, and lab scale equipment for composites processing and testing have tangible impact on student involvement. *The goal of the* SPE *grant is to promote access and broaden the use of these tools.*

Who is Eligible:

A four-year institution/university or a 2-year community college that offers courses and/or training in engineering and technology with course offerings in Introduction to Materials, Fibers, Polymers, Composites, Manufacturing. Demonstrated involvement from Freshmen to Senior to Graduate level students or K-12 outreach students is required.

Level of Funding:

SPE Composites Division will provide up to $5000 (for each approved proposal) with an institutional cost share requirement of 1:1. For example, if the value of the software or processing equipment is $10,000, SPE may contribute up to $5000 towards the purchase. The institution will be responsible to provide $5000. Indirect costs *are not* allowed in the application.

Application Process:

The application should be organized as follows:-

Cover Page: Name of the Project, Point of Contact, Institution Name and Contact Details, Date of Submission

Body of the Application (3-5 pages max):

1) Background of the Lab/Center/Department/Unit/Institution
2) Anticipated number of users and how they will use the software/equipment- undergraduates, graduates, staff, post-docs, and other users
3) Description of the software/processing/testing equipment – need, plans with the acquired capability

continued on page 36...

This Issue:

Funding Opportunity continued...

4) Budget breakdown including cost share details and justification
5) Letter of commitment for the cost share from the Dean, Department Head or other Institutional authority (authorized to sign on behalf of the institution)
6) Quote or evidence of cost based on correspondence with the vendor

Review and Selection Process:

Each application will be reviewed by a team of industry and academic experts and funding will be released based on their recommendation and approval of the SPE Composites Board.

Submission of Applications

(Two deadlines: 15 April 2016, and 15 August 2016); Limited to one application per institution per year will be considered

Expectations if awarded

Recipients are expected to:

1) Participate in one of the SPE meetings (SPE ACCE, ANTEC etc) to report on educational impact/use of the software/processing equipment. The information can be in a poster or presentation format.
2) Provide a brief summary/highlights at the end of the year that could be included in the SPE Composites Division newsletter.

Applications should be e-mailed to (with the Subject Line – SPE Education Fund Application:

Uday Vaidya, PhD; SPE Education Chair, uvaidya@utk.edu; Phone: 205-410-2898

Other Information:

The awards will be made at the annual SPE ACCE meeting usually held in Novi, Michigan in early September. The awardee institution will receive a certificate and plaque. The award notifications will be made in SPE media, website and news releases.

This Issue:

Awards Report

By: Dr. Ian Swentek

Be sure to check out the SPE Composites Division booth at ANTEC 2016 Indianapolis for further information on our awards programs.

Harold Giles Award 2016

This year, Dr. Dale Grove is overseeing the Harold Giles Award. Applications for this award are still open and close on May 1, 2016. This award is administered through the SPE Foundation. Information about the award and application process can be found on the foundation website at: http://www.4spe.org/Foundation/

METTLER TOLEDO Award 2016

The SPE Composites Division is pleased to announce that this year our two-part student award is being sponsored by METTLER TOLEDO. This award aims to sponsor student research by first soliciting an abstract for proposed research and continuing to sponsor that student when they present the results of that work. Several students submitted to this award and the judging is currently underway. The award winner is expected to be announced at ANTEC 2016 in May 23-25.

Sabic Educator of the Year Award 2016

Several educators have been nominated by their peers and students for the Sabic Educator of the Year award. This award recognizes outstanding contribution toward educating the next generation of composites professionals. This award will also be announced at ANTEC 2016 following the current applicant review.

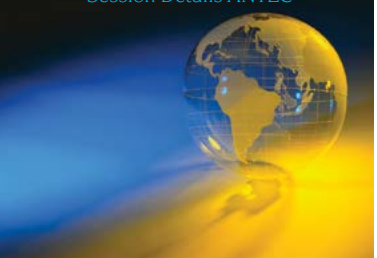
Honored Service Member / SPE Fellow

An application for Uday Vaidya is underway.

I would like to say a word of thanks to the many volunteers helping solicit and adjudicate the awards this year. Your support enables the continued success of these scholarship programs.

Kind Regards,
Dr. Ian Swentek

This Issue:



Treasury Report

By: Tim Johnson, Treasurer

SPE Composites Division (D39) FINANCIAL REPORT

Financial Report for the Period: **Sept 15, 2015 to Dec 31, 2015**
Section/Division Name: **Composites Division D39**

Balance as of 7/01/2015	-1	$108,864.69		
Income: check the "Income"worksheet for details		**Actual**	**Budget**	**Variance**
Sponsorships for Newsletter	-2	$ 2,000.00	$ 10,000.00	$ (8,000.00)
Sponsorships ANTEC Reception	-3	$ -		$ -
SPE Rebates	-4	$ -		$ -
ACCE Earnings (after expenses, scholarships and payment to SPE)	-5	$ -	$ 22,000.00	$ (22,000.00)
Sponsorship: Educator of the Year, SABIC	-6	$ -	$ 1,000.00	$ (1,000.00)
Saving Interest	-7	$ -		$ -
Training programs	-8			
Perkin Elmer Award	-9		$ 1,000.00	
Other	-10			
	-11			
	-12			
Total Income for the period	-13	$ 2,000.00	$ 34,000.00	$ (31,000.00)
Total Funds Available (add lines 1 and 13)	-14	$ 110,864.69	$ 34,000.00	$ (31,000.00)
Expense: check the "Expense" worksheet for details		**Actual**	**Budget**	**Variance**
Website - CompHelp - 1&1.com	-15	$ 175.69	$ 500.00	$ (324.31)
Newsletter	-16	$ 2,141.25	$ 5,000.00	$ (2,858.75)
Perkin Elmer Award	-17	$ -	$ 2,000.00	$ (2,000.00)
BOD Meeting Expenses	-18	$ 182.00	$ 2,000.00	$ (1,818.00)
Educator of the Year Award	-19	$ -	$ 1,000.00	$ (1,000.00)
Bank Service Fees	-20	$ 44.76	$ 250.00	$ (205.24)
Antec Suite / W&C Reception	-21	$ -	$ 2,000.00	$ (2,000.00)
ANTEC Other Expenses	-22	$ -	$ 1,000.00	$ (1,000.00)
Council Travel	-23	$ 1,217.37	$ 2,000.00	$ (782.63)
Publicity	-24	$ 432.19	$ 100.00	$ 332.19
SPE Scholarship Fund	-25	$ -		
SPE Foundation: H. Giles Scholarship	-26	$ 10,500.00	$ 10,500.00	$ -
Student Activities at ANTEC 2015 (SAC)	-27	$ -	$ -	$ -
Student Membership Program	-28	$ -	$ 4,000.00	$ (4,000.00)
	-29		$ -	$ 10,000.00
ACCE expenses	-30	$ 218.80	$ 1,000.00	$ (781.20)
SPE Foundation: Jackie Rehkopf Scholarship	-31	$ 10,000.00	$ 10,000.00	$ -
Total Expenses (add lines 15 – 31)	-32	$ 24,912.06	$ 41,350.00	$ (6,437.94)
Ending Balance (subtract line 32 from line 14)	-34	$ 85,952.63	$ (7,350.00)	$ (24,562.06)

Allocation of Funds on Line 34 (enter allocations as applicable)		
Checking Account	(A)	$ 85,952.63
Savings Account 1	(B)	$ -
Savings Account 2	(C)	$ -
Investment 1	(D)	$ -
Investment 2	(E)	$ -
Investment 3	(F)	$ -
TOTAL	(G)	$ 85,952.63
Amount on line G should equal amount reported on line 34		
Section / Division Treasurer's Name:		Timothy Johnson
Audit Committee Attest:		

This Issue:

Session Details ANTEC 2016

Time	Control #	Presenters	Title
Monday Morning		Natural / Bio Composites	
Moderator		Tim Johnson	
9:00	495	Jitlada Boonlertsamut	CHARACTERIZATION OF POLYPROPYLENE/BAMBOO FIBER COMPOSITES MODIFIED WITH POLYETHYLENE GRAFTED MALEIC ANHYDRIDE
9:30	456	Firoozeh Pourjavaheri	GREEN PLASTICS: UTILIZING CHICKEN FEATHER KERATIN TO IMPROVE THE THERMO-MECHANICAL PROPERTIES OF POLYURETHANE COMPOSITES
10:00	446	Muhammad Anwer	Improving the Impact Properties of PLA by Incorporation of PHA, TPU and Carbon Nanofibers
10:30	425	HU YongXu	Study on high-performance of WPC (Wood Polymer Composite)

Monday Afternoon		Composites Innovation	
Moderator		Dale Brosuis	
1:30	Keynote - 60 min	Kenneth Reifsnider	Composites: Holding our World Together with Plastics – New Challenges and Opportunities
2:00	-		
2:30	Keynote - 60 min	R. Byron Pipes	Design, Modeling and Simulation in Composites Manufacturing
3:00	-		
3:30	Panel - 90 min	Dale Brosius + Panel	Panel Discussion - IACMI (Institute for Advanced Composites Manufacturing Innovation) Progress to date
4:00	-		
4:30	-		

Tuesday Morning		Nanocomposites	
Moderator		Nikhil Verghese	
8:00	Keynote - 60 min	Satish Kumar	Effect of Carbon Nanotubes on the Structure, Processing, and Properties of Polymers
8:30	-		
9:00	73	Xiang Gao	USING ULTRASONIC TECHNOLOGY TO PREPARE WELL-DISPERSED POLYCARBONATE/CARBON NANOTUBES COMPOSITES AT HIGH FLOW RATE
9:30	249	Han-Xiong Huang	STRUCTURE AND PROPERTIES OF PVDF/GO NANOCOMPOSITES PREPARED BY WATER-ASSISTED MIXING EXTRUSION
10:00	349	Kazem Majdzadeh Ardakani	Improving the barrier and mechanical properties of PET/clay nanocomposites
10:30	444	Ivonne Otero Navas	PHASE MORPHOLOGY ASSEMBLING IN PP:PS BLENDS BY ADDITION OF MWCNT

continued on page 41...

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- **COMPOSITE MATERIALS HANDBOOK (CMH-17):** Polymer Matrix Composites 3-Volume Set: Includes critical properties of composite materials, and guidelines for design, analysis, material selection, manufacturing, quality control, and repair. **For more information, visit: sae.org/cmh-17**

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Session Details ANTEC 2016

Time	Control #	Presenters	Title
Tuesday Morning		Modeling / Analysis of Composites	
Moderator		Enamul Haque	
8:00	62	Abdullah Alshaya	Determination of Stress Concentrations in Orthotropic Composites Using Mapping Collocation Techniques
8:30	179	Gregory Lambert	Evaluating Rigid and Semi-Flexible Fiber Orientation Evolution Models in Simple Flow
9:00	399	Blanca Maria Lekube	PROPERTIES AND MODELING OF PARTIALLY COMPACTED, COMMINGLED POLYPROPYLENE GLASS FIBER FLEECE COMPOSITES
9:30	369	Sai Wang	Foaming effects on the percolation threshold in conductive polymer composites: a systematic analysis
10:00	270	Jessica Lin	OPTIMIZING PROCESS CONDITION OF COMPRESSION MOLDING: FROM MATERIAL PROPERTIES CHARACTERIZATION TO NUMERICAL SIMULATION
10:30	544	Eusebio Cabrera	Improved Sand Erosion Resistance and Mechanical Properties of Multifunctional Carbon Nanofiber Nanopaper Enhanced Glass Fiber/Epoxy Composites

Tuesday Afternoon		Failure Analysis in Composites (Joint Session with Failure Analysis SIG)	
Moderator		Brian Ralston	Failure Analysis in Composites (Joint Session with Failure Analysis SIG)
1:30	Keynote - 60 min	Matthew Jaworski	Advances in the Prediction of Weld Line Strength Failures for Fiber Filled Plastics
2:00	-		
2:30	Keynote - 30 min	Antoine Rios	Why it is Not Always Better to Use Fiber Reinforced Plastics
3:00	206	Amin Sedighiamiri	A THROUGH-PROCESS MODELING APPROACH FOR ANISOTROPIC PERFORMANCE AND LIFETIME EVALUATION OF FIBER REINFORCED THERMOPLASTIC PARTS
3:30	275	Masumi Ikegami	DEGRADATION INSPECTION OF GFRP STORAGE TANK WITH LONG-TERM USE UNDER HYDROCHLORIC ACID
4:00	383	David Granderson	Endurance Regression Testing: A Method to Replace ASTM D2992
4:30	524	Diego Pedrazzoli	INTERLAMINAR FRACTURE TOUGHNESS OF WOVEN GLASS FIBER-EPOXY LAMINATES WITH CARBON NANOTUBE BUCKYPAPERS

Tuesday Afternoon		Composites Processing	
Moderator		Shankar Srinivasan	
1:30	245	Amir Ameli	IMPACT OF FOAMING ON FIBER BREAKAGE, CONDUCTIVITY, AND EMI SHIELDING OF INJECTION-MOLDED POLYPROPYLENE/STAINLESS STEEL FIBER COMPOSITES
2:00	301	Stefan Epple	IN-SITU-PULTRUSION – STRUCTURAL THERMOPLASTIC FRP-PARTS
2:30	104	Zhixiang Cui	ELECTROSPUN PCL/NC COMPOSITE FIBERS AND THEIR MINERALIZATION
3:00	248	Takashi Kuboki	Effects of Thermoplastic Elastomers on Mechanical Properties of Glass Fiber Reinforced Poly(3-hydroxybutyrate-co-3-hydroxyhexanoate)
3:30	454	Jing Zhong	STUDY OF ULTRASONIC TREATMENT ON PP/CNT, PP/GNP AND PP/CB COMPOSITES USING CONTINUOUS ULTRASONIC TWIN-SCREW EXTRUSION
4:00	188	Ziran Du	EFFECTS OF TEMPERATURE ON MECHANICAL PROPERTIES OF UHMWPE/LDPE SINGLE-POLYMER COMPOSITES PRODUCED BY EXTRUSION MOLDING WITH ROLLER PRESSING
4:30			
5:00	120 min		Composites Division Board Meeting

continued on page 42...

Session Details ANTEC 2016

Time	Control #	Presenters	Title
Wednesday Morning		NDI and Processing	
Moderator		Ray Boeman	
8:00	Keynote - 60 min	David Jack	Recent Efforts on the Use of Focused Ultrasound to Identify Lamina/Laminate Information for Carbon Fiber Reinforced Laminated Composites
8:30	-		
9:00	304	Yannick Bernhardt	NON-DESTRUCTIVE TESTING OF COMPOSITES BY ROBOT SUPPORTED AIR-COUPLED ULTRASOUND
9:30	307	Stefan Meiler	NON-DESTRUCTIVE TESTING OF CFR-TAPES WITH THERMOPLASTIC MATRIX USING AIR-COUPLED ULTRASOUND
10:00	114	Krishnamurthy Jayaraman	Morphology and strength of die-drawn porous sheets from filled polypropylenes
10:30	216	Nihal Kanbargi	IMPROVING ADHESION BETWEEN KEVLAR®129 FIBERS AND NATURAL RUBBER MATRIX USING MORPHOLOGICAL TREATMENTS AND COUPLING AGENTS

Wednesday Afternoon		Long Fiber Composites	
Moderator		Creig Bowland	
1:30	153	Sebastian Goris	Analysis of the Process-Induced Microstructure in Injection Molding of Long Glass Fiber-Reinforced Thermoplastics
2:00	218	Hongyu Chen	Simulation of Long Semi-flexible Fiber Orientation during Injection Molding
2:30	252	Takashi Kuboki	Degradation of Glass Fiber Reinforced Polyamide Composites during Long Fiber Reinforced Thermoplastics Direct Extrusion Compression Moulding Process
3:00	356	Wiranphat Thodsaratpreeyakul	Effect of different fiber tex feeding on mechanical properties of glass fiber reinforced RPET composite by DFFIM process
3:30	370	Rebecca Minnick	EFFECTS OF INJECTION MOLDING PROCESSING PARAMETERS ON EXPERIMENTAL FIBER LENGTH DISTRIBUTION OF GLASS FIBER-REINFORCED COMPOSITES
4:00	406	Mark Miller	CELLULOSE NANOCRYSTALS AS REINFORCEMENT IN GLASS FIBER/EPOXY SHEET MOLDING COMPOUND COMPOSITES

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