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SPE® Names Category and Grand Award Winners in 40th Automotive Innovation Awards Competition

The Automotive Division of the Society of Plastics Engineers (SPE®) today announced the category and Grand Award winners for its 40th-annual **Automotive Innovation Awards Competition**, the oldest and largest recognition event in the automotive and plastics industries. After a pre-qualification round, surviving nomination teams presented their applications before a panel of automotive and plastics industry experts during two days of judging on September 30 and October 1.

Finalists selected from each category advanced to the *Blue Ribbon Judging* on October 11 where category and Grand Award winners were selected. Category and the event's Grand Award winners were announced on November 9 during the **Automotive Innovation Awards Gala** at Burton Manor in the suburbs of Detroit. According to the 2010 **Automotive Innovation Awards** program chair, Jeff Helms, global automotive manager, Ticona Engineering Polymers, "We were really pleased with the number of nominations we received this year, the diversity of automakers represented, and the quality of innovation they displayed. At each



Julie McCoy, PTI Chief Engineer, Ford Motor Company, accepts the 2010 SPE Innovation Awards Program Grand Award from Jeff Helms, 2010 Awards Program Chair.

round of the competition, our judges had a hard time selecting finalists and then winners from all the strong nominations we received. After four decades, it's great to see that innovation is alive

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Treasurers Report

Yvonne Bankowski

The SPE Automotive Division bank account balance is in good standing with \$70.5K in checking and \$27.4K in savings for a total of \$97.9K. In August, \$500 Scholarships were paid out to 3 students from the 2009 ACCE Student Poster Competition sponsored by Dow Chemical.

\$8250 was paid to the National Plastics Center and Museum for Plastivan Educational Programs. The IAG income and expenses are still being finalized, but a positive cash flow is expected. In mid-November the annual taxes were filed with the IRS.

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The 2011 Society of Plastics Engineering Annual Technical Conference (ANTEC) will take place in Boston, Massachusetts at the Hynes Convention Center and Boston Marriott Copley Center Hotel May 1 – 5, 2011. ANTEC is the world's largest international gathering of engineers, scientists, and business professionals in plastics.

If you want to learn about the latest technology in plastics automotive, plan to attend the Automotive Division Session at ANTEC. The Automotive Session is well attended each year by leaders in the

Automotive Division Meeting Schedule and Special-Events Calendar

Automotive Division BOD Meeting—All invited ! American Chemistry Council, Troy, MI	February 7, 2011 5:30 pm
Automotive Division BOD Meeting—All invited ! American Chemistry Council, Troy, MI	April 11, 2011 5:30 pm
6th-annual AutoEPCON Engineering Plastics Conference Troy, Michigan	April 26, 2011
SPE Annual Technical Conference (ANTEC) Boston, MA	May 1-5, 2011
11th-annual SPE Automotive Composites Conference & Exhibition Troy, MI	September 13-15, 2011
12th-annual SPE Automotive TPO Global Conference Troy, MI	October 2-5, 2011
41st-Annual SPE Automotive Innovation Awards Program Burton Manor, Livonia, MI	November, 2011

Automotive Division Board of Directors meetings are open to all SPE members. All our events are listed on our website at <http://speautomotive.com/ec>
Call Jeff Helms at (248) 337-6895 for more information.

Automotive Industry. The Chair of the 2011 ANTEC Automotive Division Session is **Tom Pickett**. Helping Tom with the ANTEC Automotive Session are **Norm Kakarala, Jay Raisoni, Suresh Shah** and **Mike Tolinski**.

For more information about ANTEC, visit the website: www.anteq.ws, or Contact: Lesley Kyle, CMP, SPE International Senior Event Manager, lskyle@4spe.org, phone: 1-203-740-5452 or Tom Pickett, Chair of SPE ANTEC Automotive Session, tomipickett@yahoo.com, phone 1-248-431-9724.

Chair's Message

Jeff Helms

This newsletter begins with reflection on the recent 40th Annual Innovation Awards Gala held on November 12th at Burton Manor in Livonia, Michigan. With over 60 nominations in this year's competition and well above 600 attendees, our 40th Innovation Awards Gala was the largest in recent years and shows that innovation is alive and accelerating in the automotive industry.

The 2010 Innovation Awards Gala continued the Division's 4-decade tradition of recognizing the people and technology advancements in automotive plastics at our industry's premiere recognition event. A sincere thank you to our Innovation Awards Gala planning committee and to our 40th-Anniversary subcommittee its work to put the program and 40th year reflection together.

Our committee members work for nine-ten months prior to the actual event to make sure that it is planned and executed with quality. I would like to recognize a few of the key contributors for this year's program. Our core planning committee consisting of Mark Lapain, Peggy Malnati, Kevin Pageau, Monica Prokopyshen, Teri Chouinard, Nippani Rao, Yvonne Bankowski, David Reed, Brian Grosser and Suzanne Cole. From sponsorship and marketing communication to awards nominations and judging, this core group handles the numerous planning details.

I would also like to thank Ron Price for his leadership in archiving the 40 year history of the this event and selecting highlights for our video segments during the awards program. Video formats have changed a lot over the last 40 years and simply finding video records from the earlier years was a challenge.

I would also like to reiterate the Division's appreciation of our event corporate sponsors. Without sponsorship, the Division would not be able to fund this event or some of our other education outreach and technical meetings. We

are also very interested in suggestions that you, our members, might have to continually improve this event.

We now turn our attention to our upcoming technical meetings in the Spring and planning for the 2011 Innovation Awards Gala. AutoEPCON is scheduled for April 26, 2011 in Troy, Michigan. AutoEPCON is a one day technical conference and exhibit on the latest in automotive engineering plastics, design and processing sponsored jointly with the SPE Detroit Section.

The Automotive Division is also planning two sessions at ANTEC May 1-5, 2011 in Boston, Massachusetts. This year's ANTEC meeting will be at the Hynes Convention Center and Boston Marriott Copley Center Hotel. Thanks to Tom Pickett for his work in organizing our technical sessions. We look forward to seeing as many of you as possible at these technical meetings.

The Division has been holding social events around the southeast Michigan area to allow for membership networking with the Automotive Division Board and to encourage participation in the Division. Ben Soltisz is our Division Social Chair and is currently planning events for 2011 including tours of plastics production, part production and/or vehicle assembly plants. As a side benefit, corporate donations of raffle items have been distributed by drawings at the previous events. Winners are posted on the division website at www.speautomotive.com. Come see us at upcoming events and try your luck.



Innovation Awards Program

Continued from Page 1

and well in the automotive plastics arena and that this industry is coming back stronger than ever with higher quality, better fuel economy, using more sustainable materials and manufacturing, and offering consumers greater features, value, and safety.”

Finalists and category winners selected from this year’s pool of nominations include the following:

The Grand Award, the most prestigious award of the evening, went to the winner of the Powertrain category - the **Diesel Exhaust Fluid (DEF) System** on the Ford Motor Company 2011 Superduty Diesel.

The other finalists in the Powertrain category were the Thermoplastic Oil Pan Module on the Chrysler Group LLC 2010 5.7L V8 Hemi, and the Electronic Throttle Control Actuator on the General Motors Co. 2010 Global Engine

The Body Exterior Category winner was the **Dual Material Sealing with PIT Technology** on the Ford Motor Company 2011 Ford C-Max. The other finalists include the Nameplate Badge on the Ford Motor Company 2010 Ford F150, the Pillar Appliqué on the Ford Motor Company 2011 Ford C-Max, the Integrated Bumper Energy-Management Device on the Ford Motor Company 2011 Ford Edge, and the Bright Belt Weather Strips with High Luster on the Ford Motor Company 2010 Ford Fiesta.

Winning the Body Interior category was the **Self Reinforced Airbag Door System** on the PSA Citroen 2008 C5. The other finalists were the Heated Steering Wheel System on the Hyundai-Kia Motor Company 2010 Kia Optima and the Interior Trim with 3-D Appearance on the Ford Motor Company 2011 Ford Explorer.

In the Chassis/Hardware category, the Integrated Carrier Rail for Rear Plastic Door Module on the Hyundai Motor Company 2010 Sonata was voted the winner. The other finalists were the Structural Composite Radiator Support on the Ford Motor Company 2010 Ford Taurus,



the Engine Cradle Mount on the Ford Motor Company 2011 Ford Focus, C-Max, and the High Duty Light Weight Engine Mounts on the BMW AG 2009 BMW 550i and 750i.

In the Environmental category, the winner was **Recycled Polyol for Seat Foam** on the Chrysler Group LLC 2011 Jeep Grand Cherokee. The other finalist was Bio-based TPU over Recycled ABS Tambour Door on the Ford Motor Company 2011 Lincoln MKZ.

The Materials category winner was the **Turbocharged Engine Cover** on the General Motors Co. 2010 Ecotec 2L Turbo engine, first used on the Cadillac CTS. The materials category was very strong this year, with 5 finalists, including the On-Engine Oil Filter Module on the Chrysler Group LLC 2010 Pentastar, the Seamless PAB IP Topper on the Ford Motor Company 2011 Lincoln MKX, Reactor Grade Talc Filled Polypropylene on the Ford Motor Company 2011 Ford Explorer, and Low Gloss Soft Feel Resin on the Ford Motor Company 2011 Ford Edge and Lincoln MKX.

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The winner in the Performance and Customization category was the **Chrome-Film Thermoformed Bumpers** on the Retro USA 2009 Limited Edition "Bullit" Mustang. The other finalists were the Modular Sunvisor Storage System on the Ford Motor Company 2012 Ford Mustang, and the Dual-Lens Cupholder Light on the Ford Motor Company 2011 Ford Explorer.

The Process/Assembly/Enabling Technologies category winner was **High-Gloss Finish without Paint** on the Ford Motor Company 2011 Ford Escape. Finalists included the Multi-Functional Exchange Blow Molding Airduct on the Subaru 2010 Legacy and Outback and the Cam Cover with Integrated Variable Valve-Timing on the Chrysler Group LLC 2011 Jeep Cherokee.

And finally, in the Safety category, the winner was the **Inflatable Seatbelts** on the Ford Motor Company 2011 Ford Explorer. The two finalists were the Film for Vacuum Folded Airbag Application on the Ferrari 2010 458 Italia and the Advanced PAB Chute on the Ford Motor Company 2011 Lincoln MKX.

Additional details on all 60 nominated applications can be found on our website at www.speautomotive.com/inno

SPE's Automotive Innovation Awards program is the largest competition of its kind in the world and the oldest recognition event in the automotive and plastics industries. Dozens of teams made up of OEMs, tier suppliers, and polymer producers submit nominations describing their part, system, or complete vehicle module and why it merits the claim as Year's Most Innovative Use of Plastics.

This annual event typically draws over 600 OEM engineers, automotive and plastics industry executives, and media. As is customary, funds raised from the event are used for SPE educational efforts and technical seminars, which help to secure the role of plastics in the advancement of the automobile.

For more information about the SPE Automotive Innovation Awards Gala, visit the Automotive Division website at www.speautomotive.com, or contact the group at +1.248.244.8993.



'85MY Chevrolet Cavalier Named 2010 Hall of Fame Winner

The 1985MY Chevrolet® Cavalier® sedan from then General Motors Corp. - the first vehicle to use painted front and rear thermoplastic polyolefin (TPO) bumper fascias - was selected as the 2010 Hall of Fame winner at the 40th-annual Automotive Innovation Awards Competition. Automotive plastic parts considered for the Hall of Fame award must have been in continuous service in some form for at least 15 years and preferably have been widely adapted within the automotive or ground-transportation industries.

"This application has been so successful," said Nippani Rao, president, Rao Associates and co-chair of the 2010 SPE Automotive Innovation Awards Hall of Fame search committee, "that even after 25 years, 90% of all the cars I see when I'm driving have TPO fascias."

The application not only proliferated throughout North American vehicle production, but also was heavily adapted in Europe and Asia. In fact, today an estimated 65-70-million vehicles each year are equipped with TPO fascias. Republic Plastics (subsequently acquired by Himont, and then LyondellBasell) was the raw material supplier. Buckeye Plastics/Worthington was the original systems supplier/molder for this application.

2010 SPE Automotive Division Grand Award Winner
"Most Innovative Use of Plastics"
Diesel Exhaust Fluid (DEF) System
on the 2011MY Ford® SuperDuty® Pickup



OEM: Ford Motor Co.
Make & Model: 2011MY Ford® SuperDuty® Pickup
Tier Supplier: Robert Bosch LLC
Processor: Kautex Textron GmbH & Co. KG
Material: Multiple
Process: Injection Molding

Also named Powertrain Category Winner

Description: This is the first high-volume pickup truck application to use an all-plastic system to fill, store, and deliver diesel-exhaust fluid (DEF) to the exhaust system to meet stringent diesel-emissions requirements. Multiple materials and molding processes are featured on this system, 90% of whose components are polymeric, including the plastic filler-pipe assembly (which requires no clamps), plastic supply module with integrated pump, reverting valve, pressure sensor, heater, and filtration unit. Additional plastic components in the system include heated intake reservoir (with integral heater), level sensor, filter, and temperature sensor. The only other type of material that could have withstood the DEF fluid would be stainless steel, which would have been 7x heavier and have cost 40%



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Body Exterior Category Winner

Dual Material Sealing with PIT Technology

OEM: Ford Motor Co.
Make & Model: 2011MY Ford® C-Max® Compact Car
Tier Supplier: Röchling Automotive AG
Processor: Röchling Automotive Italia srl
Material: Polypropylene (PP) & Ethylene Propylene Diene Monomer (EPDM)
Process: Projectile Injection Technology (PIT)

Description: Projectile-injection technology (PIT) allowed a hollow EPDM bulb seal to be co-molded with a PP cowl grille in a single process step, producing a single part. By fixing the precise position of the seal, quality improvements were gained during assembly, lower and more easily tunable compression force was achieved, and greater freedom in designing the seal's path was accomplished, saving 30% weight (vs. a separate, extruded seal) and 10% direct costs.



Environmental Category Winner

Recycled Polyol for Seat Foam

OEM: Chrysler Group LLC
Make & Model: 2011MY Chrysler® Jeep® Grand Cherokee SUV
Tier Supplier: Magna Seating of America
Processor: MS Chemical Technologies (Magna)
Material Supplier: InfiChem Polymers LLC /
Material: Repolymerized Polyurethane (PUR)

Description: This is the first industrial production application of flexible urethane seat foams produced with polyols manufactured from post-industrial scrap foam. A two-stage, closed-loop recycling process converts the scrap foam back into a polyol product, resulting in zero waste going to the landfill and allowing up to 10% recycled content in new parts. A unique process to reformulate the reclaimed polyol to meet OEM specs was also developed for this application. Neither weight nor direct cost were negatively impacted and an estimated \$348,000 USD indirect cost savings was achieved, along with reduced CO2 and landfilling.



Anthony Gasbarro (SPE), Frank D'Alessandro, Fabrizio Chini, and Jeff Helms (SPE) with the Body Exterior trophy.



Monica Prokopyshen (SPE), presents the trophy to Phil Jansen and the rest of the development team.

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Chassis & Hardware Category Winner

Integrated Carrier Rail for Rear Door Module

- OEM:** Hyundai Motors Co.
- Make & Model:** 2010MY Hyundai® Sonata® Sedan
- Tier Supplier:** PYEONG HWA Automotive
- Processor:** Arvin Meritor & Arkal Automotive
- Material Supplier:** SABIC Innovative Plastics
- Toolmaker:** Aalbers Tool & Mold
- Material:** Long-Fiber Thermoplastic (LFT)-PP
- Process:** Injection Molding

Description: Previous plastic door module designs had separate metal rails that are attached to the module after molding. This innovative design has the window-regulator guide rail molded as part of the plastic door module. Additionally, wire-harness clips are normally a snap-in feature but in this design are integrated into the module. And the drum housing, location pin, and door-handle bracket are also integrated into the design.



Bonnie Bennyhoff (SPE) presents the winning trophy to Dan Vivian of Hyundai and rest of the development team.



Body Interior Category Winner

Self-Reinforced Airbag Door System

- OEM:** PSA Peugeot Citroën
- Make & Model:** 2007MY PSA Citroën C5 Sedan
- Tier Supplier:** Visteon Corp.
- Processor:** Visteon Corp.
- Material Suppliers:** LyondellBasell & Propex Fabrics
- Material:** PP-Fiber-Reinforced PP
- Process:** Injection Molding

Description: This is the auto industry's first airbag door system that integrates an all-PP construction (PP-fiber-reinforced PP). As such, it is fully recyclable and does not require typical post-mold scoring / weakening of the door flap. The injection-molded door system is the lightest, least-expensive system solution, since additional components and post-mold operations (to enable the door flap to open / hinge) are eliminated. The program also required development of a specialized fiber-reinforced material to facilitate overmolding and subsequent adhesion. The resulting system reduced weight 30 and 300% vs. competitive systems and saved approximately \$5 USD/part vs. welded systems. Additional indirect savings of approximately 5% were also accrued, and production scrap is 100% recyclable.



Jeff Helms (SPE) and Yvonne Bankowski (SPE) present the Body Interior award to Steve Meszaros from Visteon.

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Safety Category Winner

Inflatable Seatbelts

OEM: Ford Motor Co.
Make & Model: 2011MY Ford® Explorer® SUV
Tier Supplier: Key Safety Systems

Description: Special tubular webbing used in the shoulder portion of rear seatbelts hides an inflatable airbag that is triggered when front driver and passenger airbags are triggered, protecting second- and third-row occupants, and particularly upper- and lower-percentage occupants. During inflation, the airbag breaks through the tubular webbing, expanding across the chest area and a special coating helps the airbag stay inflated for 6 sec. to protect for multiple crash modes. A new weaving technique was used to form the tubular webbing and a frangible edge that allows the belt to split and the airbag to deploy.



Materials Category Winner

Turbocharged Engine Cover

OEM: General Motors Co.
Make & Model: 2010MY GM® Ecotec® 2L Turbo Engine for Cadillac® CTS Luxury Sports Sedan
Tier Supplier: Camoplast Inc.
Material Supplier: DuPont Automotive
Toolmaker: Camoplast
Material: PA Copolymer with Extended HS
Process: Injection Molding

Description: This injection-molded turbocharged engine cover features a PA copolymer with new “Shield” technology for high-heat stability while doubling the heat-aging property retention vs. conventional nylons and some higher cost specialty resins. The material handles the application’s routine 180C service temperature and periodic 200C temperature excursions while offering easy processing, good surface finish, faster cycle times, and extended performance at up to 30% lower cost than specialty resins in this demanding underhood application.



Bill Pippine (SPE) presented the Safety Award to the Wayne Bahr of Ford and the rest of the development team.



Norm Kakarala (SPE) presented the Materials Award to Shawn Owen of General Motors, and to other members of the development team.

Ford wins VETA Award

As part of its 40th-annual Automotive Innovation Awards Competition, the Automotive Division of the Society of Plastics Engineers announced that Ford Motor Co. is the 2010 winner of the group's Vehicle Engineering Team Award (VETA) for significant use of innovative plastics content on the 2011MY Ford® Explorer mid-size sport-utility vehicle (SUV). This is the third year the automaker has been awarded the prize, winning last year with the 2010MY Ford® Taurus sedan and the previous year with the 2009MY Ford Flex™ cross-over-utility vehicle (CUV).

Unlike other SPE executive awards, the Vehicle Engineering Team Award recognizes the technical achievements of entire teams comprised of automotive designers and engineers, tier integrators, materials suppliers, toolmakers, and others whose work – in research, design, engineering, and/or manufacturing – has led to significant integration of polymeric materials on a notable vehicle.

This is the fourth time in seven years that the award has been presented. The first winner was Porsche AG in 2004 for the '04MY Porsche® Carrera GT supercar. Brian Byndas, Program Manager Ford Explorer accepted the award during SPE's annual Automotive Innovation Awards Gala. With numerous patents already filed on features that either debuted or were redesigned for the Explorer facelift, the vehicle makes extensive use of polymeric materials to improve fit and finish, reduce weight, and increase customer comfort and safety.

In addition to winning the 2010 VETA award, seven components from the Explorer SUV were entered into the parts portion of SPE's Automotive Innovation Awards Competition, with four nominations achieving Finalist status:

- Inside Handle/Tweeter/Bezel Wrap-Around – this wraparound inside door handle bezel with integral speaker tweeter and lock/unlock switch provides outstanding fit & finish and function,
- Interior Trim with 3-D Appearance – decorative film over a textured surface creates a 3-D appearance on door appliques, while reducing cost and increasing design flexibility.
- Reactor-Grade, Talc-Filled Polypropylene (PP) – eliminating secondary compounding and reducing the carbon footprint of the manufacturing process, reactor-grade PP is used to mold quarter trim



Members of the Ford Explorer development team, recipients of the 2010 Vehicle Engineering Team Award.

panels in the rear cargo area while improving craftsmanship and lowering cost.

- Dual-Lens Cup-Holder Light – a new one-piece design that integrate primary illumination surface with show-surface lens on cup-holder light rings improves perceived quality and enables vehicle occupants to customize interior lighting colors.
- 4-way Adjustable EPP Headrest – a unique 2-piece EPP foam design allows for more comfortable, 4-way adjustable headrests that still comply with new safety requirements for rear impact conditions while facilitating assembly, reducing weight, and saving on tooling costs.
- Inflatable Seatbelts – special tubular webbing used in the shoulder portion of rear seatbelts hides an inflatable airbag that is deployed when front driver and passenger airbags are triggered, protecting second- and third-row occupants, and particularly upper- and lower-percentage occupants.
- Advanced, All-TPO Airbag Chute for Seamless Passenger Airbag (PAB) Systems – unique tool design allows a special “hook and window” feature to be created at the hinges of this advanced all-thermoplastic polyolefin (TPO) PAB chute, reducing squeak and rattle, improving airbag-to-chute alignment, reducing weight and cost, and making the entire assembly fully recyclable.

Other plastics intensive features on the vehicle include all TPV glass runs, molded-in-color metallic sparkle silver roof-rack end caps, structural composite radiator support, all-plastic lower intake manifold, illuminated nameplate, and direct LED forward and side lighting.



**Process, Assembly & Enabling Technologies
Category Winner**

High Gloss Finish without Paint

OEM: Ford Motor Co.
Make & Model: 2011MY Ford® Escape® SUV
Tier Supplier: Summit Polymers, Inc.
Material Supplier: Samsung Cheil Industries, Inc.
Toolmaker: Namdo Tool Co.
Material: PC & ABS
Process: Injection Molding

Description: These are the first molded-in-color, high-gloss, jet-black ABS instrument panel, console, and door-finish panel applications produced by a modified injection process that eliminates paint while avoiding molding defects such as flow marks and knittlines. By increasing the cavity-side tool temperature to between 110 and 160C, before and during injection, then quickly cooled down before the part is injected, a highly aesthetic surface is achieved. A new grade of ABS resin was developed to deliver deep, jet-black color while also meeting head-impact criteria. The application increased aesthetics, eliminated paint, improve environmental compatibility, and lowered direct costs by 20-65%.



**Performance and Customization Category
Winner**

Chrome Film Thermoformed Bumpers

OEM: Ford Motor Co. / Retro USA
Make & Model: 2009MY Retro USA Limited-Edition "Bullit" Mustang®
Tier Supplier: Retro USA
Processors: Orion Plastics Inc.
 Brentwood Industries, Inc.
Material Suppliers: Mytex Polymers, Inc. & Soliant
Toolmaker: Castek

Description: This is the largest and thinnest chrome-film thermoformed TPO fascia to date. It offers excellent impact resistance and gravelometer performance, is fully recyclable, and offers a lustrous chromed surface while eliminating hexavalent-chromium chemicals. The result is a lighter, less costly bumper cover that is more environmentally benign. Low tooling costs make this technology very attractive for quick-change transition parts at any production volume.



Jay Rasoni (SPE) presents the trophy to Marcy Fisher of Ford, and Dr. J Y Lee and Brian Grosser of Samsung.



Jeff Helms (SPE) and Kevin Pageau (SPE) present the Performance and Customization award to Ed Bearse and Richard Partlow.



2010 SPE Automotive Division - Summary of Award Winners

Grand Award Winner - "Most Innovative Use of Plastics"

(Also Powertrain Category Winner)

**Diesel Exhaust Fluid (DEF) System
2011MY Ford SuperDuty Pickup**

Body Exterior Category Winner

Dual Material Sealing with PIT Technology - 2011 Ford C-Max Compact Car

Environmental Category Winner

Recycled Polyol for Seat Foam - 2011 Chrysler Jeep Grand Cherokee SUV

Chassis & Hardware Category Winner

Integrated Carrier Rail for Rear Door Module - 2010 Hyundai Sonata Sedan

Body Interior Category Winner

Self-Reinforced Airbag Door System - 2007 PSA Citroën C5 Sedan

Safety Category Winner

Inflatable Seatbelts - 2011 Ford Explorer SUV

Materials Category Winner

Turbocharged Engine Cover - 2010 GM Ecotec 2L Turbo Engine

Process, Assembly & Enabling Technologies Category Winner

High Gloss Finish without Paint - 2011 Ford Escape SUV

Performance and Customization Category Winner

Chrome Film Thermoformed Bumpers - 2009 Retro USA Limited-Edition "Bullit" Mustang

Hall of Fame

Painted TPO Bumper Fascias - 1985 Chevrolet Cavalier

Lifetime Achievement Award

Dr. Allan Murray

Vehicle Engineering Team Award

2011 Ford Explorer SUV

The Washington Update

The Federal Research and Development Agenda

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Extensive new research and development funding is expected for the automotive and plastics sectors in 2011. It is very beneficial to plan your research and development program in advance and complete the preliminary proposal work in advance of a federal grant opportunity announcement. Under the new program rules at several Federal Agencies including DOE, proposals are required within 45 days of the initial announcement; thus corporations and small businesses alike need to plan ahead, have a clear research agenda, identify how their program fits within the federal research agenda and define their research and development goals clearly with established milestones.

Political Change Sweeps Washington

November elections brought significant changes in the makeup of Congress and the automotive and regulatory agendas of the Obama administration. Republican leaders won control of the House of Representatives and made significant advances in the Senate. Administration officials are reeling from the legislative changes and expect significant cut backs on many of their legislative proposals including climate change, greenhouse gas emissions and Corporate Average Fuel Economy rules.

The primary shift in focus will be a change from a legislative to a regulatory solution. EPA, DOT and NHTSA have extensive regulatory agendas including joint fuel economy rulemakings to increase fuel economy standards and reduce greenhouse gas emissions for MY 2014-2018 medium and heavy duty trucks and light duty vehicle fuel economy standards for MY 2017 – MY 2025; which will increase the number of regulatory proposals ushered to the forefront of legislative and regulatory discussions.

A myriad of new regulations have been undertaken by EPA that target the chemical and oil industries including major reauthorizations on rules and regulations over 30 years old (e.g. Toxic Substances Control Act) and promulgation of a final rule on reducing greenhouse gas emissions from industrial boilers. The aforementioned issues have been on the regulatory “fast track” and Republicans have voiced

their intent to block federal funding (leveraging the new republican majority in the House) for regulatory proposals to slow or stop the tide of regulatory development by the Democratic Administration.

Legislative Change

Significant legislative leadership changes will take place in the House with many new Republican Chairmen taking the helm after intense competition within the Republican House Members for the coveted Chairmanships. The powerful Energy and Commerce committee will be led by highly respected Congressman Fred Upton from Michigan, who has been an adamant supporter of the automotive industry. Upton will replace Henry Waxman (D-CAL), and Joe Barton (R-TX) who served as the ranking minority member on the Committee and competed with Upton and others for the coveted Chairmanship position. Other important House committee chairmanship appointments include:

Appropriations: Hal Rogers (R-KY)

Ways & Means: Spencer Bachus (R-AL)

Science and Technology: Ralph Hall (R-TX)

Research and Development Update

The federal government sponsors research in the following areas of the automotive and plastics industries. The following research programs will continue in the upcoming year and significant funding will be allocated to improve vehicle performance, decrease vehicle weight, improve vehicle range and fuel economy while reducing greenhouse gas emissions to meet the new CAFÉ standards within the next twenty years.

Hybrid and Vehicle Systems Technologies —

Analysis and testing activities that provide support and guidance for many cutting-edge automotive and truck technologies now under development.

Energy Storage Technologies —

Critical enabling battery technologies for the development of advanced, fuel-efficient, light-and-heavy-duty vehicles.

Power Electronics & Electrical Machines

Technologies — Motors, inverters/converters, sensors, control systems, and other interface elements that are critical to hybrid electric and fuel cell vehicles.

Advanced Combustion Engines Technologies —

Technologies that contribute to more efficient, advanced internal combustion engines in light, medium, and heavy-duty vehicles.

Fuels & Lubricants Technologies — Fuel and lubricant options that are cost-competitive, enable high fuel economy, deliver lower emissions, and contribute to petroleum displacement.

Materials Technologies — Lightweight, high-performance materials that can play an important role in improving the efficiency of transportation engines and vehicles

Department of Energy Update

The Department of Energy has had a very busy year after embarking upon an unprecedented number of R&D projects. ARPA-E selected a total of 121 projects for \$363 million in funding, supporting research that can deliver breakthrough changes in how the U.S. generates, stores, and utilizes energy. In total, projects selected and funded through ARPA-E are based in 30 states, with approximately 39% of the projects led by universities, 33% by small businesses, 20% by large businesses, 5% by national labs, and 3% by non-profits.

FY 2010 projects awarded in the polymer, transportation, battery and automotive areas include:

Dais Analytic Corporation (Odessa, FL) – Nanotechnology Membrane-Based Dehumidifier

In warm and humid climates the efficiency of air conditioning decreases significantly in removing the moisture out of the air. This project proposes to dehumidify moist air using a nano-structured solid polymer which is permeable to moisture but not permeable to air. This technology would enable higher efficiencies and significant cost savings in cooling technologies. This project will receive \$680,000 in funding.

GE Global Research (Niskayuna, NY) - Transformational Nanostructured Permanent Magnets

In this project, General Electric Global Research (GE) will develop next-generation permanent magnets that include a lower content of critical rare-earth materials. GE will develop bulk nanostructured magnetic materials, resulting in a dramatic increase in performance over state-of-the-art magnets. The impact of these new magnets will be to increase the efficiency and power density of electric machines while reducing dependence on globally critical rare-earth minerals. These magnets will enable further market penetration of hybrid vehicles and wind turbine generators by US manufacturers. This project will receive \$2.2 million in funding.

Makani Power, Inc. (Alameda, CA) - Airborne Wind Turbine

An Airborne Wind Turbine (AWT), which is a high performance wing connected to the ground by a tether, will be developed to demonstrate autonomous flight, power generation, and flight modes under a wide range of wind conditions. Due to its enhanced performance at lower wind speeds, the AWT technology has the potential to expand the area suitable for wind power and deliver energy at a significantly lower cost than conventional horizontal-axis wind turbines. This project will receive \$3 million in funding.

General Atomics (San Diego, CA) - Soluble Acid Lead Flow Battery

General Atomics and the University of California San Diego will develop a novel flow battery technology that pumps chemicals through the battery cell when electricity is needed. The proposed flow battery revolutionizes a century-old lead-acid battery technology to achieve low cost, high efficiency and reliability needed for use on the electric power grid. This high-risk technology development program will use novel materials that greatly increase power while

Continued Page 20

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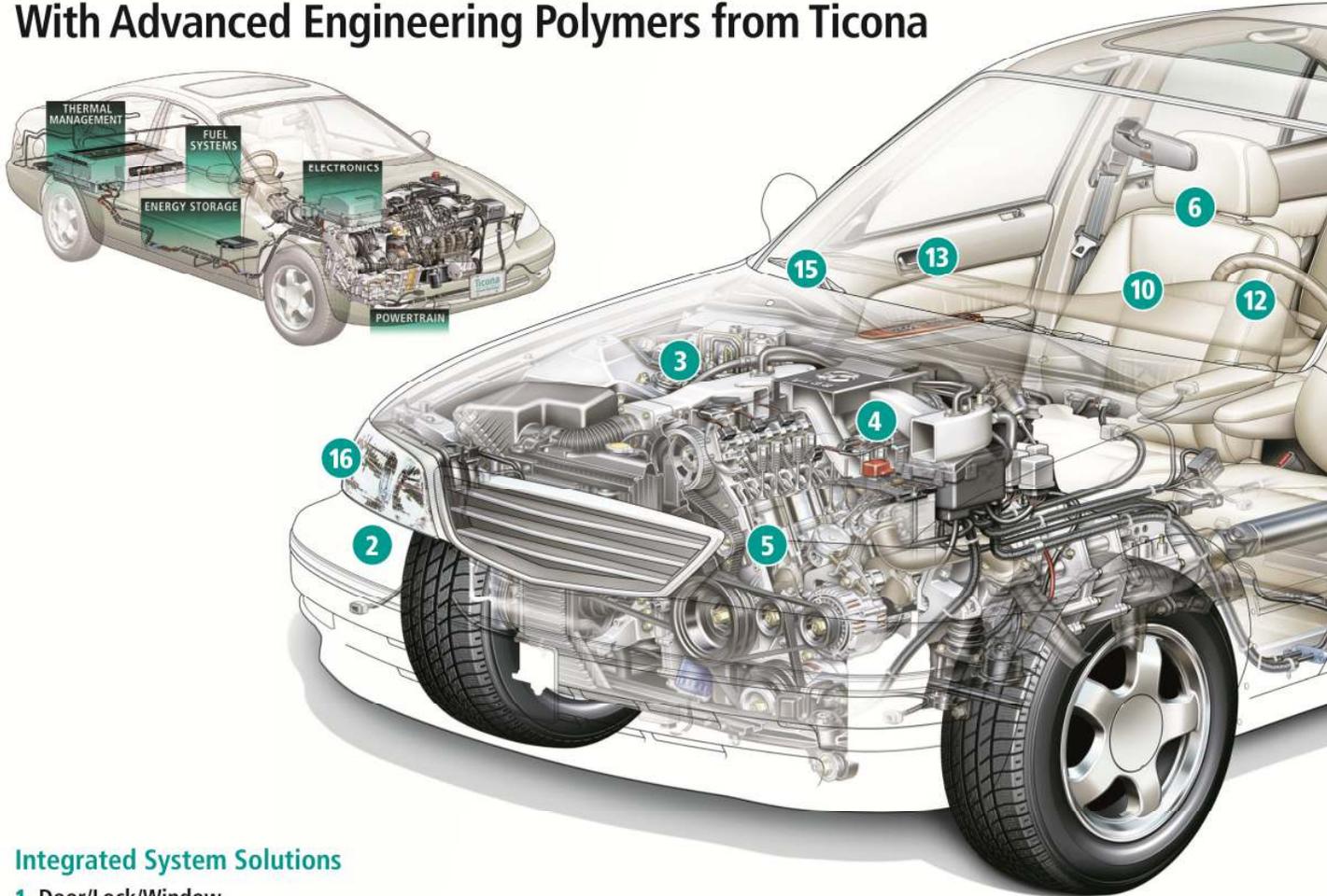
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2 Front End Modules

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Impet® PET

3 Electrical/Ignition

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Thermx® PCT

4 Power Distribution

Celstran®/Factor® LFRT, Celanex® PBT, Vectra®/
Zenite® LCP, Fortron® PPS

5 Powertrain

Fortron® PPS, Celstran®/Factor® LFRT, Vectra®/
Zenite® LCP, Hostaform®/Celcon® acetal
copolymer, Thermx® PCT

6 Cockpit Environment

Hostaform®/Celcon® acetal copolymer, Celanex®
PBT, Vandar® PBT, Riteflex® TPC-ET

7 Underbody Skid Plates

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8 Advanced Fuel Delivery

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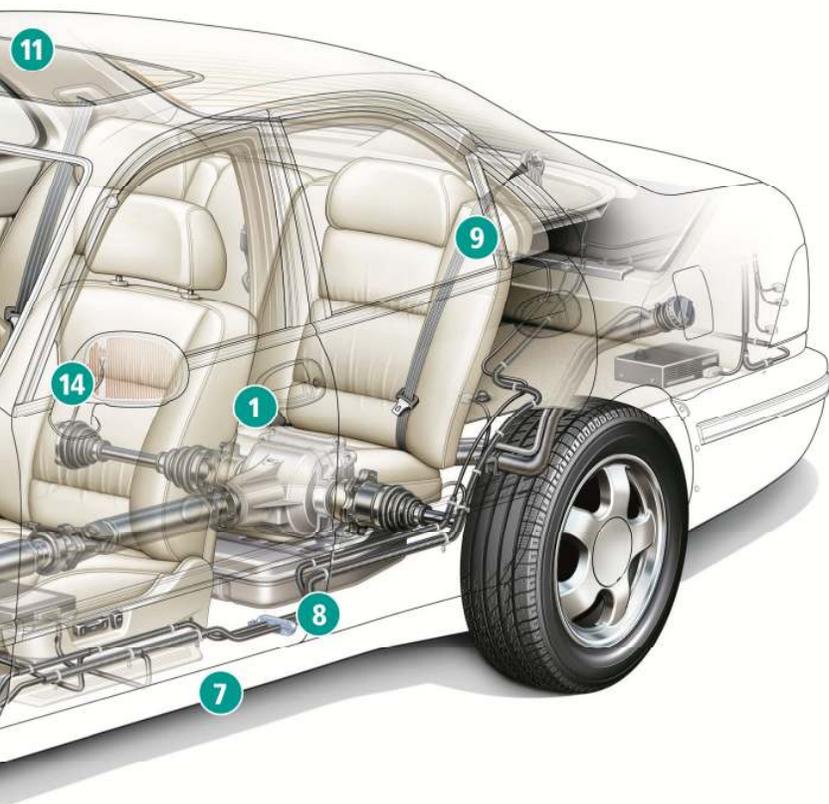
9 Seating and Restraint

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10 Safety Systems

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13 Speaker Grilles, Knobs, Handles and Levers

Hostaform®/Celcon® acetal copolymer, Celstran®/Factor® LFRT, Celanex® PBT, Riteflex® TPC-ET

14 Mirror Housings

Hostaform®/Celcon® acetal copolymer, Celanex® PBT, Celstran®/Factor® LFRT

15 Wiper Plenums

Hostaform®/Celcon® acetal copolymer, Celanex® PBT, Celstran®/Factor® LFRT

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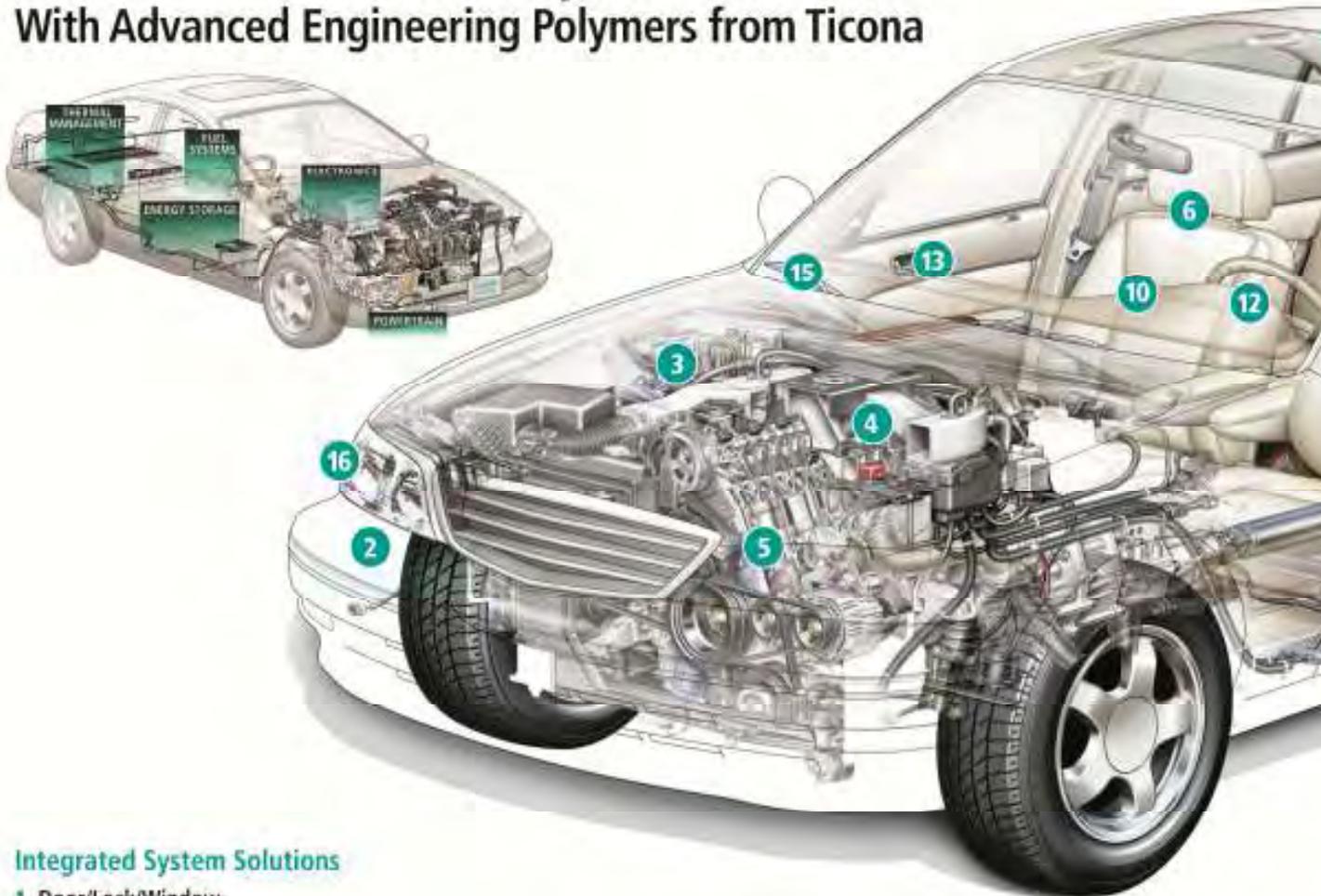
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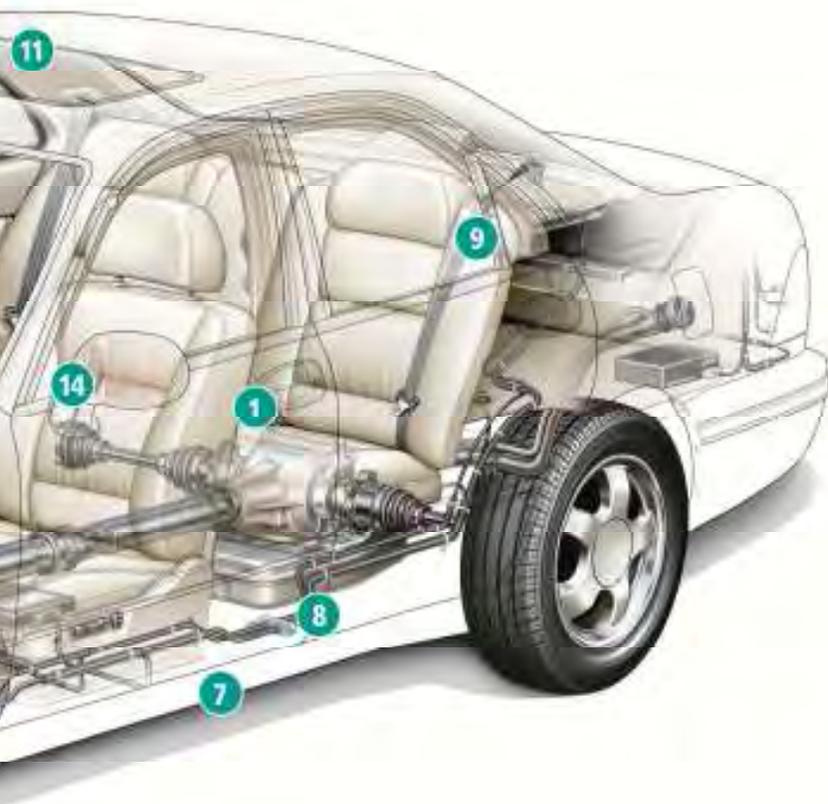
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The Washington Update

Continued from Page 17

resisting the corrosion that limits the cycle life of conventional lead acid batteries.

Harvard Medical School (Boston, MA) - Engineering a Bacterial Reverse Fuel Cell

This project would develop a bacterium to use electricity (which could come from renewable sources like solar or wind) to convert carbon dioxide into gasoline. The bacterium would act like a reverse fuel cell: where fuel cells use a fuel to produce electricity, this bacterium would start with electricity and produce a fuel. Research projects like this one demonstrate the great potential of bringing experts from other fields like biology and medicine to address our energy challenges. This project was selected for a \$4 million grant from ARPA-E. *“Electrofuels” - Biofuels from Electricity* --- Today’s technologies for making biofuels all rely on photosynthesis – either indirectly by converting plants to fuels or directly by harnessing photosynthetic organisms such as algae. This process is less than 1% efficient at converting sunlight to stored chemical energy. Instead, Electrofuels approaches will use organisms able to extract energy from other sources, such as solar-derived electricity or hydrogen or earth-abundant metal ions. Theoretically, such an approach could be more than 10 times more efficient than current biomass approaches.

MIT (Cambridge, MA) - Semi-Solid Rechargeable Flow Battery

This concept represents a new type of battery that doesn’t exist today: a semi-solid flow battery that combines the best characteristics of rechargeable batteries and fuel cells. It could enable batteries for electric vehicles that are much lighter and smaller - and cheaper - than today’s batteries. The cost difference is dramatic: this flow battery potentially could cost less than one-eighth of today’s batteries, which could lead to widespread adoption of affordable electric vehicles. This project was selected for a \$5 million grant from ARPA-E. *Better Batteries - Batteries for Electrical Energy Storage in Transportation (“BEEST”)* --- The critical barrier to wider deployment of electric vehicles is the high cost and low energy of today’s batteries. This ARPA-E program seeks to develop a new generation of ultra-high energy density, low-cost battery technologies for long range plug-in hybrid and all-electric vehicles. If successful, the technologies developed in this program will greatly improve U.S. energy security,

spur economic growth, and reduce greenhouse gas emissions.

GE Global Research Center (Niskayuna, NY) - CO2 Capture Process Using Phase-Changing Absorbents

A GE researcher came across an exciting discovery as part of an earlier Department of Energy-funded project: a certain liquid, when it reacts with carbon dioxide, turns into a solid powder. This could lead to a much less expensive way to capture carbon dioxide from coal-fired power plants -- the carbon dioxide in the powder can be much more easily separated from the plant’s flue gases than gaseous carbon dioxide can. This project was selected for a \$3 million grant from ARPA-E. *Zero-Carbon Coal: Innovative Materials & Processes for Advanced Carbon Capture Technologies (“IMPACCT”)* --- Coal-fired power plants currently generate approximately 50% of the electricity in the United States. But they also produce significant carbon pollution, which could have serious consequences for climate change. This ARPA-E program aims to support revolutionary technologies to capture carbon dioxide from coal-fired power plants using a range of approaches, including solvents, sorbents, catalysts, enzymes, membranes, and gas-liquid-solid phase changes.

How many parts still need mass reduction?

Lots

Advanced lightweight components and systems:

- Acoustic damping
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- Energy management components
- Floor liners
- Front seat systems
- Head tests
- Knee bolsters
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- Laminated pillars
- Load floors
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These projects continue to build upon the extensive federal funding that was allocated to the automotive sector last year, which included development of a lithium ion automotive battery industry in the United States, extensive loan programs which funded advanced technology vehicles/manufacturing, and substantial funding for General Motors, Chrysler and the automotive finance sector.

Renewable Energy - China

China continues to distinguish itself as the world's preeminent destination for clean energy and technology investment. In November, General Electric announced plans to invest more than \$2 billion in China over the next two years to strengthen its research and development capabilities throughout the country. GE will spend \$500 million on R&D focused on the creation of innovation centers for renewable energy, smart grid, and energy efficient lighting schemes. It will also invest more than \$1.5 billion in joint ventures with Chinese state-owned enterprises with the aim of improving smart grid and renewable power distribution capabilities in the region.

On Capitol Hill, while the political shift to the right resulting from the midterm elections is widely considered to be a bad omen for the clean energy community, there remain several opportunities for clean energy to move forward during the 112th Congress. These solutions which have enjoyed bipartisan support may be pushed through over the coming months: a renewable electricity standard, the extension of the 1603 Grants in Lieu of Tax Credits, the expansion and extension of the 48C Advanced Energy Manufacturing Tax Credit, funding for a HomeStar energy efficiency home retrofit program, and the establishment of a Green Bank. Last Wednesday, officials from the wind, solar, and geothermal industries met with the White House's National Economic Council to discuss the extension of the 1603 and 48C tax credits as well as the creation of a renewable electricity standard.

Overall, there will continue to be opportunities for R&D projects in the 112th Congress.

Extensive new research and development funding is expected for the automotive and plastics sector, but it is extremely important to be prepared to capitalize on the opportunities.

It is advisable to plan your research and development program and complete the preliminary proposal in advance of a federal opportunity announcement (FOA). Under the new federal

agency program rules, proposals are required generally within 45 days of the initial announcement so corporations and small businesses alike, should plan ahead, have a clear research agenda, identify how their program fits within the federal research agenda and define their research and development goals clearly with established milestones. If you plan ahead and have the major building blocks of your proposal prepared, meeting the deadline for successful proposal submission will not be a problem.

For more information or if you would like to explore federal opportunities please contact Miller Cole LLC at: Michigan office: (810) 750-3863; Washington office: (202) 241-3022.



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An advertisement for Plastic Engineering & Technical Services, Inc. featuring a photograph of an 'Electric Valve Gate System' with various cables and components. Text on the right says 'Eco-Friendly Manufacturing' and 'Reduce costs with advanced technology and reduced carbon footprint'. At the bottom, it includes the company name, website 'www.PETSinc.net', and phone number '800.811-4403'.

Eco-Friendly Manufacturing

Reduce costs with advanced technology and reduced carbon footprint.

Electric Valve Gate System

Plastic Engineering & Technical Services, Inc.
www.PETSinc.net 800.811-4403

Murray honored with Lifetime Achievement Award

Allan D. Murray, Ph.D., who worked more than 30 years at Ford Motor Co. as a manager of research, manufacturing, and product development guiding many advanced products and technologies to market, has been named the tenth recipient of the prestigious Lifetime Achievement Award from the SPE Automotive Division. The award was presented at the 40th Annual Innovation Awards Program.

The award recognizes the technical achievements of automotive industry executives whose work – in research, design, and engineering, etc. – has led to significant integration of polymeric materials on vehicles.

Allan Murray has a long history of service to SPE. He joined the international engineering society in 1972 and has been a member of the Automotive Division board since the mid-1970s where he has held numerous positions, including member or chair of various subcommittees, division treasurer, division chair, and national councilor.

He was elected to the prestigious Director Emeritus position 10 years ago and was also named an Automotive Division Honored Service Member and a Detroit Section Iron Man. In fact, Murray was the first automotive engineer to be elected a Fellow of SPE.



Dr. Allan Murray accepts the Lifetime Achievement Award from Fred Deans.



The 40th Anniversary Innovation Awards Program was one of the best attended programs in many years. Over 600 plastics professionals, OEM engineers, suppliers, and media were in attendance. All 60 of the nominated applications submitted for this years competition were on display, as were numerous recently introduce vehicles, including the 2011 Ford Explorer, 2011 Grand Cherokee, 2011 Hyundai Equus, the all new Chevrolet Volt, plus many others. Receptions before and after the awards program provided ample opportunities to network with leading engineers and executives in the auto industry.

Pictures from the entire event can be viewed and/or downloaded at <http://soitsy.com/t4>





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Education Report

Monica Prokopyshen & Peggy Malnati

College for Creative Studies (CCS) Plastics in Automotive Design Project

(Photos courtesy of Barbara Robertson, American Chemistry Council – Plastics Division)

The American Chemistry Council - Plastics Division (ACC-PD) kicked off the 2010 transportation design project at the automotive education center in Troy, Michigan on Sept. 13, 2010. Students subsequently visited the DuPont pilot facility and then Shuert for hands-on lessons on ideation, product development and molding of polymers. The Society of Plastics Engineers, Automotive Division and Detroit Section contributed funds and participate in project review sessions.

Sustainable Transportation for “New Detroit”

This year, students have been challenged to develop vehicles for “sustainable seed communities,” inspired by Detroit Mayor Dave Bing’s vision for “New Detroit” and his announcement that 4,000 houses in abandoned neighborhoods would be torn down for redevelopment into planned communities. For Recreation, Retirement/Mature Living, Business and Agriculture themes, sixteen students are designing vehicles for family, daily commuter and business needs. Vehicles must be low speed with maximum dimensions of 3.6 m x 1.6 m x 2 m.

Sources of inspiration include sculpture and architecture (Joe Louis’ fist, Buckminster Fuller’s geodesic dome); nature (spotted box fish, seed pods, leaves, koala bears, stone and exoskeletons); fashion (business suits); vertical agriculture; music and

dance. The “Inspiration” montage examines the ideation phase.

During the most recent trip to the CCS, the SPE and ACC team reviewed clay models in process. Look to the next newsletter to see the final quarter scale models.

New for this year, Rob Krebs, director of Market Innovation (ACC-PD), launched a facebook site to showcase student work and encourage dialogue between the college designers and industry www.facebook.com/plasticcar.

SPE AD and Composites Divisions Announced 2010 SPE ACCE Scholarship Recipients

For the fourth consecutive year, the Society of Plastics Engineers – Automotive & Composite Divisions jointly awarded two \$2000 scholarships for graduate research in automotive composites as part of this year’s **SPE Automotive Composites Conference & Exhibition (SPE ACCE)**, Sept. 15 and 16 in Troy, Michigan. **Benjamin Hangs**, a doctoral candidate at the **Fraunhofer Institute of Chemical Technology (ICT, Pfinztal, Germany)** and **Francesco Deleo**, a doctoral student in at the **University of Washington (Seattle)**, were selected from the pool of qualified applicants by the SPE ACCE planning committee and will report the results of their research during next year’s eleventh-annual conference, which takes place September 13-15, 2011.

Last year’s scholarship recipients Gregorio Manuel Vélez-García, a Ph.D. candidate at Virginia Polytechnic Institute and State University, and Zeba Farheen Abdul Samad, a doctoral candidate at the University of Illinois-Urbana/Champaign, presented research results at this September’s SPE ACCE (Automotive Composites Conference & Exhibition).



Councilor's Report

Tom Pickett

SPE Automotive Division Councilor

September 24-25, 2010 — Southbury, CT

The following summarizes the highlights of the meeting. Details of the reports and presentations are available on the SPE website.

Divisions Meeting

Motion passed to approve May 2010 SPE Division Committee meeting. Discussion that most of the TOPCON are concentrated within 5 months. TOPCON are usually September to November and others are February and March. The highest number is in September and October. We are competing amongst ourselves for sponsors and attendees for TOPCON. At the meeting, the succession of Division Chairs was discussed. We also discussed membership at the Division level. We need to find ways to increase membership to the divisions.

Council as a Whole

SPE President Ken Braney called the meeting to order. This is the first Council Meeting where electronic participation was offered for the Sections, Divisions and Council Committee of the Whole meetings. Twenty-nine Councilors/Proxies participated electronically over the course of the two meeting days.

The Council observed a moment of silence in honor of two longtime SPE members and Fellows of the Society with the loss of William K. McConnell Jr. and Dr. Richard Cowell.

President Ken Braney presented his comments on the year to date and reviewed the goals he set for the coming year.

Executive Director Susan Oderwald gave an overview of staffing and updated technology changes, in particular the about-to-be-purchased association management software. She also discussed the new program for selling booth space for ANTEC 2011, which allows Sections/Divisions to sell space and receive a portion of the funds from the space they sell.

Elections

A major portion of the Council meeting was elections. The Council elected the following individuals as Society officers for the 2011-2012 term, which begins at ANTEC 2011:

President-elect – James Griffing
Senior Vice President – Jon Ratzlaff
Vice President – Vijay Boolani

In addition to these formal offices, each year Council also elects a Chair for the Council Committee of the Whole. Dick Cameron will hold this position for the 2011-2012 year.

Budget

Another major Council action was the approval of the 2011 calendar-year budget. A full write-up on the budget was distributed to Councilors and to all Section and Division Board members in preparation for this meeting. The budget that was approved calls for gross income of \$3,794,000, direct expenses of \$1,865,500, and a net income of \$313,030. Council approved the budget unchanged from the original presentation. A full area-by-area presentation of this budget is available to members at:

<http://extranet.4spe.org/council/index.php>

Committee Meetings

Twelve committees met prior to the Council meetings. The following Committee/Officer Reports were given at the Council meeting:

Sections Committee Report

Councilor Rich Bradley, Chair of the Sections Committee, reported on the activities of the Committee. Multiple Section memberships, succession of Section Presidents, best practices and an update on the European Sections were topics.

Divisions Committee Report

Councilor Mark Barger reported on the activities of the Divisions Committee. Succession of Division chairs and minitec outreach were topics.

Student Activities at ANTEC Report

Councilor Steve McCarthy, Chair of the Committee, gave an update on the committee's activities. The topic of who has the responsibility for the formation and dissolution of Student Chapters was discussed.

Communications Committee Report

Monika Verheij, Chair of the Communications Committee, gave a report on the Communications Excellence Award and updated guidelines.

Strategic Planning Committee Report

Lance Neward, Chair of the Strategic Planning Committee presented an update on the committee's activities. Three sub-committees have been formed: Structural Development, Financial Factors and Leadership 2020. Slides are available on the Extranet.

Council Committee-of-the-Whole

Dale Grove, Chair of the Committee, conducted the meeting prior to the formal Council Meeting. Items discussed at this meeting were the proposed Proxy bylaw change and the Council Fall Survey results.

The Candidates for the upcoming elections were given five minutes each to make a presentation to the committee.

Meeting Schedule and Locations for 2011/2012 and Plans for 2011-2012 Operating Plan

President-elect Russell Broome went through the meeting schedule for 2011-2012 noting that the Fall Council meeting in 2011 will be held in conjunction with EUROTEC in Barcelona. Mr. Broome's 2011-2012 operating plan is focused on continuing the three- year plan created by Past President Andersen and President Braney.

PRESENTATIONS

Adam Hall and Dick Cameron of the Pittsburgh Section presented a check to the SPE Foundation in the amount of \$5,000.

The next Council meeting will be a Virtual Council Meeting on February 11, 2011.

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ASHLAND.

Automotive Division Board Meeting

October 11, 2010

ATTENDEES

Yvonne Bankowski, Terri Chouinard, Ed Garnham, Jeff Helms, Chuck Jarrett, Mark Lapain, Peggy Malnati Tom Pickett, Monica Prokopyshen, Jay Raison, Jackie Rehkopf, Ben Soltisz, Suresh Shah, Ron Price, Bonny Bennyhoff, Pat Levine, Conrad Zumhagen

Meeting held at ACC in Troy, 4:30 p.m. – 8:00 p.m., August minutes approved

Education (Monica Prokopyshen) The Exploration (Plastivan) session is scheduled for April 6, 2011.

Membership (Bill Pippine) No report.

SPE Social Programs (Ben Soltisz)

The winners of the door prizes were posted on the SPE AD web site home page.

Treasurer's Report (Yvonne Bankowski)

Read the treasurer's report for full details. The account balance is as follows: checking \$124.5 K, savings \$27.4 K and total \$153 K. Tax form preparation is on schedule for November.

Income summary for period 8/1/10 : 10/11/2010:

Income	\$61 K
Expenses	<u>\$57 K</u>
Net Income	\$4 K

Councilor's Report (Tom Pickett)

Councilor's meeting was Sept. 24-25, 2010.

1. Topcons (concentrated in the period Sept. – Nov.) compete for the same sponsors.

2. The 2011 ANTEC (Boston May 1-5) abstracts are due Nov. 19. A proposal was submitted to allow Divisions and Sections to sell booths at ANTEC and receive a portion of the fees for the space they sell.

3. The Council elected the following individuals for the 2011 – 2012 year: James Griffing as President-elect, Jon Ratzlaff as Senior Vice President, Vijay Boolani as Vice President and Dick Cameron as Chair for the Council Committee of the Whole.

4. The 2011 calendar year budget was approved:

Gross Income	\$3,794 K
Direct Expenses	<u>\$1,865.5 K</u>
Net Income	\$ 313.03 K

Inter-society (Jackie Rehkopf)

Jackie reported that SAMPE (local), ASCE- EMI, ASME and SAE organizations were interested in reciprocal web links.

MARCOM (Peggy Malnati)

IAG (Innovation Awards Gala) Press Releases Issued :

1. Hall of Fame.
2. VETA (Vehicle Engineering Team Award).
3. Category Finalists.

IAG Status

1. Provide badge names to Pat Levine.
2. Flower samples from Dynamic Flowers were reviewed and a red & white theme was selected for centerpieces.
3. Connie Zumhagen and Ron Price reported that 3 hours of rough footage was condensed to a 15 minute, 40th anniversary, "rest of the story," video tribute.
4. Mark Lapain reported that the fixed costs were covered.

New Business / Open Issues:

The lower cost meeting call in number was instituted for a trial period, but discontinued due to access issues.

Next BOD Meetings

BOD Judging: Sept 30, 2010 and Oct. 1, 2010 (Ticona),

Regular BOD Meeting: Dec. 6, 2010 (ACC, Troy)



Maria Ciliberti received the Pat-Chair Award from current Automotive Division Chair Jeff Helms, at the 40th Annual Innovation Awards Program

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Process Enabling Category: Using an innovative short-glass PP resin, Inalfa Roof Systems consolidated a four-part metal/plastic sunroof assembly into a single, molded frame, resulting in significant weight, piece price, capital investment and lead time savings.



Material Category: Utilizing an innovative, patented PP+mPPE resin for a liquid cooled battery application, Asahi Kasei was able to create a material for Cobasys, LLC that provides superior chemical resistance and exceeds critical environmental conditions while allowing for thin-wall molding, high-temp creep resistance and weldability.



Environmental Category: The development of a low-emission acetal copolymer resin for Brose Group's advanced lumbar support mat has exceeded even the most stringent of global OEM standards for volatile organic compound emissions.



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Predicting the Tensile Strength of Short Glass Fiber Reinforced Injection Molded Plastics

John F. O’Gara, Glen E. Novak and M. G. Wyzgoski*

All Formerly of Delphi Research Labs
*American Chemistry Council Consultant

Abstract

The tensile strength of a composite is dependent on the properties of the fiber, the properties of the matrix resin, the fiber content, the geometry and orientation of the fibers, and the interfacial strength between the fiber and the matrix. A modified Kelly-Tyson theory was found to successfully model the strength with knowledge of the fiber length distribution, the average through-thickness fiber orientation, and the stress-strain curve for the unfilled resin. Surprisingly accurate strength predictions within 10% have been validated for both flow and cross-flow directions in most cases.

Background

In a previous effort [1-3], stiffness models, which take into account the fiber orientation and lengths, have been refined to give predictions to within 10% for tensile bars and plaques. While the modeling of strength has received much attention in the literature [4-14], there has been little validation due to the paucity of experimental data related to many of the parameters in these models. In this paper, a modified version of the Kelly-Tyson strength model [4] is tested and a procedure for estimating the model parameters is shown.

Experimental

Materials and Mechanical Testing: Standard ASTM type I tensile bars were molded from two different lots of 30 wt% glass filled poly(butylene terephthalate), (PBT), which are simply designated as PBT Lot A and Lot B, unfilled PBT, 33 wt% glass filled nylon-66 (PA), unfilled PA, unfilled polycarbonate (PC) and 15 and 30 wt% glass filled PC. Plaques were also molded from these materials in geometries of 76.2 x 279.4 x 2.92 mm, 152 x 381 x 3 mm, and 152 x 203 x 6.35 mm. For strength measurements on the above end gated plaques, small ISO Type 1BA tensile bars were cut from both flow and cross-flow orientations as shown in Figure 1. All samples were tested at the same standard strain rate of 0.1 mm/mm/min.

Both the fiber length and orientation distributions have also been previously reported [3]. For this work, we use the average orientation tensor values across the thickness of the plaques, either a_{11} for “flow” or a_{22} for the “crossflow” specimens. Average fiber diameters for PBT, PA, and PC were determined to be 13.0, 9.5 and 12.6 μm respectively from the same image analysis used for fiber orientation.

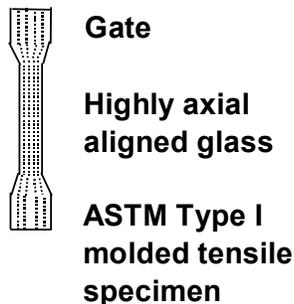
Theory

In the modified Kelly-Tyson Model, one starts with continuous, unidirectional fibers where the tensile strength can be predicted by the simple rule of mixtures,

$$\sigma_c = \sigma_f v_f + (1-v_f) \sigma_m \quad (1)$$

where σ_c is the composite tensile strength, σ_f is the tensile strength of the fiber, v_f is the volume fraction of fibers, and σ_m is the stress carried by the matrix at the failure strain. We define the failure strain as the strain at the maximum stress. In this approach, the basic assumptions used are that there is a perfect

Traditional Method



Specimens Cut From Edge-Gated Plaques

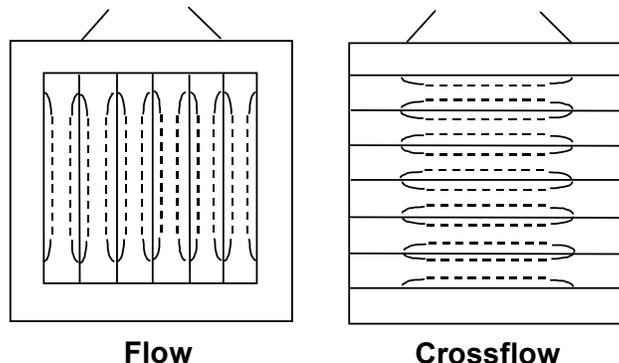


Figure 1. Schematic for the cutting of samples from an edge-gated plaque for assessing anisotropic properties.

bond between fibers and matrix and that the strain in the fibers is equal to the strain in the matrix.

In the case of discontinuous fibers, it is necessary to introduce the concept of a critical fiber length [4]. Assuming that both the matrix and fibers behave as linearly elastic materials, the stress in the fibers builds up in a linear manner from zero at the fiber end to the maximum stress that the fiber can be loaded, σ_f . A critical minimum fiber length is needed to build up sufficient stress to fracture the fiber. This critical length, l_c , is given by

$$l_c = (\sigma_f d / 2\tau) \quad (2)$$

where σ_f is the ultimate tensile strength of the fiber, d is the fiber diameter and τ (note this is the small Greek letter tau, which shows up in cursive form in some equations) is the interfacial shear strength between the fiber and the matrix or the shear strength of the matrix, whichever is less. The critical fiber length is defined, as the minimum fiber length required for the maximum fiber stress to equal the ultimate fiber strength at its midlength.

For aligned short fibers where the length is shorter than l_c , the composite failure strength is given by the simple addition of the contribution from each component:

$$\sigma_c = v_f \sigma (l/d) + (1-v_f) \sigma_m \quad \text{for } (l < l_c) \quad (3)$$

“fiber” + “matrix”

For aligned short fibers where the length is greater than l_c , the composite failure will be:

$$\sigma_c = v_f \sigma_f (1 - (l_c/2l)) + (1 - v_f) \sigma'_m \quad \text{for } (l \geq l_c) \quad (4)$$

“fiber” + “matrix”

To account for both the fiber orientation and fiber length distributions in real composites, a modified rule of mixtures has been proposed. This involves a summation over the fiber length distribution and the incorporation of an orientation factor, D , to the fiber contributions [5-7]. This model takes the final form as follows:

$$\sigma_c = D \left[\sum_{l_i=l_{\min}}^{l_i=l_c} \frac{n_i v_f \sigma_f l_i}{2l_c} + \sum_{l_j=l_c}^{l_j=l_{\max}} \sigma_f n_j v_f \left(1 - \frac{l_c}{2l_j} \right) \right] + (1 - v_f) \sigma'_m \quad (5)$$

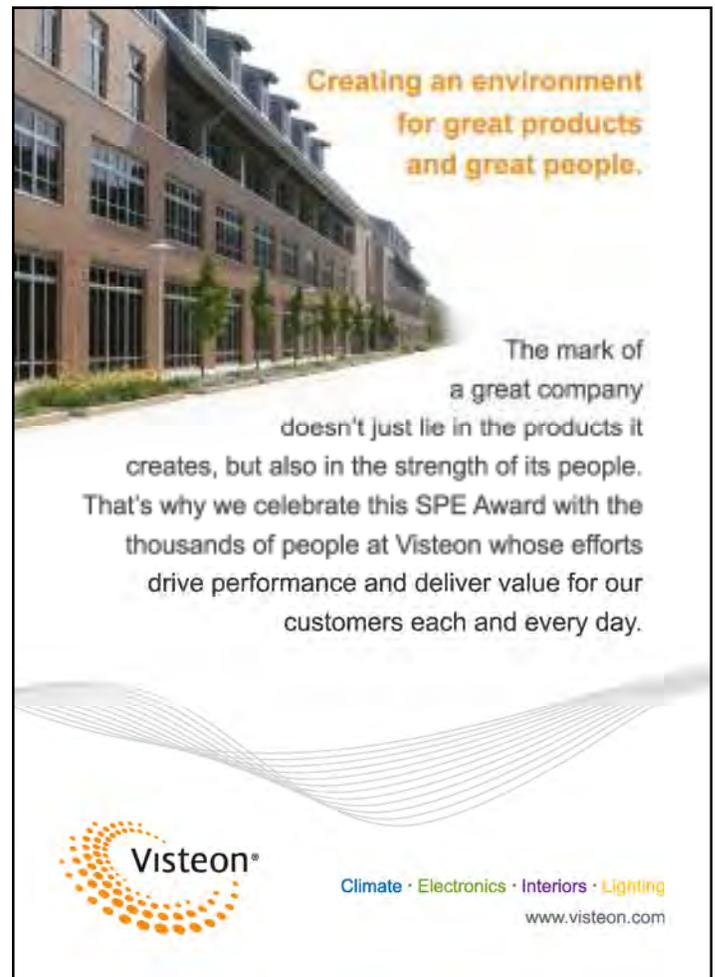
“sub-critical fiber” + “super-critical fiber” + “matrix”

where D is the orientation factor, l_i is the fiber length below l_c , l_j is the fiber length equal and above l_c , n_i or n_j are the percentage of fibers with lengths l_i or l_j ,

respectively, and σ'_m is the matrix strength at the fiber failure strain. The failure of a composite according to this equation is characterized by either fiber pull-out for the sub-critical fibers or fiber breakage for the super-critical fibers combined with matrix fracture. Depending on the fiber length distribution and fiber volume fraction, if there is substantial fiber breakage, then σ'_m should be used instead of the ultimate matrix strength, σ_m [10]. A discussion of how we approach the determination of each of the parameters is beyond the scope of this paper but is included in the expanded ACCE 2010 paper [17].

For the modeling in this work, we have used a single value of 2.4 GPa for the strength of the glass fiber. Knowledge of l_c is also needed for the model and is obtained via equation (2) once τ is obtained. Assuming an isotropic matrix, the shear strength, τ , can be estimated by the von Mises criterion by dividing the tensile strength of the unfilled matrix by the square root of three [15]. The calculated critical fiber length for PA is 244 μ m which is much lower than that for PC, 415 μ m and PBT, 494 μ m -Lot A and 510 μ m -Lot B. This is a result of the lower glass fiber diameter in PA as well as the higher matrix shear

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strength. A comparison of the fiber length distributions to the calculated critical fiber lengths reveals that for PBT and PC most of the fibers (~98%) are below l_c , while for PA ~70% are below l_c .

Results and Discussion

Modeling the Composite Strength: We have taken three approaches to predicting the strength data. Model 1: Predict the strength with equation 5 using the length distribution data previously reported [4] and the matrix stress at the fiber failure strain, σ_m' . Model 2: Predict the strength with equation 5 using the length distribution with the ultimate matrix stress, σ_m , instead of σ_m' . Model 3: Predict the strength using a single average length and the ultimate matrix stress, σ_m . This model uses only the sub-critical fiber term and the matrix term in equation 5. The relative predictions of strength for the flow and x-flow orientations, including tensile bars and plaques are shown in Fig. 2.

All three models are within 10% for the PC and PBT materials, other than the 152 x 381 mm PC plaque

with 15-wt% glass-fiber. Since the majority of fibers in these samples are below l_c , Model 3 is sufficient to predict the strength. The ultimate strength of the matrix is used since there will be minimal fiber breakage. Thus, the strength of most PC and PBT samples can be modeled very simply with only knowledge of the average through-thickness orientation, the average fiber length, and the ultimate strength of the unfilled matrix.

The 152 x 381 PC plaque with 15-wt% glass fiber and the PA samples have 20-30% of the fibers greater than l_c , so Model 1 appears to be best. Nevertheless, other than the one PA sample, the simple approach of Model 3 is within 15% of the experimental values.

Over-predictions of the strengths suggest that the matrix properties used in the model may be incorrect. Recent glass fiber reinforced PA composite modeling by Foss [18] suggests that a PA stress-strain curve having a reduced yield stress must be "backed out" from the model calculations in order to accurately capture the composite properties. More accurate strength predictions for PA would be achieved using such a reduced yield stress. Thus, improved

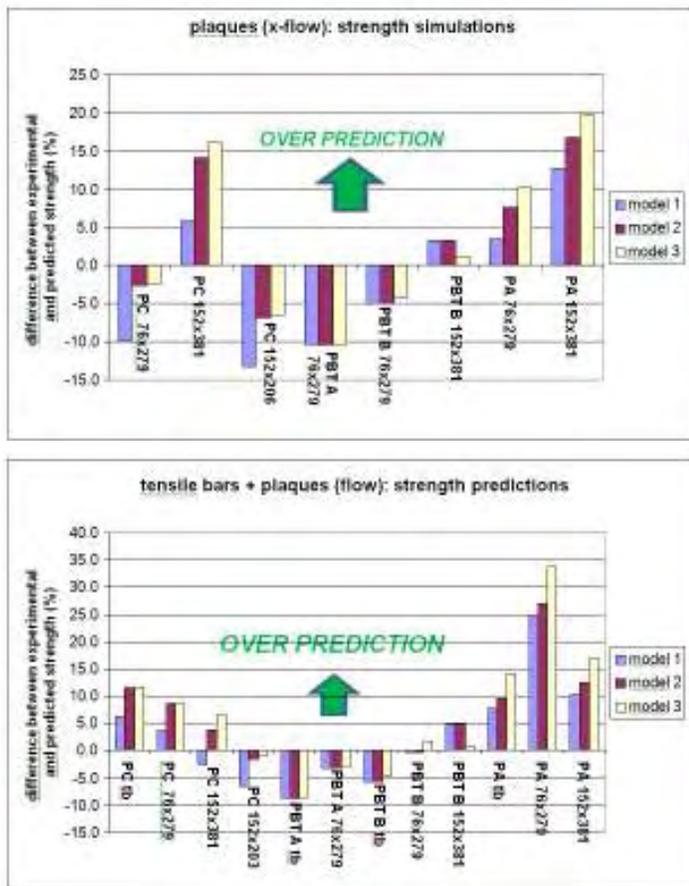


Figure 2. Relative predictions of strength for flow orientations (TOP) and crossflow orientations (BOTTOM). Models explained in text.

Continued Page 34



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strength predictions may be anticipated if micromechanics calculations are utilized to define "effective" matrix stress-strain relationships.

Concluding Remarks

As a first approximation for any material, Model 3 seems appropriate for predicting the strength. For the most part, predictions are within 10 to 15% for PBT, PC, and PA. Given that the fiber orientation can be predicted in commercially available mold-filling software, strength predictions could be easily implemented similar to predictions that are currently done for stiffness.

Acknowledgments

This research initiated during a Department of Commerce sponsored Advanced Technical Program (ATP), administered by the National Institute of Standards and Technology, and performed at General Motors and General Electric (currently Sabic Innovative Plastics).

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Social Chair Report

Ben Soltisz

Over the past year, we have held several social gatherings around the metro Detroit area to aid in the growth and awareness of SPE in the automotive industry. These events were intended to be informal and provide an opportunity for new members, current members, past members, friends of members and individuals possibly interested in becoming members to socialize with board members of the SPE Automotive Division. These events have grown in popularity.

Our most recent Detroit-area Social / Networking Event on Thursday, October 28 at Grizzly Peak Brewing Company in Ann Arbor, Michigan was a

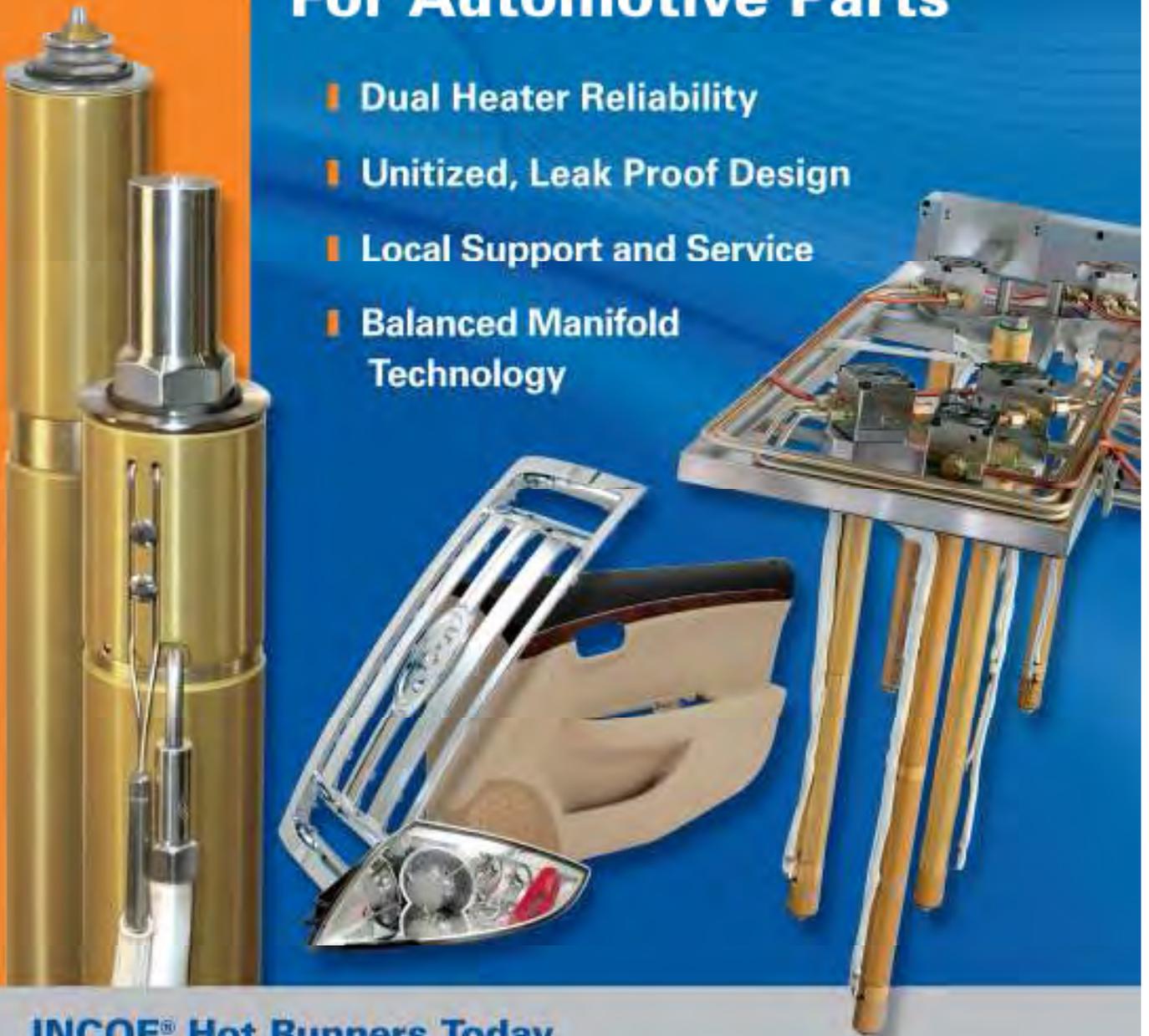
success. Three lucky attendees won three donated door prizes at the event.

Brian Rhudy won four tickets to the University of Michigan vs. University of Illinois football game and Conrad Zumhagen won a box of golf balls generously donated by Ticono Engineering Polymers. Mike Brooks won a golf bag generously donated by DIC International (USA) LLC.

Our next event is scheduled to run from 5 to 8 PM on Thursday, January 27, 2011 at Kuehnhen Brewing Company in Warren. Additional events will follow. Stay updated by visiting www.speautomotive.com and look for emails about future events. Please contact the Social Chair at social-chair@speautomotive.com, if you have an idea for a future events.

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