9TH-ANNUAL

AUTOMOTIVE COMPOSITES CONFERENCE & EXHIBITION

World's Leading Automotive Composites Forum

SOCIETY OF PLASTICS ENGINEERS
AUTOMOTIVE & COMPOSITES DIVISIONS

Plug in to Composites

SEPT 15-16, 2009

MSU Management Education Center
811 W Square Lake Road, Troy, MI USA

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Welcome

Welcome to the 9th-Annual ***Automotive Composites Conference and Exhibition*** (ACCE). Since it was first organized in 2001, the ACCE has earned its position as the ***World's Leading Automotive Composites Forum***, attracting presenters, exhibitors, and attendees year after year from Europe, Asia-Pacific, the Middle East, and the Americas. No other conference provides topics more relevant to composites for the automotive industry than the one you will witness over the next two days. This year's theme, "***Plug In To Composites***," highlights the special progress and promise of composite materials for enabling the performance of electric and hybrid electric vehicles. Lighter weight and better fuel efficiency have always been key benefits of composites. With electrics and hybrids, weight reduction is not simply a "bonus" to the OEM's design. It has become critical to extending vehicle driving range. Our conference speakers will be sharing the latest in what's practical and what's possible with the use of composites.

Each year, the ACCE planning committee aims to improve the conference based on your feedback. You will find that we have continued with the most important of these including:

~ Almost 60 peer reviewed technical papers plus keynote presentations from industry leaders,

~ Our always-lively panel discussion on the future of automotive composites,

~ Our conference ***Best Paper*** awards,

~ Two ***Graduate Student Scholarships*** to support research in the area of transportation composites,

~ A single large display room for our exhibitors and sponsors, plus a lobby full of exciting vehicles and large composite applications,

~ Our annual cocktail reception generously sponsored by Quadrant Plastic Composites,

~ And plenty of time to network with customers, suppliers, and colleagues from around the world.

New to this year's conference, we have added student technical posters from schools around the U.S., a job resources fair for job-seeking SPE members, and we will be webcasting a portion of Tuesday's keynote addresses to reach audiences unable to physically attend the conference. If successful, we will consider offering this "***virtual***" option to attendees in 2010.

I would be remiss not to acknowledge the crisis suffered by our industry over the past year. Hundreds of thousands of workers have lost their jobs, auto sales have suffered record losses in every geography, pillars of the American automotive industry, General Motors and Chrysler, entered and left bankruptcy, historic vehicle brands have been killed off, and well-known suppliers have either been liquidated or acquired by new owners. If this tumultuous experience has taught us nothing else, it has shown how truly global and interconnected our industry has become. Notwithstanding, this crisis has presented our industry with a once-in-a-lifetime opportunity to reinvent itself and truly provide quality, sustainable products that our customers want. All vehicles can benefit from greater use of composites. Perhaps the ability to start with a clean slate finally provides the opening composites have needed to be granted their logical place as viable automotive materials/process options.

I would like to personally thank each committee member for his / her contributions. The ACCE is the result of a year-round effort by members of the SPE Automotive and Composites Divisions. Many of these team members have been committed for a number of years. The conference would not be what it is today without their support, or the support of our authors, presenters, keynote speakers, sponsors, and attendees.

Please contact any of our committee members if you have questions, need assistance, or to offer feedback to help us make this and future events even better. Enjoy the conference!

Sincerely,

Cedric Ball
2009 SPE Automotive Composites Conference Chair
Ashland, Inc.

AUTOMOTIVE COMPOSITES CONFERENCE & EXHIBITION
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SOCIETY OF PLASTICS ENGINEERS
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PANEL DISCUSSION
THE ROLE OF COMPOSITES IN THE NEW AUTOMOTIVE LANDSCAPE
Dale Brosius (Organizer/Moderator)
Quickstep Technologies

David Cole
Center for Automotive Research (CAR)

Jim deVries
Ford Motor Co.

Barrie Dickinson
Tesla Motors

Mike Jackson
CSM Worldwide

Tadge Juechter
General Motors Co.

Phil Sklad
U.S. Departmzent of Energy

Tuesday, Sept 15

Time	in Auditorium	in Amphitheater 101	in Amphitheater 102
6:30–7:00	**Registration -** Coffee in Mezzanine *(Sponsored by SPE)*		
7:00–8:30	**Ribbon-Cutting Ceremony; Exhibits Open** Frank Henning		
	Continental Breakfast Served - Ballroom *(Sponsored by Quadrant Plastic Composites)*		
8:30–8:45	**Opening Remarks** (Including Best Paper Awards & Student Scholarship Announcements) Cedric Ball, *'09 SPE ACCE Chair*		
8:45–9:15	**Keynote Speaker** Kalyan Sehanobish, Dow Chemical, *A Vision for Carbon Fiber Composites in Automotive*		
9:15–9:45	**Keynote Speaker** Deborah Mielewski, Ford Motor Co., *Can You Be-Leaf It? Development & Implementation of Sustainable Materials for the Automotive Industry*		
9:45–10:00	**Coffee Break & Exhibits - Ballroom** *(Sponsored by American Chemistry Council)*		
	ENABLING TECHNOLOGIES - PART 1: *Additives, Reinforcements, & Matrix Enhancements*	**VIRTUAL PROTOTYPING & TESTING OF COMPOSITES - PART 1:** *Coupling Process & Structural Simulations*	**BIO- & NATURAL FIBER COMPOSITES - PART 1:** *Green Thermosets*
10:00–10:30	**Nikhil Verghese** Dow Chemical *Epoxy Thermosets Modified with Novel Nano-Scale, Self-Assembled Block Copolymers: Toughening Mechanisms and Extension to Composites*	**Roger Assaker** e-Xstream Engineering *Digimat Material eXpert – From the Material Lab to the Efficient and Optimal Design of Reinforced Plastic Parts*	**Dejan Andjelkovic** Ashland, Inc. *Renewable Resource-Based Composites for the Automotive Industry*
10:30–11:00	**Gero Nordmann** BASF *Zero-Emission Acrylic Thermoset Technology*	**Ba Nghiep Nguyen** Pacific Northwest National Laboratories *Damage Modeling of Injection-Molded Short- and Long-Fiber Thermoplastics*	**Thomas Steinhäusler** AOC, LLC *An Investigation of 'Green' Class-A SMC*
11:00–11:30	**Zeba Farheen Abdul Samad** Univ. of Illinois-Champagne Urbana *Improved Matrix Materials for High-Performance Carbon Fiber Aromatic Thermosetting Copolyester* ***2009 SPE ACCE Scholarship Award Winner***	**Peter Foss** General Motors Co. *Application of Digimat Micromechanical Modeling to Polymer Composites*	**Dwight Rust** United Soybean Board *Bio-Based Polymers from Soy Chemistry*
11:30–12:30	**Lunch & Exhibits - Ballroom** *(Sponsored by Ticona Engineering Polymers)*		
12:45–1:15	**Keynote Speaker** Eann Patterson, Michigan State University *An Innovation Process for Composite Structures from the Nano- to Macro-Scale: A Vision for a New Center*		
1:15–1:45	**Keynote Speaker** Barrie Dickinson, Tesla Motors, *Plastics & Composites Solutions for the Tesla Roadster*		
1:45–2:00	**Coffee Break & Exhibits - Ballroom** *(Sponsored by Ashland, Inc.)*		
	ENABLING TECHNOLOGIES - PART 2: *Product Enhancements via Processing & Bonding*	**VIRTUAL PROTOTYPING & TESTING OF COMPOSITES - PART 2:** *Coupling Process & Structural Simulations (continued)*	**BIO- & NATURAL FIBER COMPOSITES - PART 2:** *Natural Fiber Advances*
2:00–2:30	**Heinrich Ernst** Dieffenbacher GmbH *Long-Fiber Reinforced Thermoplastic LFT-D & Thermosetting DSMC Processes for Lightweight Parts Production – Trends & Recent Applications*	**Tom Trexler** Ashland, Inc. *Sensing When the Molding Cycle is Over.... The Key to Productivity & Product Consistency*	**Ellen Lee** Ford Motor Co. *Development of Injection Moldable Composites Utilizing Annually Renewable Natural Fibers*
2:30–3:00	**David Trudel-Boucher** National Research Council of Canada *Development of an Adhesive-Primer for Polypropylene Composites*	**Suresh Shah** Delphi Corp. *Advanced Simulation of Fiber-Reinforced Automotive Radiator End Tanks by Capturing Anisotropic Material Properties*	**Anthony Mascarin** IBIS Associates *Economical Preform Production for Conventional and Natural Fiber Composites*
3:00–3:30	**Michael Barker** Ashland, Inc. *Low Temperature Cure Polyurethane Adhesive for "Primerless" Composite Bonding*	**Matthew Marks** SABIC Innovative Plastics *Material Characterization & Modelling of Long Glass-Fiber Composites*	**Richard Bell** DuPont Engineering Polymers *Renewably Sourced Engineering Polymers For High Performance End Use Applications*
3:30–4:00	**Coffee Break & Exhibits - Ballroom** *(Sponsored by Williams, White & Co.)*		
4:00–5:30	**Panel Discussion** *The Role of Composites in the New Automotive Landscape* Moderator: Dale Brosius Panelists: D. Cole, J. deVries, B. Dickinson, M. Jackson, T. Juechter, P. Sklad		
5:30–6:30	**Networking Reception - Ballroom** *(Sponsored by Quadrant Plastic Composites)*		


Wednesday, Sept 16



	in Auditorium	in Amphitheater 101	in Amphitheater 102
6:30–7:45	**Continental Breakfast Served & Exhibits - Ballroom** *(Sponsored by Dieffenbacher)*		
7:45–8:15	**Keynote Speaker** Hadrian Rori, Bright Automotive, *Development of the 100 MPG Bright Automotive Plug-in Hybrid Vehicle*		
8:15–8:30	**Coffee Break & Exhibits - Ballroom** *(Sponsored by Addcomp Holland BV)*		
	ADVANCES IN THERMOSET COMPOSITES - PART 1: *Material & Process Enhancements*	**ADVANCES IN THERMOPLASTIC COMPOSITES - PART 1:** *Long-Fiber Thermoplastics*	**VIRTUAL PROTOTYPING & TESTING COMPOSITES - PART 3:** *Data Collection & Materials Characterization*
8:30–9:00	**Hamid Kia** General Motors Co. *Alternative Methods to Enable the Powder Priming of SMC*	**Eric Wollan** PlastiComp LLC *Pushtrusion™ Direct In-Line (D-LFT) Compounding Technology vs. LFT Pellets & GMT Sheet*	**Shivanand Sankaran** University of Michigan-Dearborn *Fatigue Properties of Injection Molded 33% E-Glass Fiber Reinforced Polyamide-6,6*
9:00–9:30	**Kedzie Fernholz** Ford Motor Co. *The Influence of SMC Formulation, Inner Panel Thickness, and Bond Stand-Offs on Bond-Line Read-Through Severity*	**Creig Bowland** PPG Industries *A Formulation Study of Long Fiber Thermoplastic Polypropylene (Part 2): The Effects of Coupling Agent Type & Properties*	**Ellen Lackey** University of Mississippi *Identification, Selection & Development of Composite Test Standards – A Case Study from the Development of a Design Standard for Composites*
9:30–10:00	**Tobias Potyra** Fraunhofer Institute of Chemical Technology *Flexibility in the Direct Strand Moulding Compound Process* ***2008 SPE ACCE Scholarship Award Winner***	**Uday Vaidya** University of Alabama-Birmingham *Fatigue & Vibration Response of Long Fiber Reinforced Thermoplastics*	**Jay Tudor** Dow Automotive *Engineering Aspects of Designing with Pultruded Carbon-Fiber Composites*
10:00–10:30	**Usama Younes** Bayer MaterialScience *Recent Advances in Class A Polyurethane Long Fiber Injection (LFI) Composites*		**Andy Rich** Plasan Carbon Composites *Study of Braided Composites for Energy Absorption*
10:30–11:00	**Coffee Break & Exhibits - Ballroom** *(Sponsored by AOC Resins)*		
	ADVANCES IN THERMOSET COMPOSITES - PART 2: *Application Development*	**ADVANCES IN THERMOPLASTIC COMPOSITES - PART 2:** *Trends & Opportunities*	**VIRTUAL PROTOTYPING & TESTING COMPOSITES - PART 4:** *Simulation & Part Verification*
11:00–11:30	**Toai Ngo,** Ashley Industrial Molding, Inc. **Mayur Shah,** Continental Structural Plastics *Composite Power-Train Components: Reducing Warranty Costs & Improving Part Quality*	**Bob Eller** Robert Eller Associates *Automotive Thermoplastic Composites... Industry Structure and New Technologies Respond to a Global Recession*	**James Sherwood** University of Massachusetts-Lowell *Mesoscopic Finite Element Simulation of the Compression Forming of Sheet Molding Compound Woven-Fabric Composites*
11:30–12:00	**Libby Berger** General Motors Co. *Automotive Composites Consortium Structural Composite Underbody*	**David Lake** Milliken Chemical *High Performance Reinforcement: A Pathway to Density Reduction while Maintaining Physical Properties of Polyolefin Composites*	**Gregorio Vélez-García** Virginia Tech *Progress in Simulations for Short and Long Glass Fiber Thermoplastic Composites* ***2009 SPE ACCE Scholarship Award Winner***
12:00–12:30	**Jim Cederstrom** Bulk Molding Co. Inc. *BMC Composites: High Value Metal Replacement Material Alternative for Automotive Powertrain Applications*	**Duane Emerson** Ticona Engineering Polymers *Innovative PPS Blow-Molded Air Duct for Turbocharged Diesel Engine*	**Hannes Fuchs** Multimatic *Initial Finite Element Analysis of Bond-Line Read-Through in Composite Automotive Body Panels Subject to Elevated Temperature Cure*
12:30–1:30	**Lunch & Exhibits - Ballroom** *(Sponsored by RTP Company)*		
1:30–2:00	**Keynote Speaker** Dana Myers, Myers Motors, *Composites Help Electrify Transportation*		
2:00–2:15	**Coffee Break & Exhibits - Ballroom** *(Sponsored by Reichold Inc.)*		
	ENABLING TECHNOLOGIES - PART 3: *Process & Tooling Enhancements*	**ADVANCES IN THERMOPLASTIC COMPOSITES - PART 3:** *Matrix Enhancements*	**VIRTUAL PROTOTYPING & TESTING OF COMPOSITES - PART 5:** *Simulation & Part Verification (continued)*
2:15–2:45	**Antony Dodworth** Bentley Motors *Bentley Motors Develops Unique Directional Carbon Fibre Preforming Process for Chassis Rails*	**Alan Murray** Allied Composite Technologies *Structural Thermoplastic Composites – Filling the Gap between Stamped Steel and Molded Composites*	**Barton McPheeters** Nei Software, Inc. *Progressive Ply Failure Analysis for Composite Structures*
2:45–3:15	**Andrew Wabran** University of Aukland *Reducing Setup Costs: Tooling Force Prediction in Resin Transfer Moulding (RTM) & Compression RTM*	**Frank Henning,** Fraunhofer ICT **Louis Martin,** Addcomp North America *Latest in Additive Developments for Long Fibre Reinforced Polymers*	**Uday Sharma** University of Michigan-Dearborn *Analysis of Woven Glass Fiber Reinforced Thermoplastic Composites under Varying Strain Rates* ***2008 SPE ACCE Scholarship Award Winner***
3:15–3:45	**Herbert Funke** FibreTech & Fachhochschule Dortmund / University of Applied Sciences and Arts *Electrically-Heated Moulds of CRP Composite Materials for Automotive Application*	**Fred Deans** Allied Composite Technologies *Advances in Thermoplastic Composites Using CBT*	
3:45–4:00	**Coffee Break & Exhibits - Ballroom** *(Sponsored by PPG Industries)*		
4:00–4:30	**Keynote Speaker** Gary Lownsdale, Plasan Carbon Composites, *Automotive Carbon Composites – Historic Obstacles, Current Solutions, & Future Trends*		
4:30–4:45	**Closing Remarks** Cedric Ball, *'09 SPE ACCE Chair*		

Keynote Speakers

A Vision for Carbon Fiber Composites in Automotive

Kalyan Sehanobish, *Dow Chemical*

Currently, the composites industry lacks any real alternative to high-speed metal-stamping technology, and carbon fiber composites in particular lag metal-forming industries in terms of fast, low-cost fabrication technologies. Present technology is both hostage to excessively costly precursor and to slow and costly conversion technologies. While this is likely to improve somewhat as carbon fiber supply increases, still no single commercial entity is going to take on the challenge of delivering low-cost carbon fiber without a commitment for serious growth of these materials in ground transportation and a less-costly manufacturing strategy. To solve the complex and formidable challenges ahead will require a consortium of industries coming together and attacking the problem from all angles.

Can You Be-Leaf It? Development & Implementation of Sustainable Materials for the Automotive Industry

Deborah Mielewski, *Ford Motor Co.*

Interest in the benefits of using carbon-sequestering, bio-based monomers and polymers and natural-fiber reinforcements to produce lighter, greener composites for automotive and ground-transportation applications has been growing for over a decade. Ford Motor Co. has long been a leader in incorporating environmental technologies such as bio- and natural-fiber composites and recycled polymers into vehicles sold worldwide. Learn about technologies the company is currently working on, key challenges that have already been overcome, and further work that must be done to meet all durability and functional requirements needed for passenger vehicles.

An Innovation Process for Composite Structures from the Nano- to Macro-Scale: A Vision for a New Center

Eann Patterson, *Michgan State University*

Established in 2007, the Composite Vehicle Research Center (CVRC) at Michigan State aims to create a new paradigm in university research centers by its dual focus on collaboration across the length scales (from nano to macro), and on collaboration across the innovation process (from breakthrough research to technology validation). Learn how the center plans to contribute to wealth and job creation via commercial exploitation of the new technology it develops through spinoff companies and by providing a competitive edge for industrial partners by enabling global collaborations and participating in pre-normative research to support the development of standards.

Plastics & Composites Solutions for the Tesla Roadster

Barrie Dickinson, *Tesla Motors*

When it was introduced a few years ago, the Tesla Motors *Roadster* – a sleek plug-in-electric, composite-bodied, two seater that does 0-60 mph / 0-97 kmph in 4 seconds – broke the stereotype that eco-friendly vehicles had to be ugly and plodding, and created a whole new demographic for "*green*" transportation among sports-car aficionados. Learn about development of the vehicle's unique carbon composite sandwich panel body and other composites and plastics applications from the engineer responsible for developing these components.

Development of the 100 MPG Bright Automotive Plug-in Hybrid Vehicle

Hadrian Rori, *Bright Automotive*

At a time when new and traditional automakers are scrambling to increase mileage & reduce emissions by reimagining passenger cars, the delivery-vehicle segment is wide open and much in need of a makeover – an opportunity that startup automaker Bright Automotive is positioning itself to serve. The company has announced plans for a 2012 launch of its *IDEA* hybrid-electric delivery van, capable of 100 miles/gallon / 42.5 kilometers/liter for a 50-mile / 81-kilometer commute. Early working prototypes of the vehicle sport composite body panels.

Composites Help Electrify Transportation

Dana Myers, *Myers Motors*

Switching from metals to composites can help automakers reduce vehicle mass, increase fuel efficiency, lower CO_2 emissions, while also reducing costs and assembly operations, maintaining or improving performance and safety, and facilitating excellent design and aesthetics. Myers Motors should know. This startup automaker manufactures and sells the composite-bodied, 76-mph / 122-kmph *NmG* (No More Gas) three-wheel commuter electric vehicle.

Automotive Carbon Composites – Historic Obstacles, Current Solutions, & Future Trends

Gary Lownsdale, *Plasan Carbon Composites*

This presentation will review the issues that have historically prevented carbon fiber composites from evolving in the automotive industry, describe how those obstacles are presently being pushed aside, and give likely trends for the use of these materials through 2018, including key milestones that will impact acceptance such as pedestrian-protection legislation, tougher fuel-economy standards, and next-generation vehicle architecture.

Enabling Technologies

PART 1: Additives, Reinforcements, & Matrix Enhancements

Epoxy Thermosets Modified with Novel Nano-Scale, Self-Assembled Block Copolymers: Toughening Mechanisms and Extension to Composites

Nikhil Verghese, *Dow Chemical*

A unique approach to toughening thermosets has been identified by introducing small amounts of amphiphilic block copolymer. The result is a good viscosity-Tg-toughness balance. In this work, the fracture behavior of these modified epoxies was carefully studied in an attempt to understand the toughening mechanisms that exist. The findings suggest that cavitation in even these nano-sized spherical micelles is the primary mechanism of toughening. These findings were also found to be a strong function of the cross-link density of the host network, with higher levels of plastic deformation at the crack tip being observed in the low-cross-link density systems. Glass-fiber-reinforced composites made with epoxies modified with these toughening agents were found to have improved fatigue resistance.

Zero-Emission Acrylic Thermoset Technology

Gero Nordmann, *BASF*

In today's environment, there is an ever-increasing desire to 'circle the square,' reaching high-performance, durability, light weight and manufacturing flexibility without increasing and even trying to lower overall system costs. This presentation will discuss a new enabling technology platform engineered towards these ends: cross-linked thermoset acrylics. These are non-flammable, zero-emission systems that contain no volatile or hazardous components at any stage of their life cycle. They are easy to use in molding processes and ideally suited for today's 'greener,' lightweight automotive composites. Their application in natural fiber composites will also be outlined in the presentation.

Improved Matrix Materials for High-Performance Carbon Fiber Aromatic Thermosetting Copolyester

Zeba Farheen Abdul Samad, *Univ. of Illinois-Urbana / Champaign*

2009 SPE ACCE Scholarship Award Winner

The use of new aromatic thermosetting copolyester (ATSP) is described and compared to the best available epoxies for high performance composites. ATSP oligomers display liquid crystalline behavior, which was identified using optical microscopy with cross-polarizers. ATSP tailored to have a liquid crystalline structure has reduced stresses at the fiber/matrix interface and better thermal fatigue resistance compared to epoxy.

Enabling Technologies PART 2: Product Enhancements via Processing & Bonding

Long-Fiber Reinforced Thermoplastic LFT-D & Thermosetting D-SMC Processes for Lightweight Parts Production – Trends & Recent Applications

Heinrich Ernst, *Dieffenbacher GmbH*

The direct process of producing long-fiber-reinforced thermoplastics (LFT-D) is highly innovative and economical for producing semi-structural and structural components as well as cosmetic parts with grained surfaces. The advanced plastic-hybrid developments with tailored LFT and E-LFT technologies fulfill crashworthiness requirements. Similiarly, the direct processing of fiber-reinforced thermosetting materials – direct strand molding compound (D-SMC) – is focused on the reproducible manufacturing of the compound resulting in a constant part production at a high level, minimizing material costs and expensive post-mold operations and paint processes, as well as reducing logistical costs. The high flexibility in composing the recipe in selecting the resins, fillers and reinforcements result in the high degree of freedom of this process.

Development of an Adhesive-Primer for Polypropylene Composites

David Trudel-Boucher, *National Research Council of Canada*

Joining is often one of the critical steps in the fabrication of composite products. However, the low polarity and inert characteristics of polypropylene composite surfaces cause many problems in the assembly of these composites with dissimilar materials. In order to overcome the adhesion issues, an epoxy-based primer was developed and the compatibility of several commercial adhesives with the primer was evaluated. Results showed very-good lap-shear strength of up to 15 MPa with substrate failure. The performance of the primer was also evaluated between -30 and 80°C and after conditioning in humidity. While lap-shear strength decreased with increasing temperature, it remained unchanged after conditioning. Finally, different practical approaches to apply the primer film to a polypropylene continuous-fiber composite were investigated, including techniques to apply the primer during and after composite consolidation.

Low Temperature Cure Polyurethane Adhesive for "Primerless" Composite Bonding

Michael Barker, *Ashland Inc.*

A new polyurethane adhesive has been developed that provides excellent adhesion to SMC, HSU, and RTM without surface preparation and requiring only a room-temperature cure or greatly reduced post-bake temperatures. This presentation will review where such an adhesive will find application, its general chemistry and supporting data.

Enabling Technologies
PART 3: Process & Tooling Enhancements

Bentley Motors Develops Unique Directional Carbon Fibre Preforming Process for Chassis Rails

Antony Dodworth, *Bentley Motors*

Details are presented on an automated process for manufacturing net-shape charges for compression moulding using a spray-deposition technique. The novel process uses a resin-spray technique and magnetic fibre to position and hold fibres onto the tool face. The process is intended for producing structural components using discontinuous bundles for medium-volume applications.

Reducing Setup Costs: Tooling Force Prediction in Resin Transfer Moulding (RTM) & Compression RTM

Andrew Wabran, *University of Aukland*

Mould tools used for processes such as RTM and compression RTM must withstand significant forces generated by the fluid resin and the fibrous reinforcement. Prediction of these forces will allow for optimizations in setup costs and time, and maximize the usage of the capabilities of peripheral equipment (such as presses). SimLCM is being developed at the University of Auckland as a simulation package with the capability to predict clamping forces and stress distributions during complete moulding cycles for RTM and CRTM.

Electrically-Heated Moulds of CRP Composite Materials for Automotive Application

Herbert Funke, *FibreTech & Fachhochschule Dortmund / University of Applied Sciences and Arts*

The moulding system FIBRETEMP describes a procedure to heat moulding surfaces efficiently with a consistent distribution of temperature. The heart of this invention the use of carbon fibres to conduct electricity as well as integrating the heating element and the structure within the surface to be heated. These moulds are highly energy-efficient and extraordinarily dimensionally stable, while also being produced at low cost. This technology has already been proven in manufacturing composite parts and has nearly halved cycle time for some applications due to its efficient heating characteristics.

Virtual Prototyping & Testing of Composites
PART 1: Coupling Process & Structural Simulations

Digimat Material eXpert – From the Material Lab to the Efficient and Optimal Design of Reinforced Plastic Parts

Roger Assaker, *e-Xstream Engineering*

Fast and cost-efficient design of higher quality, lighter, and more energy efficient vehicles is one of the key success factors for today's automotive industry. Predictive CAE and the use of composites materials, offering good weight to mechanical-performance ratio, are two ingredients that will help the industry moving forward profitably. We will introduce the DIGIMAT nonlinear, micromechanical-modeling technology, which can be used to predict the nonlinear behavior and failure of multi-phase materials based on their underlying microstructure (e.g. fiber content, fiber orientation, fiber length, etc.). The multi-scale material-modeling process, used to model the reinforced plastic part, will then be presented.

Damage Modeling of Injection-Molded Short- and Long-Fiber Thermoplastics

Ba Nghiep Nguyen, *Pacific Northwest National Laboratories*

An integrated approach linking process to structural modeling has been developed to predict the nonlinear stress-strain responses and damage accumulations in injection-molded long-fiber thermoplastics (LFTs). The approach uses Autodesk® Moldflow® Plastics Insight's fiber orientation results predicted by a new fiber-orientation model developed for LFTs and maps these results to an ABAQUS® finite-element mesh for damage analyses using a new damage model for LFTs. The damage model, which has been implemented in ABAQUS via user-subroutines, combines micromechanical modeling with a continuum damage-mechanics description to predict the nonlinear behavior of LFTs due to plasticity coupled with damage. Experimental characterization and mechanical testing were performed to provide input data to support and validate both process modeling and damage analyses.

Application of Digimat Micromechanical Modeling to Polymer Composites

Peter Foss, *General Motors Co.*

DIGIMAT micromechanics-modeling software was evaluated to predict the nonlinear stiffness and strength properties of glass-filled nylon. In this particular case, due to the high aspect ratio of the fibers, the properties of reverse engineered "effective matrix" rather than the actual matrix properties were needed to accurately correlate both the flow and transverse to flow stress-strain behavior.

Virtual Prototyping & Testing of Composites PART 2: Coupling Process & Structural Simulations *(continued)*

Sensing When the Molding Cycle is Over.... The Key to Productivity & Product Consistency

Tom Trexler, *Ashland, Inc.*

Dielectric cure monitoring has been used in thermoset laboratories for decades to characterize materials. Historically, attempts to take the technology to the production floor where the benefits can be maximized in production tools have failed due to shortcomings in sensor durability and system reliability. Breakthroughs in dielectric sensor design have resulted in the development of durable in-mold sensors that can operate on the production floor. Thermoset molders can now "see" changes in flow and cure inside their production tools, allowing automatic "real-time" adjustments for process variation and enabling significant gains in productivity and quality. Benefits to compression and injection molders include: 10-25% reductions in cycle time, improvements in quality and reduction of scrap, and a better understanding of flow and cure rates inside the mold.

Advanced Simulation of Fiber-Reinforced Automotive Radiator End Tanks by Capturing Anisotropic Material Properties

Suresh Shah, *Delphi Corp.*

This study aims to capture realistic anisotropic properties of a plastic material in a structural analysis. Moldflow software has been used to obtain the fiber-orientation details for a plastic radiator tank. This fiber-orientation output data have been transferred to the structural analysis software (ABAQUS using commercially available interface software (DIGIMAT). This integrated simulation technique helps in accurate prediction of burst pressure strength of the plastic tank.

Material Characterization & Modelling of Long Glass-Fiber Composites

Matthew Marks, *SABIC Innovative Plastics*

Modeling the stiffness of parts injection molded from long-fiber materials is similar to yet different from behavior using short-fiber-filled materials. This work discusses the effects of various modeling assumptions and methods on stiffness predictions using a coupled Moldflow-Digimat-Abaqus analysis methodology.

Virtual Prototyping & Testing of Composites PART 3: Data Collection & Materials Characterization

Fatigue Properties of Injection Molded 33% E-Glass Fiber Reinforced Polyamide-6,6

Shivanand Sankaran, *University of Michigan-Dearborn*

This paper presents the effects of melt temperature, injection pressure, hold pressure, and injection speed on the tensile and fatigue properties of 33-wt% E-glass fiber-reinforced polyamide-6,6. It was observed that these process parameters had a greater influence on the fatigue properties than on the tensile properties. Melt temperature had the greatest effect followed by injection pressure. Both hold pressure and injection speed had smaller but significant effects on the fatigue life.

Identification, Selection & Development of Composite Test Standards – A Case Study from the Development of a Design Standard for Composites

Ellen Lackey, *University of Mississippi*

This paper examines the identification, selection, and development of appropriate composite test methods as required in the composites design process. Examples from the development of a load and resistance factor design (LRFD) standard for pultruded composites are presented. The issues addressed for this case study discussion are applicable to any segment of the composites market that is looking to establish design procedures or develop design standards.

Engineering Aspects of Designing with Pultruded Carbon-Fiber Composites

Jay Tudor, *Dow Automotive*

Often times a composite component can be used to replace a metallic component, providing a significant reduction in weight while providing little or no loss in strength or stiffness. For automotive engineers to further utilize composites in new applications, it is important to understand the mechanical behavior of the material in all the critical loading directions. This paper focuses on the relevant tests necessary to characterize the mechanical properties of a pultruded carbon fiber composite material. The mechanical properties evaluated include tension, compression, interlaminar shear, and fatigue testing in the fiber direction. Included is a discussion on key aspects of the testing in order to ensure reliable results. Also, a set of design criteria is developed for the use of the material according to the measured properties.

Study of Braided Composites for Energy Absorption

Andy Rich, *Plasan Carbon Composites*

The goal of this research project was to provide data to build FEA tools and to improve the understanding of braiding technology in order to expand predictive abilities for post-yield behavior of carbon fiber products braided with multiple hybrid fibers.

Virtual Prototyping & Testing of Composites PART 4: Simulation & Part Verification

Mesoscopic Finite Element Simulation of the Compression Forming of Sheet Molding Compound Woven-Fabric Composites

James Sherwood
University of Massachusetts-Lowell

This paper describes a mesoscopic approach of using beam and shell finite elements to model the forming of composite parts using an SMC woven fabric. Nonlinear constitutive models are implemented in ABAQUS/Explicit via user-defined material subroutines to describe the shear and tensile mechanical behavior of the woven fabric. Both single-ply and multiple-ply layups are modeled.

Progress in Simulations for Short and Long Glass Fiber Thermoplastic Composites

Gregorio Vélez-García, *Virginia Tech*

2009 SPE ACCE Scholarship Award Winner

The development and implementation of lightweight materials using fiber composites made by injection molding represents an engineering challenge due to the inability to control the fiber orientation in the required direction of mechanical demand. This paper presents progress in developing the capability of predicting fiber orientation in simple and complex flow geometries for highly concentrated short-glass-fiber suspensions and the extension of this approach to long-glass-fiber suspensions. Three important aspects included in the approach are the implementation of new theories to model fiber orientation, the evaluation of model parameters from rheological experiments, and the use of stable numerical methods based on discontinuous Galerkin finite-element method.

Initial Finite Element Analysis of Bond-Line Read-Through in Composite Automotive Body Panels Subject to Elevated Temperature Cure

Hannes Fuchs, *Multimatic*

The Automotive Composites Consortium (ACC) is conducting a multi-year project to develop a better understanding of the root causes of the visual surface deformation effect known as bond-line read-through (BLRT). BLRT is associated with bonded automotive Class A exterior panels, and produces out-of-plane deformations on the order of 0.010-0.050 mm. The ACC is studying the relationship between material and process factors and BLRT severity. The majority of the investigations have focused on SMC composite panels bonded with urethane and epoxy adhesives under elevated-temperature cure conditions, and subsequently primed and topcoat painted. An investigation was conducted to see if analytical tools could predict the BLRT effect observed in the physical experiments. The present work describes the initial effort to model the BLRT effect using a finite-element analysis (FEA)-based approach. As part of this effort, detailed three-dimensional FEA solid models were developed for two idealized panel configurations: (a) an outer panel with an adhesive bead and drops, and (b) a bonded outer/inner panel assembly. Results were predicted for the case of an idealized elevated-temperature adhesive cure condition using a steady-state thermo-elastic analysis. The predicted surface curvature results indicated a good qualitative agreement to available measurement data, with the analysis over-predicting the BLRT severity.

Virtual Prototyping & Testing of Composites PART 5: Simulation & Part Verification *(continued)*

Progressive Ply Failure Analysis for Composite Structures

Barton McPheeters, *Nei Software, Inc.*

Design engineers working with composite materials typically use a linear finite-element-analysis (FEA) solution and a failure-index calculation based on the current state of stress in the model. However, this type of analysis can only provide accurate results up to first-ply failure because of the linear assumption. This presentation will show how nonlinear progressive-ply failure analysis can go beyond first-ply failure and simulate subsequent damage propagation through a structure. This allows engineers to make a better assessment of conditions for ultimate failure so they can optimize their designs and also provide guidance on the most appropriate physical-test program.

Analysis of Woven Glass Fiber Reinforced Thermoplastic Composites under Varying Strain Rates

Uday Sharma, *University of Michigan-Dearborn*

2008 SPE ACCE Scholarship Award Winner

Increased use of polymer matrix composites depend on having a deeper understanding of their mechanical response under varying strain rates. In this study the mechanical behavior of thermoplastic woven composites was investigated under varying strain rates between 5.0 x 10-5 s^{-1} and 5.0 x 102 s^{-1} using a screw-driven universal testing machine and an impact testing and imaging apparatus. Results yielded stress vs. strain curves over the full range of loading rates highlighting the strain-rate sensitivity exhibited by the thermoplastic composites. In addition, the non-contact strain-measurement system revealed the effect of woven architecture on the mechanical behavior of thermo-plastic woven composites.

Bio- & Natural Fiber Composites

PART 1: Green Thermosets

Renewable Resource-Based Composites for the Automotive Industry

Dejan Andjelkovic, *Ashland Inc.*

The incorporation of renewable resources in composite materials is a viable means to reduce environmental impact and support sustainability efforts in the composites industry. This paper will focus on unsaturated-polyester resins prepared from renewable resources and their use in composite materials. Applications of these resins in the automotive industry will be described, including a comparison of properties and performance vs. typical petroleum-based resins.

An Investigation of 'Green' Class-A SMC

Thomas Steinhäusler, *AOC, LLC*

Saturated- and unsaturated-polyester resins containing glycols made from renewable or recycled sources are being developed as a way to become less dependent on petroleum-based glycols. In this study, SMC performance of standard-density, Class A, automotive SMC containing polyester resins produced from petroleum-based glycols was compared to standard-density, Class A, automotive SMC containing polyester resins produced from renewable-source glycols. The evaluation included processing, aesthetics and adhesion performance. Finally, a new, low-density, Class A automotive SMC containing polyester resins produced from renewable-source glycols will be introduced.

Bio-Based Polymers from Soy Chemistry

Dwight Rust, *United Soybean Board*

Research on the use of soybeans to produce polyurethane polyols, unsaturated polyester resins, and thermoplastic fibers has been funded by the United Soybean Board (USB). The USB funds a wide range of activities including research and development of new industrial products made from soy. These developments have resulted in new patented technology. Commercialization of this technology has resulted in the production of unsaturated-polyester resins for fiberglass-reinforced composites and urethane polyols for polyurethane foams. The commercial applications of these bio-based polymers are found in a wide range of applications in the transportation markets.

Bio- & Natural Fiber Composites PART 2: Natural Fiber Advances

Development of Injection Moldable Composites Utilizing Annually Renewable Natural Fibers

Ellen Lee, *Ford Motor Co.*

In order to advance the commercialization of natural fiber reinforced plastics for automotive use, a partnership was formed between academia, natural fiber processor, material supplier, and OEM. This partnership improved the communication along the supply chain and resulted in optimized material properties to meet OEM specifications and application part performance. Several products have been developed that meet current material specifications, offer significant weight savings over conventional mineral- and glass-reinforced composites, and are competitively priced.

Economical Preform Production for Conventional and Natural Fiber Composites

Anthony Mascarin, *IBIS Associates*

This paper presents an independent cost analysis for a novel slurry-based preform technology in order to understand its potential benefits across a range of component and reinforcement scenarios. Specifically, the economics for small, medium, and large automotive composites reinforced with glass, carbon, and natural fibers through the use of manual sprayup, automated P-4, and slurry preforming are examined and compared through technical cost analysis. The molding economics of SMC, RTM, and SRIM are also addressed in detail.

Renewably Sourced Engineering Polymers For High Performance End Use Applications

Richard Bell, *DuPont Engineering Polymers*

External trends have continued to drive end users in consumer and industrial applications to seek renewably sourced and sustainable solutions to use in more and more demanding applications. To meet this need, a portfolio of renewably sourced engineering materials was developed. The products are designed to provide performance and functionality equivalent to or better than today's petroleum-based materials while reducing the environmental footprint. The portfolio includes glass-reinforced thermoplastic grades for high strength and stiffness.

Advances in Thermoset Composites

PART 1: Material & Process Enhancements

Alternative Methods to Enable the Powder Priming of SMC

Hamid Kia, *General Motors Co.*

Previous work has shown that the newly developed SMC systems are powder-primer ready in straight-through operations. However, after an extended stoppage in the operation – such as July shutdown – the success of the powder application depends on the severity of temperature ramp in the oven. To overcome this issue, alternative methods are proposed such as 4 min. of preheating in the oven at 180°C, or 3 min. of IR exposure.

The Influence of SMC Formulation, Inner Panel Thickness, and Bond Stand-Offs on Bond-Line Read-Through Severity

Kedzie Fernholz, *Ford Motor Co.*

Two experiments designed to understand the relationship between material and process factors and bond-line read-through (BLRT) severity will be discussed. Regression analyses of the data collected in these experiments were able to establish relationships between the experimental factors and BLRT severity with at least 80% correlation.

Flexibility in the Direct Strand Moulding Compound Process

Tobias Potyra, *Fraunhofer Institute of Chemical Technology*

2008 SPE ACCE Scholarship Award Winner

In order to improve quality issues as well as to establish an integrated and continuous process for compression-moulded parts, a direct processing technology has been developed. This presentation should demonstrate the flexibility of the new direct-SMC technology in terms of use of alternative and new raw materials and formulations.

Recent Advances in Class A Polyurethane Long Fiber Injection (LFI) Composites

Usama Younes, *Bayer MaterialScience*

Recent advances in related polyurethane chemistry have increased the commercial viability of the long fiber injection (LFI) process for producing very-large composite parts such as entry-door skins, truck body and spa panels, and recreational boat hulls. These advances enable the LFI process to achieve previously unattainable extended gel times on an open hot mold, retain a relatively short demold time, and form defect-free surfaces that can lead to the Class A surfaces required for large automotive body panels.

Advances in Thermoset Composites PART 2: Application Development

Composite Power-Train Components: Reducing Warranty Costs & Improving Part Quality

Toai Ngo, *Ashley Industrial Molding, Inc.*
Mayur Shah, *Continental Structural Plastics*

Sheet-molding compound has been used in underhood applications and is extending its reach to drivetrain components. This presentation will show how vehicle manufacturers have reduced costs and improved quality through product designs that eliminate hardware, enhance capability, and improve system performance.

Automotive Composites Consortium Structural Composite Underbody

Libby Berger, *General Motors Co.*

The Automotive Composites Consortium Focal Project 4 (ACC FP4) is a joint program between GM, Ford, and Chrysler to develop structural automotive components from composite materials. Part of this project is a structural composite underbody capable of carrying crash loads. Phase 2 of the project involves a full design of the underbody, including design for durability, and feasible component manufacturing and vehicle assembly scenarios.

BMC Composites: High Value Metal Replacement Material Alternative for Automotive Powertrain Applications

Jim Cederstrom, *Bulk Molding Co. Inc.*

Performance requirements for underhood components are increasing, making historically used thermoplastics unsuitable for next-generation engines. The need for higher thermal, chemical, and mechanical resistance is opening the door to thermoset bulk-molding compounds (BMC) for critical metal-replacement opportunities, successful examples of which will be presented.

Advances in Thermoplastic Composites

PART 1: Long-Fiber Thermoplastics

Pushtrusion™ Direct In-Line (D-LFT) Compounding Technology vs. LFT Pellets & GMT Sheet

Eric Wollan, *PlastiComp LLC*

PlastiComp's direct in-line (D-LFT) compounding process provides processors of fiber-reinforced thermoplastics a simple and affordable alternative to pre-compounded pellets and GMT sheet while yielding equivalent and, in some cases, slightly higher mechanical properties. This paper summarizes a comparative study of the properties of D-LFT vs. traditional LFT pellets in an injection-molding process as well as D-LFT vs. GMT sheet in a compression-molding process.

A Formulation Study of Long Fiber Thermoplastic Polypropylene (Part 2): The Effects of Coupling Agent Type & Properties

Creig Bowland, *PPG Industries*

The relationship between the resin and fiber properties in polypropylene long fiber thermoplastics is further analyzed in the second part of this work. The properties of the maleic anhydride grafted polypropylene additives (coupling agents) are studied and correlations between the maleic anhydride content, melt flow, and base polymer used is presented. Polypropylene long fiber thermoplastics pellets were compounded with various coupling agents. The materials were then molded and tested. The results of the study are presented.

Fatigue & Vibration Response of Long Fiber Reinforced Thermoplastics

Uday Vaidya, *University of Alabama-Birmingham*

While numerous advances have been made in the manufacturing methods of long-fiber thermoplastics (LFTs), their dynamic response in terms of fatigue and vibration damping has been a subject of limited study. There is presently no standardized design information for a composites / automotive designer for use of LFTs in situations of long-term fatigue and vibration. The behavior of E-glass fiber / polypropylene LFT composites has been characterized for their fatigue behavior and vibration response in the present study. The work provides an understanding of the influence of extrusion / compression-molded long fibers and the fiber orientation that is generated during their processing. Results will be useful to designers in accounting for fatigue life and damping factors.

Advances in Thermoplastic Composites PART 2: Trends & Opportunities

Automotive Thermoplastic Composites... Industry Structure and New Technologies Respond to a Global Recession

Bob Eller, *Robert Eller Associates*

The deterioration of macroeconomic conditions has severely impacted automotive production and the autoplastics supply chain. Thermoplastic composites – especially long-glass-fiber versions – will benefit from these conditions via the development and implementation of new resin and compound technology, as well as advances in fabrication technology adapted to the requirements of a new automotive paradigm and new applications. Our outlook is for gains in high-performance long-glass (and other fiber) reinforced-PP compounds in competition with short-glass and mineral-filled compounds.

High Performance Reinforcement: A Pathway to Density Reduction while Maintaining Physical Properties of Polyolefin Composites

David Lake, *Milliken Chemical*

To achieve significant part weight reductions of 15-20%, Milliken Chemical's high performance reinforcing (HPR) additive may be an excellent choice for the replacement of talc and other mineral fillers in polypropylene composites. For instance, vs. talc, HPR will typically provide comparable or superior performance with only about one-third of conventional talc concentrations. Furthermore, these improvements may be realized without any detrimental effects on aesthetic properties.

Innovative PPS Blow-Molded Air Duct for Turbocharged Diesel Engine

Duane Emerson, *Ticona Engineering Polymers*

A new patented in-mold assembly process forms an optimized assembly using a combination of blow molding and injection molding for a turbo-charged diesel charge air duct. The process incorporates a 15%-GF-reinforced blow-molding grade and a 30%-GF-reinforced injection molding grade of polyphenylene sulfide. PPS was the material of choice due to its superior heat and chemical resistance.

Advances in Thermoplastic Composites PART 3: Matrix Enhancements

Structural Thermoplastic Composites – Filling the Gap between Stamped Steel and Molded Composites

Alan Murray, *Allied Composite Technologies*

For over 50 years, the auto industry has been gradually replacing steel with plastics and molded composites. Substantial progress has been made, particularly in applications where significant parts consolidation is possible using composites. The need is greater than ever for further substitution of composites for steel, but large performance gaps between steel and composites limit the rate of progress. Current gap factors include: stiffness and strength, molding thickness, process cycle time, ability to weld to steel, and cost. This presentation will address approaches for eliminating each of these gap elements for non-appearance parts using a systems approach based on new thermoplastic composite technologies.

Latest in Additive Developments for Long Fibre Reinforced Polymers

Frank Henning, *Fraunhofer ICT*
Louis Martin, *Addcomp North America*

Composite parts made from long-fibre-reinforced thermoplastic (LFT) material systems are known for their high impact and tensile strength. And due to the benefits of the outstanding price to performance relationship of the in-line compounded (ILC) direct-LFT (LFT-D) technology used for production of composites based on the use of polypropylene and glass fibres, it has achieved consistently more applications in the automotive industry. But LFT-based automotive applications are mainly used for parts with large surfaces, which can contribute significantly to the total amount of VOCs and odor inside a car. The current work explains a feasible approach of using commercial additives – provided as a complete system – in combination with VOC- and odor-reducing additives to further enhance the mechanical and outgasing properties of the PP / GF composites produced by LFT-D / ILC technology.

Advances in Thermoplastic Composites Using CBT

Fred Deans, *Allied Composite Technologies*

The use of cyclic-polybutylene terephthalate (C-PBT) for manufacturing high-performance composites is taking on new roles. Advances in injection molding, RTM molding, pultrusion, and composite tooling are benefiting from the use C-PBT thermoplastic resins, leading to the development of new C-PBT technologies and applications.

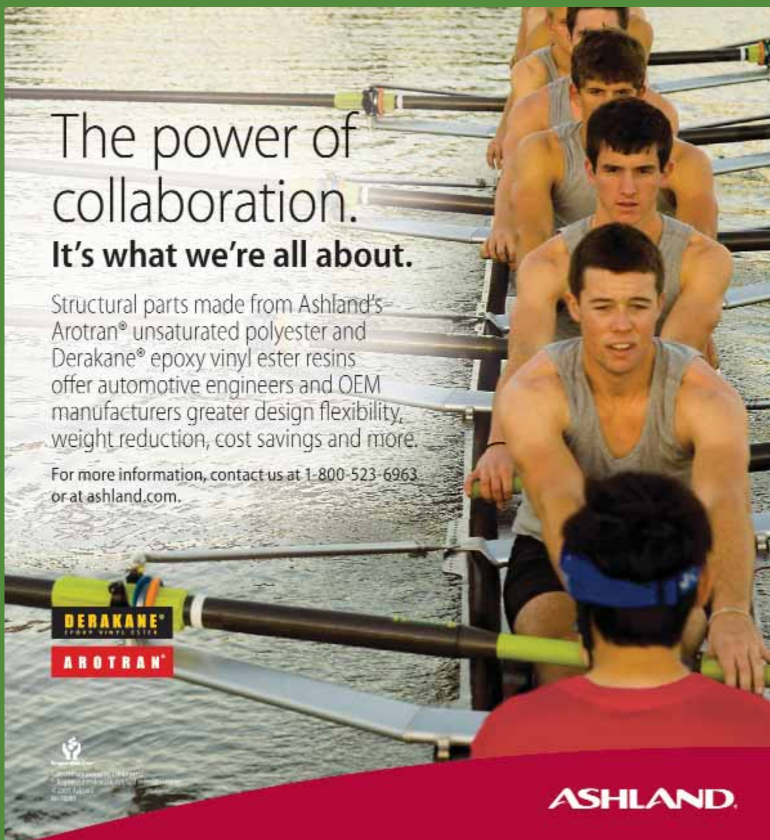
Panel Discussion

The Role of Composites in the New Automotive Landscape

Moderator: Dale Brosius
Panelists: D. Cole, J. deVries, B. Dickinson, M. Jackson, T. Juechter, P. Sklad

The global automotive industry has undergone a massive upheaval in the past 12 months, and its future is still a bit cloudy. Major restructurings, ownership changes, and sizable government interventions have all combined with the global-economic crisis to reshape this industry at a pace and on a scale never before seen. When the dust settles, how will the industry move forward to meet the desires of the marketplace for functional, fuel-efficient vehicles? Will the '*new*' auto industry be more global or more regional? Is it inevitable that small cars will dominate the market? What options, other than downsizing, exist for achieving higher fuel economy? Where do plastics – and more specifically composites – fit into the spectrum of choices available to automakers? Will automakers be better positioned and more inclined to turn to '*clean-sheet*' designs and market-disruptive technologies for their vehicles? These are just a few of the questions that will be asked of executive panel members. Audience participation is strongly encouraged through an active Q&A session.


9th-Annual SPE Automotive Composites Conference & Exhibition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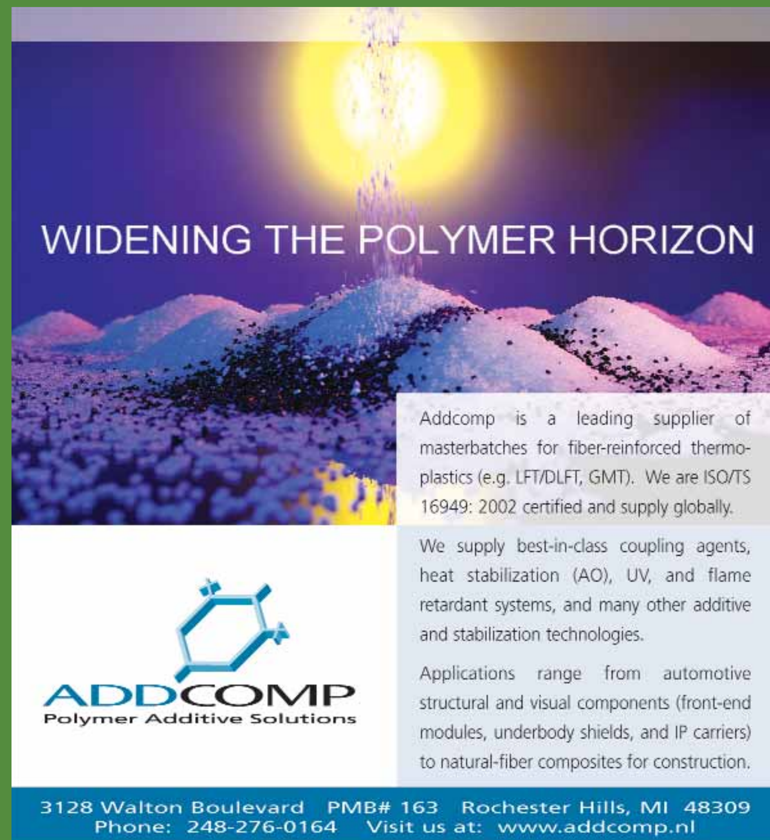
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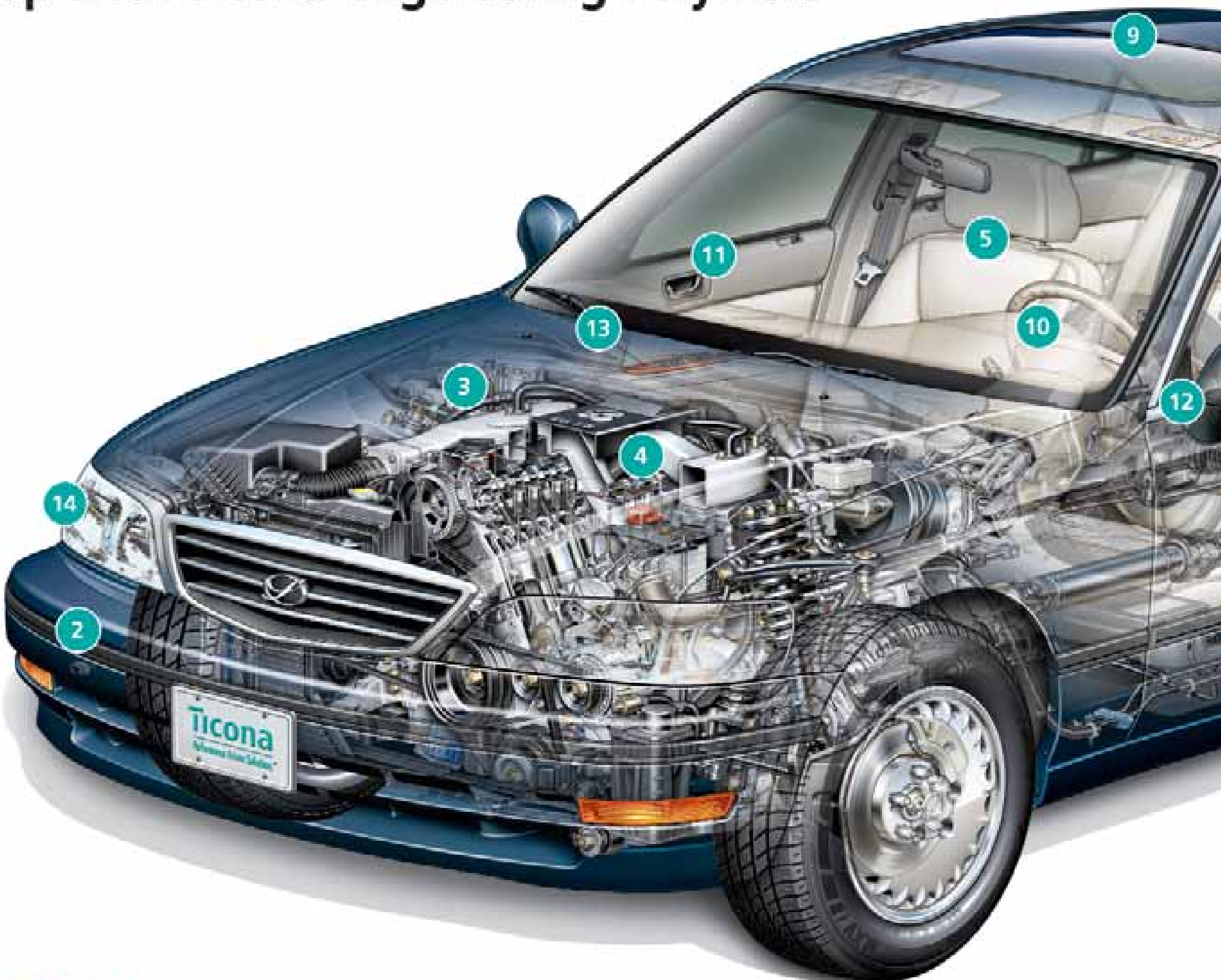

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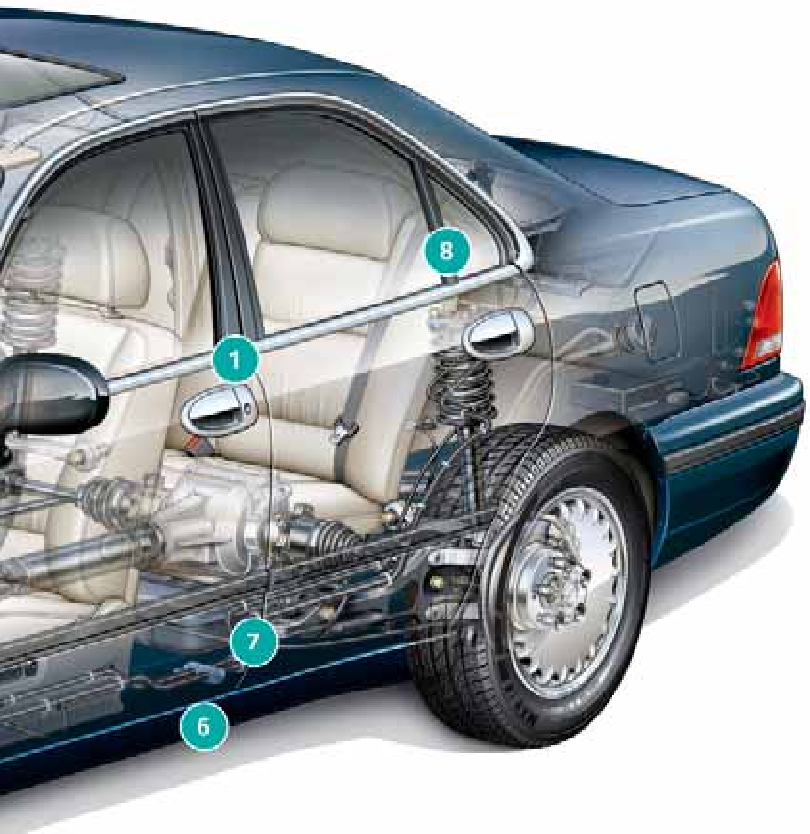
5 Cockpit Environment
Celanex® PBT, Vandar® PBT, Riteflex® TPC-ET, Hostaform®/Celcon® acetal copolymer

6 Underbody Skid Plates
Celanex® PBT, Celstran® LFRT

7 Advanced Fuel Delivery
Hostaform®/Celcon® acetal copolymer, Fortron® PPS, Celanex® PBT, Riteflex® TPC-ET

8 Seating & Restraint
Hostaform®/Celcon® acetal copolymer, Celstran® LFRT, Riteflex® TPC-ET, Celanex® PBT, Vandar® PBT



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12 Mirror Housings
Hostaform®/Celcon® acetal copolymer, Celanex® PBT, Celstran® LFRT

13 Wiper Plenums
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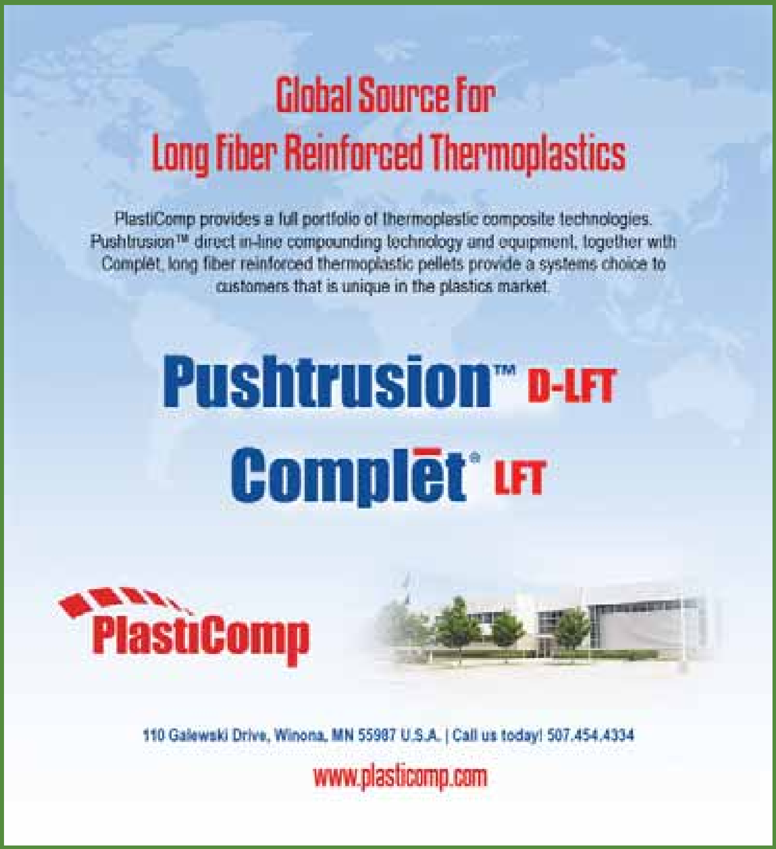
SPE® Announces Winners of Scholarships for Graduate-Level Research in Automotive Composites

Two graduate students will each receive a $2,000 USD scholarship check from the *Society of Plastics Engineers – Automotive & Composites Divisions* at this year's *SPE Automotive Composites Conference & Exhibition* (SPE ACCE), September 15 & 16, 2009 to help underwrite research in composites for ground transportation. Gregorio Manuel Vélez-García, originally from Puerto Rico and a Ph.D. candidate at ***Virginia Polytechnic Institute and State University*** (Virginia Tech, Blacksburg, Va.), and Zeba Farheen Abdul Samad, originally from India and a doctoral candidate at the ***University of Illinois-Urbana/Champaign*** (Urbana, Ill.), were selected from the pool of qualified applicants by SPE ACCE committee members and will report the results of their findings during next year's tenth-annual SPE ACCE, which takes place in September 14-16, 2010. Vélez-Garcia will use his scholarship for development work on a new method for predicting fiber orientation in fiber-reinforced, injection-molded thermoplastics, while Abdul Samad will use her scholarship to continue her work on aromatic thermosetting copolyester (ATCP) / carbon fiber composites.

Gregorio Manuel Vélez-García was born and grew up in a small fishing village of Vieques on the east side of Puerto Rico. His educational experiences from middle school through his Master's were complemented with research programs sponsored by the National Science Foundation (NSF), National Institutes of Health (NIH), and the National Aeronautics & Space Administration (NASA). He earned B.S. and M.S. degrees in Chemical Engineering from the University of Puerto Rico-Mayaguez (UPRM). In 2000, Vélez-García began teaching classes on process manufacturing, process design, fundamentals of polymer science and engineering, and materials science at his alma mater, UPRM. He also was a consultant to the electronics, medical device, pharmaceutical, and biotechnology industries in Puerto Rico, and has been a traveling lecturer in Latin America giving talks on polymer processing in Spanish. In 2004, he began work on a Ph.D. in Macromolecular Science and Engineering at Virginia Tech., sponsored by UPRM as well as an NSF Integrative Graduate Education & Research Traineeship Program (IGERT) fellowship. As part of this fellowship, he completed a summer internship at Oak Ridge National Laboratories, working towards a simple method to characterize fiber-length distribution in long glass fibers. In 2006, he began working on a short-fiber composite project sponsored by NSF and the U.S. Department of Energy (DOE). From this research activity, he has produced three journal articles and 11 conference presentations as second author, and nine conference presentations as lead author. He is currently working on three additional journal articles that focus on his experimental and numerical work in short-fiber composites. Next year, Vélez-García will return to teach at UPRM, where he will also be responsible for developing the school's new Polymer Processing & Composites Center, which will provide support to Puerto Rico's aerospace and medical-device industries. Vélez-García is an active member of SPE and a councilor for SPE's Caribbean Section.

Zeba Farheen Abdul Samad holds an undergraduate degree in Polymer Engineering and Technology from the Institute of Chemical Technology, Mumbai, India – where she developed a passion for composites while working on mica/ABS materials for her senior thesis. She joined Professor James Economy's research group in the Department of Materials Science and Engineering at the University of Illinois at Urbana/Champaign in 2006. A focus of her research group is the synthesis and characterization of novel polymers for use as matrix materials in composites. Abdul Samad's primary research interest is designing polymeric materials for high-temperature applications, specifically for composite matrix materials. She is currently working on novel aromatic thermosetting copolyester matrix systems for high temperature stable composite applications as well as on silver-based bactericidal systems for enhancing shelf-life of milk in tropical temperatures. Abdul Samad was awarded the Perkin-Elmer Award from the Composites Division of SPE (2007-2008) and was the recipient of the Bostik Award at SPE's Annual Technical Conference (ANTEC) in 2009.

Abdul Samad will use her scholarship to continue her work on aromatic thermosetting copolyester (ATCP) / carbon fiber composites, a promising new family of materials that show liquid crystalline structures during melt and post-cure. As a matrix resin, not only does ATSP offer high thermal stability and thermal fatigue resistance, flame retardance, and damage tolerance, but it also possesses unique properties like easy processing of nearly void-free structures and the ability to form adhesive self-bonds.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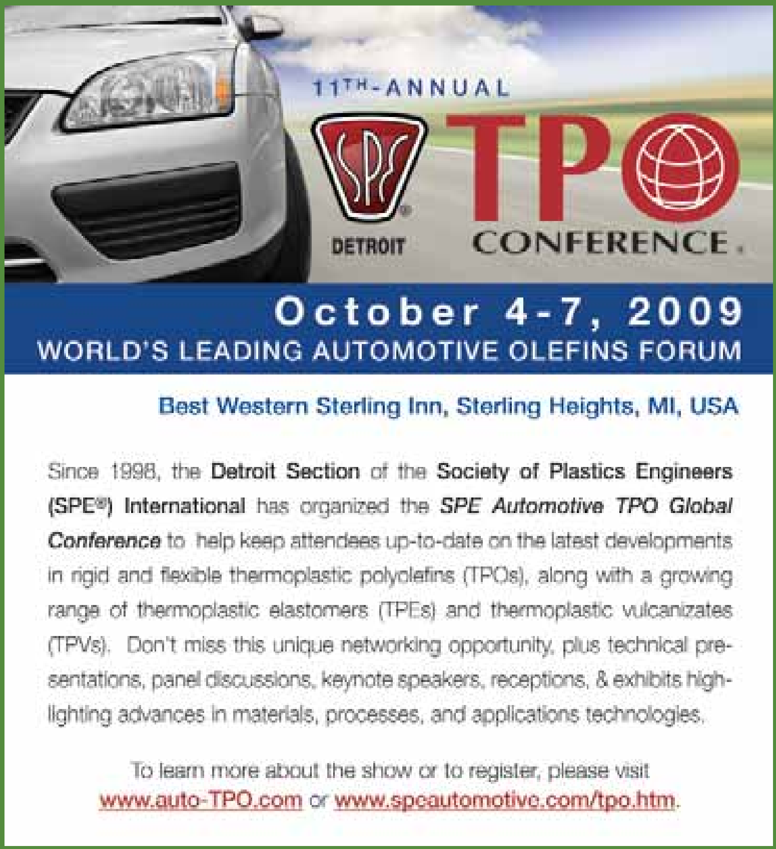
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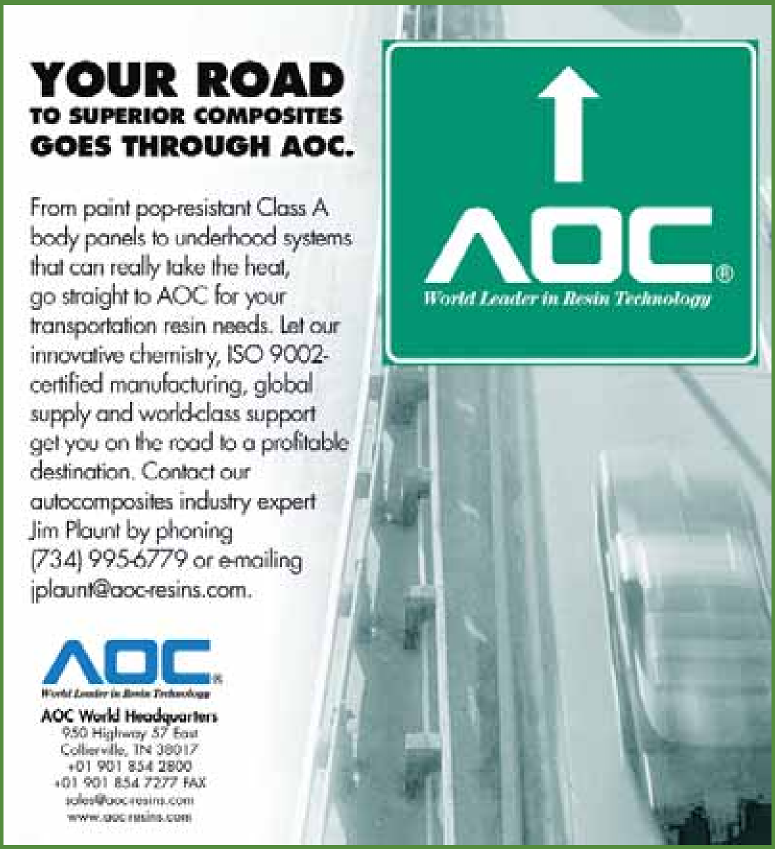
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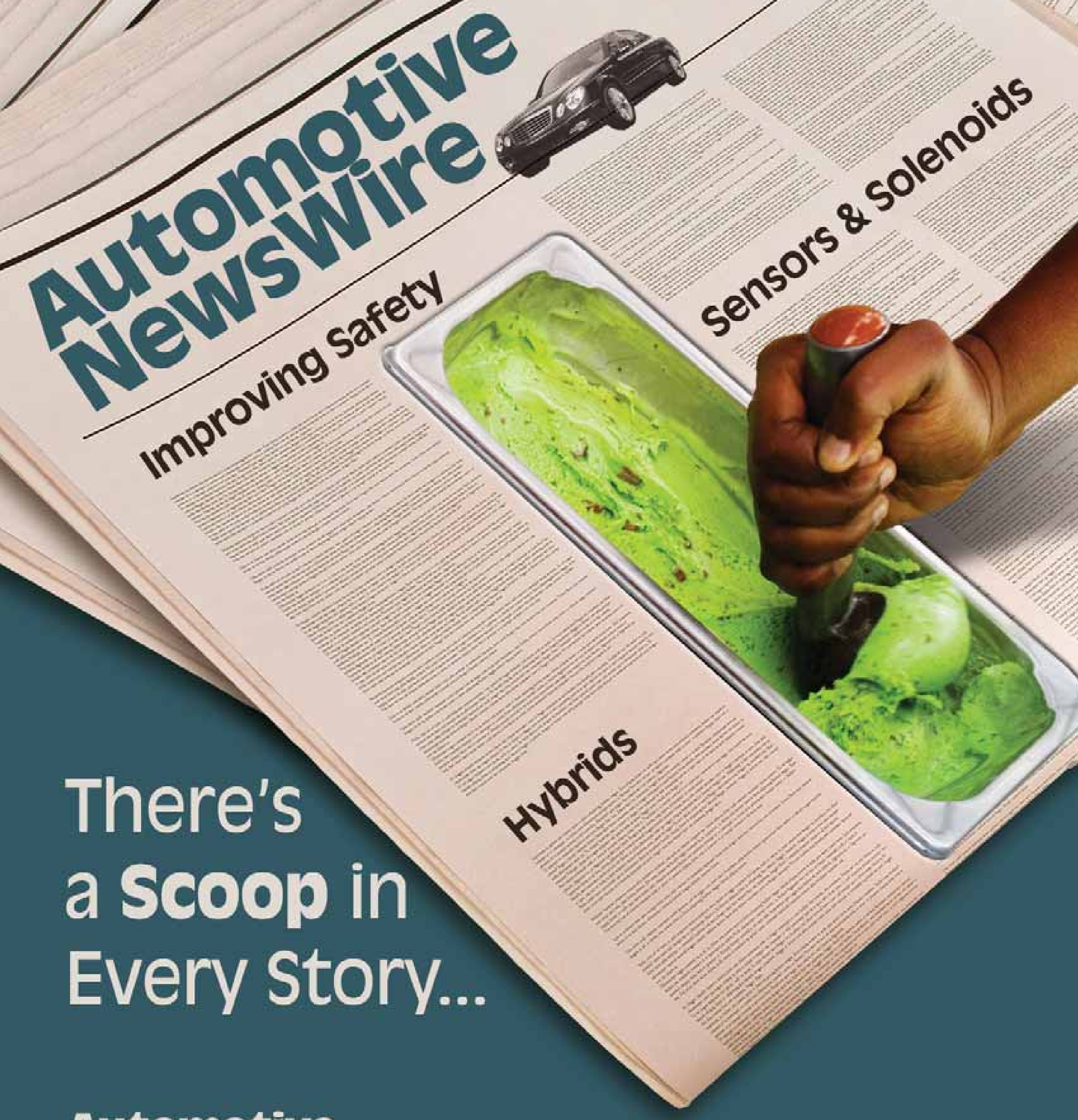
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