8TH - ANNUAL

AUTOMOTIVE COMPOSITES CONFERENCE & EXHIBITION

World's Leading Automotive Composites Forum

SOCIETY OF PLASTICS ENGINEERS
AUTOMOTIVE & COMPOSITES DIVISIONS

THE ROAD TO LIGHTWEIGHT PERFORMANCE

SEPTEMBER 16-18, 2008

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Welcome to ACCE 2008

On behalf of the Automotive and Composites Divisions of the Society of Plastics Engineers, International (SPE®), welcome to the 8th-Annual *Automotive Composites Conference and Exhibition* (ACCE). This year's theme, "*The Road to Lightweight Performance*," highlights the progress transportation OEMs, tier suppliers, and composites producers have made in taking weight out and improving vehicle performance by replacing metal and glass with lightweight, impact- and corrosion-resistant polymer composites. Given sustained high oil prices and the pressures to improve fuel economy, engine technology and alternative powertrains can only go so far. Making vehicles lighter without sacrificing safety, aesthetics, and fun can substantially assist in meeting market needs, as many of the displays, papers, and keynote addresses presented at this year's conference demonstrate.

Over the course of the last eight years, we have established the ACCE as the *World's Leading Automotive Composites Forum*, attracting presenters and attendees year after year from Europe, Asia-Pacific, the Middle East, and the Americas. No other conference provides the breadth of topics related to composites for ground transportation as the one you are attending.

In the past two years we have implemented a number of improved features, based on feedback from participants, and in 2008 have continued the best of them, including:

- A vibrant program that includes over 70 technical papers and keynote presentations across multiple technologies and applications, including speakers from outside the automotive industry providing alternate perspectives about the value of composite materials.
- Recognizing the increasing importance of partnering in solving future fuel-economy issues, we have developed a panel discussion on government-industry collaboration in automotive composites, featuring representatives from the U.S. Department of Energy, the Automotive Composites Consortium, and the supply community. We anticipate this panel session to be both entertaining and informative, particularly in light of our usual "active" audience participation.
- All displays in a single large room to facilitate booth visits and improve traffic flow during breaks, making it easier to obtain food and beverage. Please visit our sponsors, whose generosity allows us to host this event each year. Two sponsored evening receptions provide further opportunities to network and explore the latest technologies on display.
- Awarding two scholarships this year to graduate students performing research in the area of composites for ground transportation. The winners of last year's scholarships are presenting the results of their graduate work at this year's conference. This year's winners will present their work in 2009.
- Best Paper Awards in the categories of *New Materials, Processing / Enabling Technologies*, and *New Composite Applications*. The winning entries were selected from among written papers submitted for peer review, and the authors will be recognized at the start of the conference.

A year-round effort by members of the SPE Automotive and Composites Divisions on the planning committee allows us to seamlessly pull together an excellent program for this important learning and sharing event. Many of these team members have been committed for a number of years, and I would like to personally thank each committee member for his / her contributions.

The conference could not exist without the support of our authors, presenters, keynote speakers, sponsors, and attendees, and I thank each of them as well.

I encourage you to take advantage of this unique confluence of automotive composites knowledge to forge new relationships and strengthen existing ones as you seek answers to your most challenging questions.

Enjoy the conference, and please contact any of our committee members if you have questions, need assistance, or to offer feedback to help us make next year's event even better.

Best Regards,

Dale Brosius

Dale Brosius
2008 SPE Automotive Composites Conference Chair
Quickstep Technologies Pty. Ltd.

Contributors 2008

8th Annual Automotive Composites Conference & Exhibition

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Panel Discussion

Government-Industry Panel on the Future of Automotive Composites

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(Organizer/Moderator)
Quickstep Technologies

Derek Buckmaster
(Organizer/Moderator)
SABIC Innovative Plastics

Joseph Carpenter
U.S. Department of Energy

C. David Warren
Oak Ridge National Laboratory

John Snider
General Motors Corp. &
the Automotive Composites Consortium

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Edward Zenk
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Thomas Stanley
SABIC Innovative Plastics

Design/Pre-Production JPICreative Group
Signage That Color
Printing Allegra Wixom Print & Imaging
CDs Malnati & Associates / N-Code
Pens/Notepads/Bags Graphic Services Inc.

Tuesday, Sept 16

	IN AUDITORIUM	IN AMPHITHEATER 101	IN AMPHITHEATER 102
6:30–7:00	REGISTRATION - Coffee in Mezzanine *(Sponsored by MAG Industrial Automation Systems)*		
7:00–8:00	RIBBON-CUTTING CEREMONY; EXHIBITS OPEN Frank Henning		
	CONTINENTAL BREAKFAST SERVED - BALLROOM *(Sponsored by American Chemistry Council - Plastics Division)*		
8:00–8:15	OPENING REMARKS (Including Best Paper Awards & Student Scholarship Announcements) Dale Brosius		
8:15–9:15	KEYNOTE SPEAKER Joseph Carpenter, U.S. Department of Energy, *Challenges & Opportunities for Automotive Composites*		
	ADVANCES IN THERMOPLASTIC COMPOSITES - PART 1: *Long-Fiber Thermoplastics*	STRUCTURAL COMPOSITES	NEW COMPOSITE MATERIALS & PROCESSES
9:15–9:45	Uday Vaidya University of Alabama - Birmingham *Damage Tolerance Enhancement Using Continuous Fiber Reinforcements Co-Molded with Long Fiber Reinforced Thermoplastics*	Hans-Juergen Karkosch, ContiTech Vibration Control & Holger Klink, BASF *High Performance Plastic Components for Engine Mount Applications*	Suresh Shah Delphi Corp. *Opportunities for Plastics Materials / Processes for Under-the-Hood Applications*
9:45–10:15	Creig Bowland PPG Industries *A Formulation Study of Long Fiber Thermoplastic Polypropylene (Part 1): The Effects of Coupling Agent, Glass Content & Resin Properties on the Mechanical Properties*	Roston Ellwell Texas A&M University *Machine Augmented Composites Utilizing an Hourglass Shaped Core Element in a Soft Nearly Incompressible Matrix* *2007 Student Scholarship Winner*	Alan Murray Allied Composite Technologies, LLC *Basalt Fibers for High-Performance Composites*
10:15–10:45	Frank Henning Fraunhofer Institute of Chemical Technology *E-Coat Sustainable Long-Fiber Thermoplastic Composites for Structural Automotive Applications*	Libby Berger General Motors Corp. / Automotive Composites Consortium *Development of a Structural Composite Underbody*	Mike Zimmerman, Quantum Leap Packaging, Inc. & Charles Buehler, General Motors Corp. *Revolutionary Polymer for Metal Replacement in Automotive Applications*
10:45–11:15	Matthew Marks SABIC Innovative Plastics *Long Glass Fiber-Polypropylene Light Weight Instrument Panel Retainers & Door Modules*	Fred Deans Allied Composite Technologies, LLC *Advances in High Fiber Composites*	John Shin AZDEL, Inc. *Low Weight & High Sound Absorption GMT for Underbody Shields*
11:15–12:15	LUNCH & EXHIBITS - BALLROOM *(Sponsored by Ticona Engineering Polymers)*		
12:15–1:15	KEYNOTE SPEAKER C. David Warren, Oak Ridge National Laboratory *Future Lower Cost Carbon Fiber for Autos: International Scale-Up & What is Needed*		
1:15–2:15	KEYNOTE SPEAKER Gary Savage, Honda Racing F1 Team *Composite Materials Technology in Formula 1 Motor Racing*		
2:15–2:30	COFFEE BREAK & EXHIBITS - BALLROOM *(Sponsored by Dieffenbacher)*		
	ADVANCES IN THERMOPLASTIC COMPOSITES - PART 2: *Other Thermoplastic Technologies*	VIRTUAL PROTOTYPING, ANALYSIS & TESTING - PART 1: *Modeling*	
2:30–3:00	Harsh Bhagat Ticona Engineering Polymers *Linear Polyphenylene Sulfide (PPS) for Thermoplastic Composites*	Harish Iyer University of Michigan - Ann Arbor *Constitutive Modeling of Polymer Composites made from LBL Manufacturing Technique*	
3:00–3:30	Edward Kung SABIC Innovative Plastics *Low-Gloss, Weatherable, Molded-In-Color PC/PBT Composite for Vehicle Interiors*	Roger Assaker e-Xstream Engineering *DIGIMAT Multi-Scale Modeling: The Technology & Software Tools for a Predictive Development of Reinforced Plastic Parts*	
3:30–4:00	Ab van Geenen Brüggemann Chemical *New Methods to Produce Reinforced Polyamide-6 for Improved Material Properties in Engineering Plastic Applications*	Medhi Kiasat, Amirkabir University of Technology & Hamid Mostofi, Iran University of Science & Technology *Theoretical Simulation of Cure-Induced Deformations of Composite Car Body Panels*	
4:00–5:30	PANEL DISCUSSION *Government-Industry Panel on the Future of Automotive Composites* Moderators: Dale Brosius & Derek Buckmaster		
5:30–7:00	NETWORKING RECEPTION - BALLROOM *(Sponsored by Quadrant Plastic Composites)*		

Wednesday, Sept 17

	IN AUDITORIUM	IN AMPHITHEATER 101	IN AMPHITHEATER 102
6:30–8:15	CONTINENTAL BREAKFAST SERVED & EXHIBITS - BALLROOM *(Sponsored by SABIC)*		
8:15–9:00	KEYNOTE SPEAKER David Dyke, Meridian Automotive Systems *ACMA / ACA Study on Composites for Hybrid Electric Vehicles*		
	ADVANCES IN THERMOSET COMPOSITES - PART 1: *SMC & Urethane*	NANOCOMPOSITES - PART 1	ENABLING TECHNOLOGIES - PART 1: *Formulation & Finishing*
9:00–9:30	Dwight Rust National Composite Center *Opportunities and Development of Bio-Based Materials for SMC (Sheet Molding Compound)*	Amit Kumar Chaudhary Michigan State University *Better Quality Thermoplastic Foams with Nanoclay*	Rena Pomaville American Compounding Specialties, Inc. *Production Scale-Up of New Thermoplastic Composite Resin Formulations: Demonstrating that the Calculated Savings Are Real*
9:30–10:00	Tobias Potyra Fraunhofer Institute of Chemical Technology *Characterisation of the Direct-SMC (D-SMC) Process* *2008 Student Scholarship Winner*	Harris Goldberg InMat Inc. *Aqueous Nanocomposite Barrier Coatings*	Ara Asadorian Schibley Chemical Company Inc. *Film Transfer Technology Advancements for Composites*
10:00–10:30	Stephan Schleiermacher Bayer MaterialScience AG *Lightweight Structural Parts with Rigid Integral PUR Foams*	Amit Kaushik University of Michigan - Ann Arbor *Mechanical & Thermal Investigation of Polyurethane Nanocomposites*	Paul Stassen, Addcomp Holland BV & Frank Henning, Fraunhofer Institute of Chemical Technology *New Ultrapure Coupling Agents for Enhancing the Performance of Olefinic LFT & DLFT Composites*
10:30–11:00	COFFEE BREAK & EXHIBITS - BALLROOM *(Sponsored by PPG Industries)*		
	ADVANCES IN THERMOSET COMPOSITES PART 2: *Advanced Composites*	NANOCOMPOSITES - PART 2	
11:00–11:30	Martin Starkey Gurit *Advanced Composite Class A Closures - Production Ready or Production Proven?*	Ray Pearson Lehigh University *Toughening Mechanisms in Epoxy Matrix Hybrid Composites / Nanocomposites*	
11:30–12:00		Cathy Fleicher NaturalNano *Clay Nanotubes in Polymer Composites: A Route to Stronger, Lighter & Less Expensive Materials*	
12:00–12:30		Seung Soon Jang Georgia Institute of Technology *NanoStructured Polymer Membrane for Fuel Cell Application: Computational NanoTechnology Approach*	
12:30–1:30	LUNCH & EXHIBITS - BALLROOM *(Sponsored by ACMA / ACA)*		
1:30–2:30	KEYNOTE SPEAKER Jan-Anders Månson, Ecole Polytechnique Fédérale de Lausanne (EPFL) *Composites in Extreme Sports* Plus "SPE Educator of the Year" Award Presentation		
	VIRTUAL PROTOTYPING, ANALYSIS & TESTING - PART 2: *Analysis & Testing*	COMPOSITES IN TRUCKS	BONDING, JOINING, & FINISHING OF COMPOSITES - PART 1: *Welding, Mechanical Fastening, & Finishing*
2:30–3:00	Vlastimil Kunc Oak Ridge National Laboratory *Techniques and Results for Fiber Length Distribution Determination as a Function of Thickness in Long Fiber Reinforced Injection Molded Thermoplastics*	Edward Zenk Navistar, Inc. *Case Study: Tough, Low-Mass Class A SMC*	Andrew Lizotte Fiberforge Corp. *Evaluation of Thermal Welding Techniques for Continuous Fiber Reinforced Thermoplastic Composites*
3:00–3:30	Alejandro Londoño-Hurtado University of Wisconsin-Madison *Computer Predictions of the Behavior of Fiber-Reinforced Composites During Molding* *2007 Student Scholarship Winner*	Garland Lee Metton America *Reaction Injection Moldable Polydicyclopentadiene (pDCPD) for the Heavy Truck Market*	Chris Korson LPKF Laser & Electronics *Hybrid Laser Welding of Polymers*
3:30–4:00	Uday Sharma University of Michigan - Dearborn *Damage Repair of Low Velocity Impacted Woven Thermoplastic Composites* *2008 Student Scholarship Winner*	Barry Loucks Multimatic, Inc. *Multimatic Tailgate Step for Ingress / Egress*	Joe Gobernatz ATF, Inc. *State-of-the-Art Fastening Technology in Thermoplastics and Thermosets*
4:00–4:30	Peter Foss General Motors Research & Development *Composite Liftgate Ductility Performance*	Fred Buck Commercial Vehicle Group *Introduction of Proven Marine Composite Process for the Commercial Vehicle Market*	Kedzie Fernholz Ford Motor Co. / Automotive Composites Consortium - Joining Working Group *Bond-Line Read-Through Investigation for Composite Closure Panels: Initial DOE Results*
4:30–5:30	KEYNOTE SPEAKER James Colgrove, Trek Bikes *Trek's Use of Composites to Lightweight Racing Bikes*		
5:30–7:00	NETWORKING RECEPTION - BALLROOM *(Sponsored by Ashland Chemical)*		

Thursday, Sept 18

	IN AUDITORIUM	IN AMPHITHEATER 101	IN AMPHITHEATER 102
6:30–8:00	CONTINENTAL BREAKFAST SERVED & EXHIBITS - BALLROOM *(Sponsored by RTP Company)*		
8:00–9:00	KEYNOTE SPEAKER Barbara A. Sanders, Delphi Corp. *History of Automotive Composites*		
	BIO- & NATURAL-FIBER COMPOSITES - PART 1: *Bio-Based Resins*	BONDING, JOINING, & FINISHING OF COMPOSITES - PART 2: *Adhesives, Gaskets, & Seals*	ENABLING TECHNOLOGIES - PART 2: *Processing & Tooling Advances*
9:00–9:30	Mark Goldhawk Dow Automotive *Renuva Soy-Based Polyol RIM for Automotive Exterior Applications*	Dave Whitinger Bostik, Inc. *Getting Started with Automated Gasketing & Sealing*	Dan Buckley American GFM *High Volume Preforming for Structural Applications Using Engineering Fabrics*
9:30–10:00	Brian Grosser Samsung *Samsung's Bioplastics for Automobiles*	Dieter Rueger COLLANO (nolax Automotive) *Thermoplastic Film Adhesives for Rear Injection Molding*	Ben Halford Surface Generation Ltd. *Good-Bye Machining: Reconfigurable Pin Tooling*
10:00–10:30	Darcy Culkin Ashland Chemical *Recent Developments in Renewable Resource-Based Resins*	M.D. Thouless University of Michigan - Ann Arbor *The Use of Cohesive-Zone Models to Analyze the Behavior of Adhesive Joints*	Stewart Davis CRP Technology *Rapid Manufacturing & Continued Development of Highly Stressed Fibre-Reinforced Plastic Parts: Motorbike Dash Assembly Made by Windform XT and SLS Technology*
10:30–11:00	Craig Chmielewski L&L Products *Chopped Glass & Natural Fiber Composites Based on a Novel Thermoplastic Epoxy Resin Matrix*	Dave Whitinger Bostik, Inc. *Adhesives for Automotive Interiors*	Phil Maniscalchi Mold-Tech *An In Depth Study of Texture Characteristics & Their Affects on Texture Performance*
11:00–11:30	COFFEE BREAK & EXHIBITS - BALLROOM *(Sponsored by Brüggemann Chemical)*		
	BIO- & NATURAL-FIBER COMPOSITES - PART 2: *Natural-Fiber Reinforcements*	ADVANCES IN THERMOPLASTIC COMPOSITES -PART 3: *Exterior Automotive Uses*	VIRTUAL PROTOTYPING, ANALYSIS & TESTING - PART 3: *Predicting Fatique*
11:30–12:00	Jay Amarasekera SABIC Innovative Plastics *Natural Fibers Plastic Composites for Automotive Applications*	Mike Birrell Azdel, Inc. *Thermoplastic Composite Hybrids for Horizontal Automotive Panels*	Jackie Rehkopf Exponent *Strain-Life Fatigue Behaviour of Long Glass Fiber-Reinforced Polypropylene*
12:00–12:30	Lina Herrera-Estrada University of Alabama - Birmingham *Banana Fiber Composites for Automotive & Transportation Applications*	John Shin Azdel, Inc. *GMT Bumper Beam*	Robert Wahlmueller Magna Powertrain *Fatigue Life Prediction of Short Fiber Reinforced Plastic Components*
12:30–1:30	LUNCH & EXHIBITS - BALLROOM *(Sponsored by AZDEL, Inc.)*		
1:30–2:15	KEYNOTE SPEAKER Matt Tsien, General Motors Corp. *Driving Innovative Solutions for Tomorrow*		
2:15–3:00	KEYNOTE SPEAKER Toru Yamanaka, Toray Industries Inc. *CFRP: What is Needed Next for Mass Production in the Automobile?*		
3:00–3:15	CLOSING REMARKS Dale Brosius		

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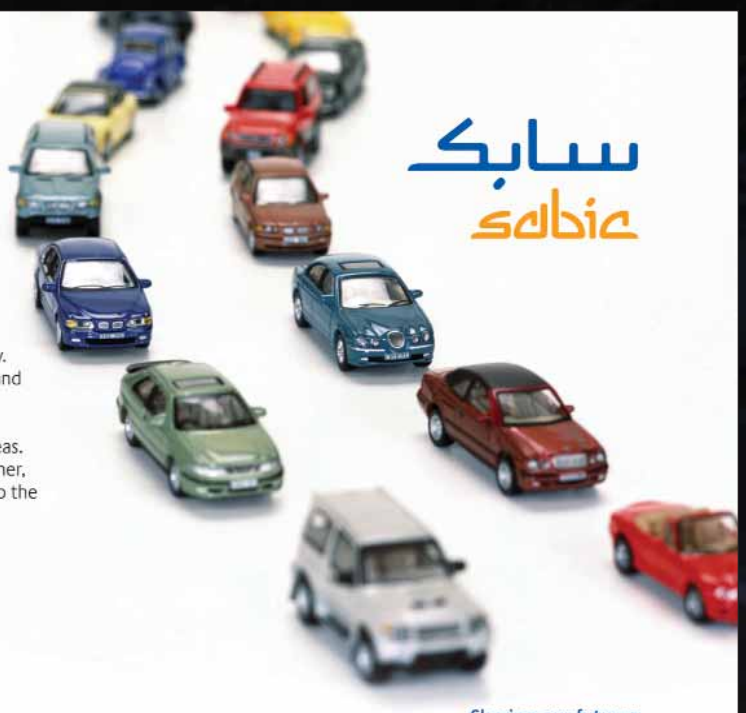

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Abstracts

ADVANCES IN THERMOPLASTIC COMPOSITES (TUES. & THURS.)

PART 1: LONG-FIBER THERMOPLASTICS (TUES.)

Damage Tolerance Enhancement Using Continuous Fiber Reinforcements Co-Molded with Long Fiber Reinforced Thermoplastics

Uday Vaidya

University of Alabama - Birmingham

Continuous tape thermoplastics with long fiber thermoplastic E-glass/PP are compared against rib-reinforced long fiber thermoplastics. The synergy of combining continuous and LFT material forms in terms of flexural properties and low velocity impact characteristics has been demonstrated. The benefits for automotive are: design flexibility, reduced thickness profile, increased energy absorption, and enhanced durability.

A Formulation Study of Long Fiber Thermoplastic Polypropylene (Part 1): The Effects of Coupling Agent, Glass Content & Resin Properties on the Mechanical Properties

Creig Bowland

PPG Industries

The relationship between the resin and fiber properties in polypropylene long fiber thermoplastics is presented. The effects of glass content, maleic anhydride grafted polypropylene additives (coupling agent), and melt flow of the resin are also discussed.

E-Coat Sustainable Long-Fiber Thermoplastic Composites for Structural Automotive Applications

Frank Henning

Fraunhofer Institute of Chemical Technology

In order to develop LFT materials for structural automotive applications, a feasibility study to investigate the e-coating process sustainability of LFT materials was conducted. The current presentation addresses the developed LFT formulations, their basic mechanical properties, and influence of e-coating process on the properties of the LFT materials.

Long Glass Fiber-Polypropylene Light Weight Instrument Panel Retainers & Door Modules

Matthew Marks

SABIC Innovative Plastics

This presentation provides a brief history of door modules, their acceptance in the automotive industry, and materials used in them. It also compares materials used today for instrument panels, including both long- and short-glass-filled materials. It describes the advantages and disadvantages of these materials, including the benefit of molding into thin-walled applications and the challenge of warpage typically associated within long-glass-fiber-filled materials. Through proper design and engineering, warpage can be minimized to produce quality parts for the automotive industry. This presentation will conclude with a few comments on future trends in instrument panels and door systems.

PART 2: OTHER THERMOPLASTIC TECHNOLOGIES (TUES.)

Linear Polyphenylene Sulfide (PPS) for Thermoplastic Composites

Harsh Bhagat

Ticona Engineering Polymers

This presentation will provide a summary of the properties of linear polyphenylene sulfide (PPS) and its use in continuous fiber composites. The advantages of thermoplastic composites vs. thermoset composites will be discussed, including examples of continuous fiber composite processing technologies and relevant composite applications in the aerospace market.

Low-Gloss, Weatherable, Molded-In-Color PC/PBT Composite for Vehicle Interiors

Edward Kung

SABIC Innovative Plastics

There has been a growing trend away from painted parts towards molded-in-color (MIC) plastic parts for vehicle interior components. This presentation will discuss reinforced PC / PBT composites that have been developed to deliver low-gloss, weatherable MIC, good impact, good dimensional stability, and structural performance.

New Methods to Produce Reinforced Polyamide-6 for Improved Material Properties in Engineering Plastic Applications

Ab van Geenen

BrüggemannChemical

This presentation provides an overview of existing and future applications of NYRIM and anionic polyamide-6 in reinforced and composite products.

PART 3: EXTERIOR AUTOMOTIVE USES (THURS.)

Thermoplastic Composite Hybrids for Horizontal Automotive Panels

Mike Birrell

Azdel, Inc.

With rising steel and energy costs, coupled with advances in thermoplastic composite product and processing technologies, hybrid thermoplastic composites offer an attractive alternative for vehicle panels. Thermoplastic composites solutions improve durability, weight, safety, and overall energy consumption. In this presentation, composite development, potential applications, and competitive advantages will be discussed.

GMT Bumper Beam

John Shin

Azdel, Inc.

Glass Mat Thermoplastic (GMT) composites continue to be used by global automotive OEMs for lightweight structural applications. Recent advances in GMT material formulations, processing, testing, and development have led to improved GMT application performance. This presentation will focus on new developments in bumper systems, pedestrian beams, and underbody shields.

ADVANCES IN THERMOSET COMPOSITES (WED.)

PART 1: SMC & URETHANE

Opportunities and Development of Bio-Based Materials for SMC (Sheet Molding Compound)

Dwight Rust

National Composite Center

Bio-based materials in SMC present an opportunity to help automotive manufacturers in the U.S. to meet the 2020 Freedom Car weight and 35 mpg CAFE requirements as currently mandated by the federal government. Developments in the industrial biotechnology sector are also contributing knowledge to provide opportunities for bio-based materials solutions using SMC to lower costs and weight. The National Composite Center is leading collaborative efforts in the development of bio-based resins, fillers, and reinforcements.

Characterization of the Direct-SMC (D-SMC) Process

Tobias Potyra

Fraunhofer Institute of Chemical Technology

2008 Student Scholarship Winner

It is a well-established fact that conventional sheet-molding compound (SMC) manufacture is a multistep process. Oftentimes the sheet manufacturing and molding steps take place at different locations. While it offers some flexibility in isolating sheet production from molding, it also leads to challenges in planning, logistics, storage, and maintaining quality throughout the process steps. These factors were the motivation to develop a new process combining "in-line compounding" with molding operations. The potential for cost savings is large but raw material properties at each step need calibration and control.

Lightweight Structural Parts with Rigid Integral PUR Foams

Stephan Schleiermacher

Bayer MaterialScience AG

With climate change and the current situation regarding energy and environmental policy dominating the agenda, car manufacturers are faced with the complex problem of drastically lowering the fuel consumption of their vehicles in order to reduce CO_2 emissions. One way of tackling the problem is to pursue a consistent strategy of lightweight construction. Two families of polyurethanes (PUR) can help to realize reductions in weight and are ideal for use in structural parts. This presentation covers some of their state-of-the-art solutions and techniques, followed by a vision of a new composite design for roof modules.

PART 2: ADVANCED COMPOSITES

Advanced Composite Class A Closures - Production Ready or Production Proven?

Martin Starkey

Gurit

Over the last 7 years, Gurit has continued to develop advanced composite materials to address the needs of the niche automotive market, with a proven track record as an innovative Tier 2 supplier. In 2006 the decision was taken to strengthen this position with the investment and move to a Tier 1 role. Through close collaboration with Aston Martin, Gurit successfully introduced its Class A composite body system, CBS 96, onto their premium vehicle DBS establishing our first 20,000-sq. ft. advanced-composite manufacturing facility. This presentation aims to establish the production route for these OEM quality components and the evolution of the manufacturing processes over these critical 18 months. The presentation will detail how cycle times have evolved through online and off-line processes, the analysis of quality trends including 'Right First Time' and reject causes, and finally to draw trends from the analysis and establish the future opportunities for Gurit's range of innovative advanced composites in this market.

Abstracts

BIO- & NATURAL-FIBER COMPOSITES (THURS.)

PART 1: BIO-BASED RESINS

Renuva Soy-Based Polyol RIM for Automotive Exterior Applications

Mark Goldhawk

Dow Automotive

This presentation describes the development of a novel soy-oil-based polyol, which has technical advantages in terms of odour, physical properties, compatibility, and processability in engineered polyurethane applications. A development partnership undertaken by The Dow Chemical Company and Decoma Polycon (a division of Magna) to utilize this green polyol technology to develop a reaction injection moulded (RIM) polyurethane formulation suitable for painted exterior applications will also be described. Finally, the viability of a 50% soy-based polyol solution to meet the processability, paintability, performance, and physical property specification of a current OEM RIM program through direct comparison of extensive trial work done on series production fascia tooling at Decoma will be described.

Samsung's Bioplastics for Automobiles

Brian Grosser

Samsung

Samsung Cheil Industries Inc. has developed several materials based on polylactic acid (PLA) technology. This presentation will review developments in PC / PLA, long fiber / PLA, and ABS / PLA alloys. Properties of these materials will be discussed along with a review of PLA technology and environmental impact.

Recent Developments in Renewable Resource-Based Resins

Darcy Culkin

Ashland Chemical

The incorporation of renewable resources into composite materials is a viable means to reduce environmental impact and support sustainability efforts in the composites industry. This presentation will focus on bio-based polyester resins designed for compression molding applications. Properties of composite materials derived from these resins will be discussed and compared to traditional petroleum-based resins.

Chopped Glass & Natural Fiber Composites Based on a Novel Thermoplastic Epoxy Resin Matrix

Craig Chmielewski

L&L Products

Composites of chopped glass and natural fibers based on a novel thermoplastic epoxy resin (TPER) matrix are introduced. Natural fibers can be compounded into TPER at temperatures low enough to avoid thermal decomposition, and yet result in composite mechanical properties of 3 to 4 times the flexural strength and 2 to 3 times the modulus of standard natural fiber-HDPE blends.

PART 2: NATURAL-FIBER REINFORCEMENTS

Natural Fibers Plastic Composites for Automotive Applications

Jay Amarasekera

SABIC Innovative Plastics

This presentation reviews natural fiber plastic composites made using curauá fiber (grown in Brazil's Amazon region) and wood powder. These materials provide lighter weight parts with good physical properties and unique surface aesthetics suitable for automotive applications. The properties of these products are compared with glass- and mineral-filled plastics.

Banana Fiber Composites for Automotive & Transportation Applications

Lina Herrera-Estrada

University of Alabama - Birmingham

Banana fiber composite were investigated for two different matrices, an epoxy and an ecological unsaturated polyester. Resulting composites were evaluated for mechanical properties and environmental resistance, to yield a material suitable for automotive and transportation applications.

BONDING, JOINING, & FINISHING OF COMPOSITES (WED. & THURS.)

PART 1: WELDING, MECHANICAL FASTENING, & FINISHING (WED.)

Evaluation of Thermal Welding Techniques for Continuous Fiber Reinforced Thermoplastic Composites

Andrew Lizotte

Fiberforge Corp.

Continuous fiber reinforced thermoplastics (CFRTP) offer significant potential for reducing weight in structural parts in transportation applications, as they bridge the traditional divide between performance and high-volume production capability by combining the high specific stiffness and strength of glass or carbon fiber reinforcement with the the rapid processing of thermoplastic resin systems. This presentation provides an overview of joining techniques that can be used with CFRTP materials, summarizes the benefits and challenges of several techniques, and presents a case study that includes test results for parts joined with adhesive bonding, induction welding, and resistance welding.

Hybrid Laser Welding of Polymers

Chris Korson

LPKF Laser & Electronics

Laser welding is being accepted as the choice solution for plastic-plastic bonding. Plastic laser welding is capable of creating high-strength, attractive, hermetically sealed, and consistent welds with very-low cycle times. Hybrid welding pushes laser welding to the next level. This is a dual-source 3-D laser / halogen welding system that reduces overall laser power, increases seam quality, decreases welding time further, and reduces the formation of stress cracks during the welding process. The increased processing window allows different base polymers to be welded to each other such as PC-PP. This presentation will show the strengths of hybrid welding vs. conventional laser welding and describe the benefits for automotive lighting assemblies.

State-of-the-Art Fastening Technology in Thermoplastics and Thermosets

Joe Gobernatz

ATF, Inc.

This presentation covers important considerations when selecting threadformers for plastic components, including a short history of plastics fastening, design guidelines, features and benefits, and 2 short case histories.

Bond-Line Read-Through Investigation for Composite Closure Panels: Initial DOE Results

Kedzie Fernholz

Ford Motor Co. / Automotive Composites Consortium - Joining Working Group

The Automotive Composites Consortium and Meridian Automotive Systems are conducting a series of experiments to understand the material and process variables that influence bond-line read-through and to determine how to minimize the severity of this surface distortion without increasing the thickness of the outer panel. The results of the first two experiments will be summarized.

PART 2: ADHESIVES, GASKETS, & SEALS (THURS.)

Getting Started with Automated Gasketing & Sealing

Dave Whitinger

Bostik, Inc.

This presentation provides a "starting point outline" for an engineer who has never set up an automated dispense system for gasketing and sealing assembly applications. It serves to familiarize and outline the steps for determining which materials will be required, types of automation and support equipment available, and some basic design considerations.

Thermoplastic Film Adhesives for Rear Injection Molding

Dieter Rueger

COLLANO (nolax Automotive)

The technology of rear injection molding is one of the most engineered plastic processes in the car industry for producing interior parts. The main field of activity is textile structured surface, for example: pillars with a fabric / non-woven combination. nolax, a part of Collano Holding, together with several business partners in Europe have developed another interesting application of rear injection molding: Aluminum Covered Parts (ACP). Today, rear injection molding of ACP is an established and easy process using pre-applied multilayered technology from Collano. The presentation provides examples of the interior parts produced with this method and a discussion of how the development is proceeding.

The Use of Cohesive-Zone Models to Analyze the Behavior of Adhesive Joints

M.D. Thouless

University of Michigan - Ann Arbor

The use of adhesives in structural automotive applications will rely on an effective understanding of how they behave under crash conditions, and how to model their performance. Traditional approaches that have been developed from fracture mechanics are not applicable for automotive applications, because of the extensive amounts of plasticity in the adherends that needs to accompany fracture so as to enhance energy absorption. Cohesive-zone models provide an approach that permit quantitative analysis of the fracture and deformation of adhesive joints under a broad range of conditions.

Adhesives for Automotive Interiors

Dave Whitinger

Bostik, Inc.

This is a basic introductory presentation to interior-trim adhesives. It provides a broad overview of the most common types of adhesives used in automotive interiors. It serves to familiarize the audience with these adhesives, the processes used when applying them, and some of the basic terms used in conjunction when researching these adhesives.

Abstracts

COMPOSITES IN TRUCKS (WED.)

Case Study: Tough, Low-Mass Class A SMC

Edward Zenk
Navistar, Inc.

A study conducted with a commercial fleet owner, a heavy-truck manufacturer, and their suppliers demonstrated a cost-effective approach for significant weight savings through the use of tough low mass Class A sheet molding compound (SMC). This paper describes the customer's objectives, issues encountered, and commercial results achieved with the new technology.

Reaction Injection Moldable Polydicyclopentadiene (pDCPD) for the Heavy Truck Market

Garland Lee
Metton America

Reaction injection moldable polydicyclopentadiene (pDCPD) was first commercialized in the late 1980s, so it is still a relatively new plastics technology. The viscosity of the liquids is similar to milk or water with a cavity pressure of 15 to 30 psi. The low cavity pressures allows part sizes up to 120 square feet weighing more than 100 kg to be produced using low-pressure-rated molds. Prototypes are possible in soft molds. The part is injected in 5 to 15 seconds and it is fully cured in 1 minute. The system has no fillers with a mechanical property profile similar to an engineering thermoplastic. The first construction equipment hoods and body panels were commercialized in the late 1980s. The first heavy-truck applications started in 1996. Today, there are a dozen truck hoods in production along with a large variety of other body panels. The traditional molder base has been expanded into Eastern Europe, Russia, Brazil, and India.

Multimatic Tailgate Step for Ingress / Egress

Barry Loucks
Multimatic, Inc.

This presentation discusses the development of a novel integral tailgate step for pickups made of hybrid steel / composite. The step, which stows inside the tailgate, helps facilitate safe and easy ingress into and egress out of the pickup box.

Introduction of Proven Marine Composite Process for the Commercial Vehicle Market

Fred Buck
Commercial Vehicle Group

Through an exclusive agreement with VEC Technology LLC, Commercial Vehicle Group is applying a composite closed-mold process that has been used extensively in the manufacture of recreational boats to the unique needs of the commercial vehicle / heavy-duty truck industry. The parts for heavy truck are very large in size, while the part volumes are moderate and this situation presents interesting opportunities. This molding process bridges the gap between the limitations of open-face molding and the higher costs associated with other forms of composite closed molding.

ENABLING TECHNOLOGIES (WED. & THURS.)

PART 1: FORMULATION & FINISHING

Production Scale-Up of New Thermoplastic Composite Resin Formulations: Demonstrating that the Calculated Savings Are Real

Rena Pomaville
American Compounding Specialties, Inc.

New product development is sometimes driven by cost-down initiatives within a company. New product development, testing, and approval can be time-consuming and costly. This presentation will explore the elements that affect total product costs and give you the tools necessary to improve profit margins quickly - by optimization of your current production process - prior to considering development of a new product.

Film Transfer Technology Advancements for Composites

Ara Asadorian
Schibley Chemical Company Inc.

Film transfer technology expands a manufacturer's capability to coat, protect, and produce products with printed images during the production process. For example, a manufacturer can immediately produce a woodgrain panel at no capital cost. Film transfer technology is applicable for SMC, BMC, resin infusion, and open-mold manufacturing processes. The coating provides protection to the end product and image in chemical, abrasive, and outdoor environments. Thus, film transfer technology increases the capability of and the markets into which decorative products may be sold at higher value.

New Ultrapure Coupling Agents for Enhancing the Performance of Olefinic LFT & DLFT Composites

Paul Stassen, Addcomp Holland BV &
Frank Henning, Fraunhofer Institute of Chemical Technology

Long-fiber reinforced thermoplastics (LFT) are cost-effective materials for substitution of metal and short-glass engineering thermoplastics in many automotive applications. These composites – typically based on polypropylene and long glass fibres (> 13 mm) – are being specified for an ever broader range of applications, which helps account for the double-digit growth this segment of the plastics industry has experienced for the past decade. One key to the success of LFT materials is the ability to use specific additive packages to enhance mechanical performance and ensure high quality long term. New improved combination additive / stabilizer and coupling agent formulations (called combi-masterbatches) help improve performance while reducing systems cost. This presentation will discuss the use of the latest-generation coupling agent in such combi-masterbatch formulations to further improve the cost / performance ratio of LFT formulations.

PART 2: PROCESSING & TOOLING ADVANCES

High Volume Preforming for Structural Applications Using Engineering Fabrics

Dan Buckley

American GFM

The presentation will show the methods and process steps required for the high-volume manufacturing of preforms using glass-fiber engineering fabrics. The unique problems and issues surrounding preforming using engineering fabrics will also be shown and discussed.

Good-Bye Machining: Reconfigurable Pin Tooling

Ben Halford

Surface Generation Ltd.

The ability to quickly and cost-effectively create tooling for product evaluation is crucial to companies maintaining competitive advantage in increasingly frenetic global marketplaces. Fundamentally, current mould-making techniques are inflexible and cannot easily be reused. This in turn makes the production of moulds for limited volume applications, including R&D and one-offs extremely expensive, particularly in higher cost manufacturing region. This presentation will discuss alternate strategies for rapid tooling, focusing on reconfigurable tooling technologies that can be used to make jigs and molds for R&D and low-volume production.

Rapid Manufacturing & Continued Development of Highly Stressed Fibre-Reinforced Plastic Parts: Motorbike Dash Assembly Made by Windform XT and SLS Technology

Stewart Davis

CRP Technology

The utilization of a selective laser sintering machine to produce a dashboard for a 125-cc racing motorcycle utilizing a carbon fiber / nylon composite material known as Windform XT will be discussed.

An In Depth Study of Texture Characteristics & Their Affects on Texture Performance

Phil Maniscalchi

Mold-Tech

The purpose of this research study is to identify the specific characteristics of automotive textures and how these characteristics affect mar and gloss on molded plastic parts. By analyzing these characteristics, designers will be able to create or modify textures that are both robust and aesthetically pleasing. This presentation focuses on the contributing texture characteristics that lead to performance failures, discussing how these characters can be manipulated to improve performance, and gives recommendations as to how ideal textures can be developed for the future.

NANOCOMPOSITES (WED.)

Better Quality Thermoplastic Foams with Nanoclay

Amit Kumar Chaudhary

Michigan State University

The object of this work was to investigate extrusion foaming of different polypropylene-clay nanocomposites having different rheological properties in extensional flow and different thermal characteristics. The nanocomposite that displayed melt-strain hardening in uniaxial extensional flow and slower rates of crystallization resulted in closed-cell foams with smaller cell size and a more uniform cell size distribution.

Aqueous Nanocomposite Barrier Coatings

Harris Goldberg

InMat Inc.

A new family of water-based nanocomposite barrier coatings that contain no volatile organics or hazardous materials, and that enable significant reductions in the material needed to achieve gas barrier requirements in a variety of products including tires and food packaging will be discussed. First used commercially in a Wilson Sporting Goods tennis ball, use of these products in tires would enable lighter, cooler running tires with lower rolling resistance. The basic concepts behind this technology platform will be described, and the performance of its barrier coating formulations presented.

Mechanical & Thermal Investigation of Polyurethane Nanocomposites

Amit Kaushik

University of Michigan - Ann Arbor

This presentation will discuss both the development of polymer nanocomposites with improved mechanical properties via the exponential layer-by-layer (LBL) technique, and also the need to better understand toughening mechanisms in nanocomposites.

Toughening Mechanisms in Epoxy Matrix Hybrid Composites / Nanocomposites

Ray Pearson

Lehigh University

Epoxy resins are often used as matrices for structural adhesives or aerospace composites. One factor that often limits the application of epoxies is their inherently poor flaw tolerance. Fortunately, the flaw tolerance of epoxies can be improved by the incorporation of toughening agents or fillers into the formulation. This presentation will discuss the use of both micron-size and nanometer-size toughening agents and fillers to improve the flaw tolerance of epoxy resins. The focus is on the toughening mechanisms induced by nanometer-size fillers and rubber particles as well the synergistic effects observed when rubber-based toughening agents are combined with fillers / nanofillers, i.e. the so-called hybrid composites / nanocomposites.

Abstracts

Clay Nanotubes in Polymer Composites: A Route to Stronger, Lighter & Less Expensive Materials

Cathy Fleicher

NaturalNano

Halloysite nanotubes (HNTTM) provide a new avenue for the preparation of nanocomposites. Halloysite is a naturally occurring member of the kaolin family of aluminosilicate clays. Its uniqueness is that it exists predominantly in a tubular form with lengths of up to 10 microns and diameters of up to 400 nm rather than the layered platy form of essentially all other clays. Well-behaved dispersions of HNT in nylon-6, polypropylene, TPO, and several varieties of polyethylene have been obtained by standard melt processes. In all cases, improved physical performance has been realized for molded parts. The result is a molded part that is more durable and lighter than a glass-fiber reinforced counterpart. In addition, injection molded HNT-containing composite parts exhibit improved surface appearance and reduced extrusion and molding cycle time, relative to glass fiber containing composites.

NanoStructured Polymer Membrane for Fuel Cell Application: Computational NanoTechnology Approach

Seung Soon Jang

Georgia Institute of Technology

In this presentation, the manner in which computational nanotechnology serves in studying the structure-property relationships of membrane polymer fuel cells will be described. First, we will present well-known perfluorosulfonic acid polymer systems and then suggest new polymer architectures.

NEW COMPOSITE MATERIALS & PROCESSES (TUES.)

Opportunities for Plastics Materials / Processes for Under-the-Hood Applications

Suresh Shah

Delphi Corp.

This presentation will discuss the state-of-the-art for several key applications such as HVAC components, radiator components, fan-shroud assemblies / modules, air-intake manifolds, engine "beauty" covers, rocker panels, and other multi-functional assemblies etc. The detail on material and process innovations are discussed based on newer requirements and challenges for each application.

Basalt Fibers for High-Performance Composites

Alan Murray

Allied Composite Technologies, LLC

Reinforcement fibers made from basalt rock offer cost / performance benefits compared to other composite reinforcement fibers. These benefits include high-temperature capability, resistance to chemical attack, high strength and stiffness, and recycling advantages. Fiber production characteristics and sources will be discussed, as well as some applications for which basalt fiber benefits are important.

Revolutionary Polymer for Metal Replacement in Automotive Applications

Mike Zimmerman, Quantum Leap Packaging, Inc. &
Charles Buehler, General Motors Corp.

A new materials science that solves the problems of conventional liquid crystal polymers (LCPs) and that is new for automotive applications will be discussed. These materials, whose CTE matches that of metals (steel), are chemical resistant, have high thermal and dimensional stability, and are ideal for demanding applications.

Low Weight & High Sound Absorption GMT for Underbody Shields

John Shin

AZDEL, Inc.

This presentation discusses several tough, lightweight GMT technologies available to produce underbody shields to reduce stone impingement and noise, and increase vehicle aerodynamics.

STRUCTURAL COMPOSITES (TUES.)

High Performance Plastic Components for Engine Mount Applications

Hans-Juergen Karkosch, ContiTech Vibration Control &
Holger Klink, BASF

In the face of dwindling resources, rising energy prices, and increasing environmental pollution, reductions in consumption and emissions are topics of increasing importance in all fields of technology. This presentation introduces the principle procedure for developing load-bearing plastics components for engine-mount applications, and looks at the topics of integrative simulation, laboratory component tests, and in-vehicle testing.

Machine Augmented Composites Utilizing an Hourglass Shaped Core Element in a Soft Nearly Incompressible Matrix

Roston Ellwell

Texas A&M University

2007 Student Scholarship Winner

Machine augmented composites (MACs) offer the ability to incorporate both structure and actuator into a material. MACs utilizing an hourglass shaped core element in a soft, nearly incompressible matrix show potential ability to perform useful work or undergo advantageous shape changes. These MACs have been simulated with the finite-element modeling methods to study deformation and predict response.

Development of a Structural Composite Underbody

Libby Berger

General Motors Corp. / Automotive Composites Consortium

The Automotive Composites Consortium is a joint program between General Motors, Ford, and Chrysler to develop structural automotive components from composite materials. A current focal project is a

structural composite underbody capable of carrying crash loads, with mass reduction of the vehicle structure a primary goal. Phase 1 of the project is the selection of a material and process system (M&P system). Three systems were evaluated, each with several subsets. The selected M&P system is compression molding of sheet molding compound (SMC), with a vinyl ester matrix and predominately glass fabric reinforcement, with some chopped glass.

Advances in High Fiber Composites

Fred Deans

Allied Composite Technologies, LLC

Recent advances in material compounding has led to increased levels of fiber content in traditional resins used for composites. The use of lower cost E-Glass fibers in thermoset and thermoplastic high-glass composites can bring improved structural performance, durability, and lighter mass automotive applications.

VIRTUAL PROTOTYPING, ANALYSIS & TESTING (TUES. – THURS.)

PART 1: MODELING (TUES.)

Constitutive Modeling of Polymer Composites made from LBL Manufacturing Technique

Harish Iyer

University of Michigan - Ann Arbor

Computing the fracture toughness of thin films made from polymer composites using discrete cohesive-zone models requires the accurate modeling of the material's mechanical behavior. This presentation will discuss research on the phenomenological / micromechanical modeling of polymer nanocomposites based on the mechanical characterization.

DIGIMAT Multi-Scale Modeling: The Technology & Software Tools for a Predictive Development of Reinforced Plastic Parts

Roger Assaker

e-Xstream Engineering

In this talk we will present the nonlinear micromechanical material modeling technology and the multi-scale modeling approach underlying the DIGIMAT software platform. This technology and software toolset enables reinforced plastic professionals (material suppliers, automotive OEMs, and their suppliers) to accurately predict the anisotropic, nonlinear, rate-dependent, damage and failure behavior of plastic parts in service. The actual material behavior is computed as a function of the local composite microstructure morphology (fiber content, length, and orientation) induced by the manufacturing process. This approach bridges the gap between injection molding software (e.g. Moldfow, Moldex3D, Sigmasoft) and advanced structural FEA (Abaqus, ANSYS, LS-DYNA, PAM-CRASH, etc.).

Theoretical Simulation of Cure-Induced Deformations of Composite Car Body Panels

Medhi Kiasat, Amirkabir University of Technology &
Hamid Mostofi, Iran University of Science & Technology

This presentation is dedicated to a realistic prediction of the deformations of advanced composite car body panels during curing. These panels deform due to the curing shrinkage of the thermosetting matrix of the composite. Both open- and closed-mold curing conditions are simulated. It is concluded that the curing deformations cannot be avoided even if symmetric laminates are cured in closed molds.

PART 2: ANALYSIS & TESTING (WED.)

Techniques and Results for Fiber Length Distribution Determination as a Function of Thickness in Long Fiber Reinforced Injection Molded Thermoplastics

Vlastimil Kunc

Oak Ridge National Laboratory

New measurement technique used to obtain unbiased fiber-length distribution at specified locations in the thickness of long fiber reinforced thermoplastic samples will be presented. This technique relies on elastic energy stored in long fiber thermoplastics, which is released during partially constrained burn-off.

Computer Predictions of the Behavior of Fiber-Reinforced Composites During Molding

Alejandro Londoño-Hurtado

University of Wisconsin - Madison

2007 Student Scholarship Winner

Mechanistic computer simulations of flexible fiber suspensions are developed to study the molding of fiber-reinforced composites. Parameters such as fiber concentration, fiber length, and stiffness can be modified to match specific processing conditions. Simulation results include final fiber orientations and fiber distributions within a molded part. Specific applications for this type of simulation are compression molding of sheet molding compound, where defects such as fiber-jamming and fiber-matrix separations are difficult to predict and still not well understood.

Damage Repair of Low Velocity Impacted Woven Thermoplastic Composites

Uday Sharma

University of Michigan - Dearborn

2008 Student Scholarship Winner

In this study, the low-velocity impact behavior of 3-layer thermoplastic laminates consisting of woven glass fiber and polypropylene were investigated. Results suggested that the composites exhibit good energy-absorbing properties. After impacting, a simple compression-molding damage-repair process was applied to the damaged laminates. Repaired samples were tested under 4PB and results showed a significant recovery of flexural strength to approximately 98% of the undamaged strength.

Abstracts

Composite Liftgate Ductility Performance

Peter Foss

General Motors Research & Development

The FMVSS 301R Fuel System Integrity Test requirements on closures, as well as field experience, have increased demand on the liftgate performance. The energy imparted to the liftgate structure in this test configuration is difficult to absorb with inherently brittle composite materials. This report documents the load-displacement response of several reinforced composite liftgates in a static test designed to simulate the deformations experienced in the FMVSS 301R test.

PART 3: PREDICTING FATIQUE (THURS.)

Strain-Life Fatigue Behaviour of Long Glass Fiber-Reinforced Polypropylene

Jackie Rehkopf

Exponent

The objective of this research was to determine whether some of the techniques used for metals can be applied to LGFR-PP materials. Four grades of LGFR-PP were tested under strain-control fatigue at the application temperature of 120C. Using a Neuber parameter to account for the hysteretic stress-strain response of each grade, quantifiable differences in fatigue performance were revealed between the 4 grades of LGFR-PP.

Fatigue Life Prediction of Short Fiber Reinforced Plastic Components

Robert Wahlmueller

Magna Powertrain

For fatigue life prediction, a simulation process was established that takes into account the fiber orientation and distribution as a result from a molding simulation. Suitable interfaces have been developed for this purpose. Also for structural stress analysis with the finite-element method, the local orthotropic material behavior derived from molding simulation needs to be considered. Nevertheless, the fatigue behavior of short fiber reinforced plastics is rather complex. A lot of tests on specimens are necessary to quantify influences such as fiber orientation and distribution, mean stress influence, etc. Hypotheses for fatigue life prediction of orthotropic materials have been derived, implemented into a standard fatigue software tool, and verified so far with component tests.

KEYNOTE ADDRESSES

Challenges & Opportunities for Automotive Composites

Joseph Carpenter

U.S. Department of Energy

While there are numerous advantages to lightweight composites in passenger cars, the challenges of widespread implementation will require these materials to earn their way onto vehicles. How do composites stack up against higher performance metals? What is the real value of weight savings? Is there truly an energy crisis? These topics are examined and potential outcomes explored relative to the future of the automotive industry.

Future Lower Cost Carbon Fiber for Autos: International Scale-Up & What is Needed

C. David Warren

Oak Ridge National Laboratory

In pursuit of the goal to produce ultra-lightweight fuel-efficient vehicles, there has been great excitement during the last few years about the potential for using carbon fiber reinforced composites in high volume applications. Currently, the greatest hurdle that inhibits wider implementation of carbon fiber composites in transportation is the high cost of the fiber when compared to other candidate materials. As part of the United States Department of Energy's FreedomCAR initiative, significant research is being conducted to develop lower cost, high-volume technologies for producing carbon fiber. This paper will highlight the on-going research in this area.

Composite Materials Technology in Formula 1 Motor Racing

Gary Savage

Honda Racing F1 Team

The strategy of Formula 1 will be discussed with a view to explain why the cars are so dependent on the use of advanced materials, in particular fibre-reinforced composites. The introduction of fibre-reinforced composite chassis was one of the most significant developments in the history of Grand Prix motor racing. Technology advances gained from these advanced materials have produced cars that are lighter, faster, and safer than ever before. A short introduction to the science of composite materials will be followed by a history of their use and development within the sport. Design manufacture and operation of composite structures will be reviewed. Reference will also be made to their energy absorbing properties that have contributed so significantly to the improved safety record of Formula 1 and the more specialist composite materials, such as carbon-carbon, used in brakes and clutches etc.

ACMA / ACA Study on Composites for Hybrid Electric Vehicles

David Dyke

Meridian Automotive Systems

A newly published study by the Automotive Composites Alliance (ACA), a division of the American Composites Manufacturers Association (ACMA), shows that composites make better sense for hybrid-electric

vehicles than steel or aluminum. This is because no competitive material / process combination offers more possibilities to reduce weight, lower tooling investment and part costs, and provide opportunities for parts consolidation and reduction or elimination of secondary-finishing operations. Although produced in modest volumes by only a few of the world's automakers at the present, hybrid cars and light trucks are predicted to exceed 1-million units annually within 4 years. To understand the opportunities this presents better, the ACA decided to benchmark a hypothetical hybrid sedan to evaluate where composites could best be used and determine the benefits such a conversion could offer automakers.

Composites in Extreme Sports

Jan-Anders Månson

Ecole Polytechnique Fédérale de Lausanne (EPFL)

It has been demonstrated clearly in recent years that sport not only makes increasing use of advanced technologies, but also plays an increasingly important role in the public economy. In comparison with other market sectors, such as the aerospace and automotive industries, the sport industry is exposed to rapid market changes. The sport industry is often extremely performance driven as well as sensitive to rapid changes in trends. This places enormous time constraints on the innovation process with respect to technology development and implementation. It is well known that you cannot win the America's Cup or Formula 1 with last year's technology. Thus, it is not surprising that sport has increasingly positioned itself as a driver in materials research over the last decade. However, it is vital to seek synergy in research and implementation strategies in order to benefit fully from the unique experiences from different disciplines, gained in design, materials performance, and manufacturing.

Trek's Use of Composites to Lightweight Racing Bikes

James Colgrove

Trek Bikes

Trek Bikes has been designing, building, and racing carbon fiber composite bicycles for over 20 years. The company believes that bicycles are key to helping solve many world issues, including low-cost transportation, reduced carbon footprint, rising fuel prices, and escalating obesity in developed countries. This presentation will describe the historical influences, current issues, and challenges faced when designing, engineering, and manufacturing the next generation of carbon fiber bike frames. The talk will also touch on Trek's design process, and use of analytical and engineering tools (CAD, CAM, FEA, SPC, etc.) to produce these composites-intensive bicycles.

History of Automotive Composites

Barbara A. Sanders

Delphi Corp.

Automotive composite materials / technology started as an art form with formulations that were virtually "a pinch of this and a dash of that" and usually based upon a chemist or formulator's feel for what was right. The presentation gives an overview of how technology grew and changed through the years. Manufacturability improved from slow and long cycle times to fast processes with higher first-time-quality parts, with limited to no need for secondary operations. Greater design freedom with composites and lower part weight for fuel savings continues to be the winning combination for increased use of composites in automotive applications. The presentation also briefly discusses the latest innovations and future trends in the automotive composites industry.

Driving Innovative Solutions for Tomorrow

Matt Tsien

General Motors Corp.

GM is continuing to focus on innovation in many areas of the vehicle. Innovation has two key phases - creation of an idea and implementation. Both are important and required to impact a company's product. GM has formalized an innovation process through 2 approaches: the first, short term (for 1 year or less), is call Decoupled Development (DD); and the second, (for longer than 1 year), is called Global Advanced Technology System (GATS). Both of these processes will be presented. Supplier involvement in these processes contributes to their success. There are different GM / supplier relationships that are available and will be presented. Finally, the key advanced development areas requiring composite supplier involvement will be presented.

CFRP: What is Needed Next for Mass Production in the Automobile?

Toru Yamanaka

Toray Industries Inc.

Carbon fiber reinforced plastic (CFRP) is widely used in aeronautic applications to reduce weight as well as for high-performance cars. This presentation will introduce Toray's latest strategy for use of CFRP in mass-produced automobiles. Among the topics covered will be faster cycling resin transfer molding (RTM), a numerical analysis technique for calculating head injury criteria (HIC) values for CFRP parts, and a pilot recycling plant for carbon fiber, pre-preg, and CFRP parts that is being developed in conjunction with Toray, Teijin, and Mitsubishi Rayon and sponsored by the Japan Ministry of Economy, Trade & Industry. Last, a new automotive center being opened by Toray in Nagoya this October will be discussed.

PANEL DISCUSSION

Government-Industry Panel on the Future of Automotive Composites

Moderators: Dale Brosius & Derek Buckmaster

What does the future hold for fuel economy standards, and is lightweighting the best path to more efficient vehicles? How can government cooperate with industry to enable lower weight composites to be used more widely? A premier panel of executives from the U.S. Department of Energy, automotive and heavy-truck OEMs, and the supply base will tackle these and other provocative questions. Audience participation is strongly encouraged through an active Q&A session.

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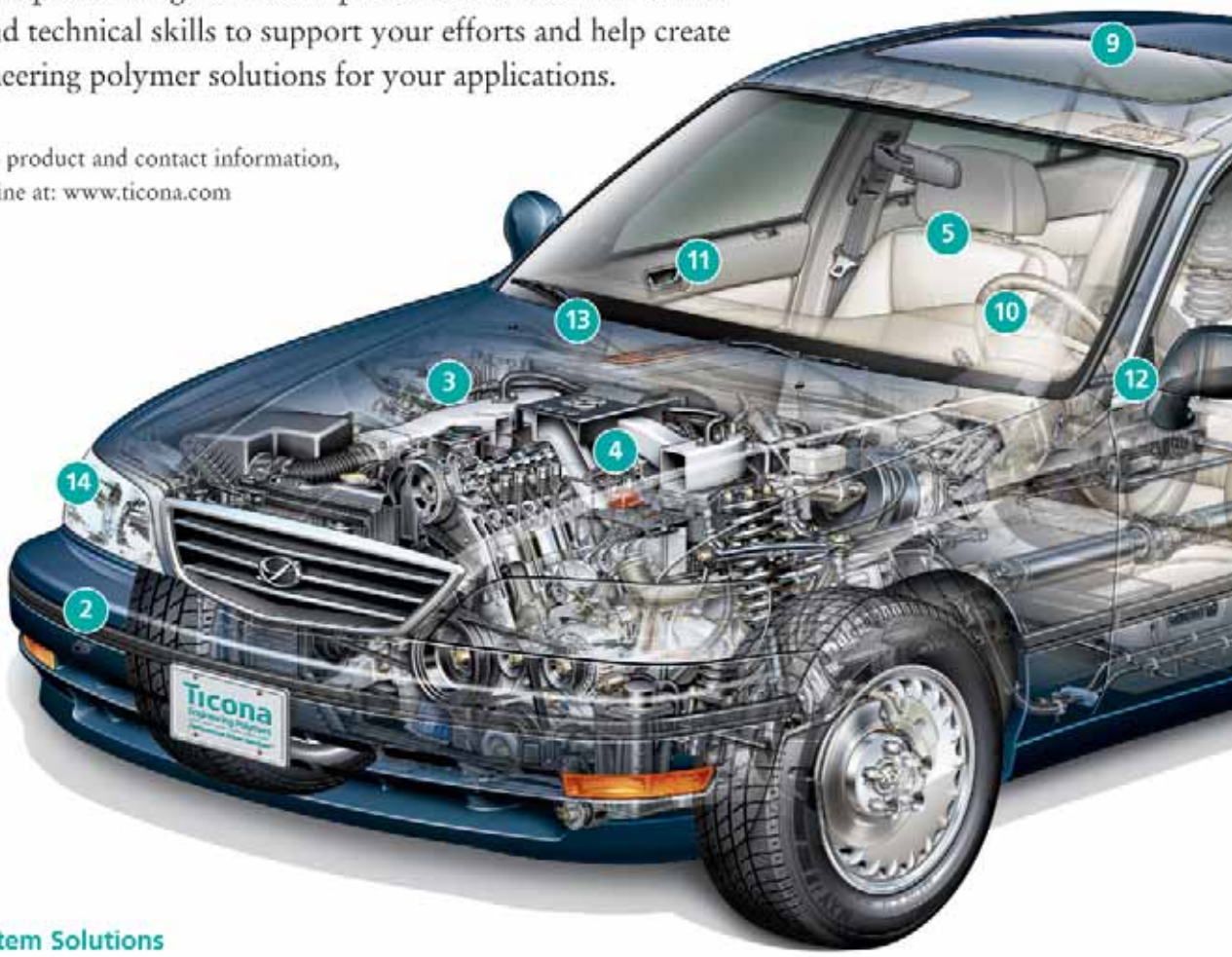

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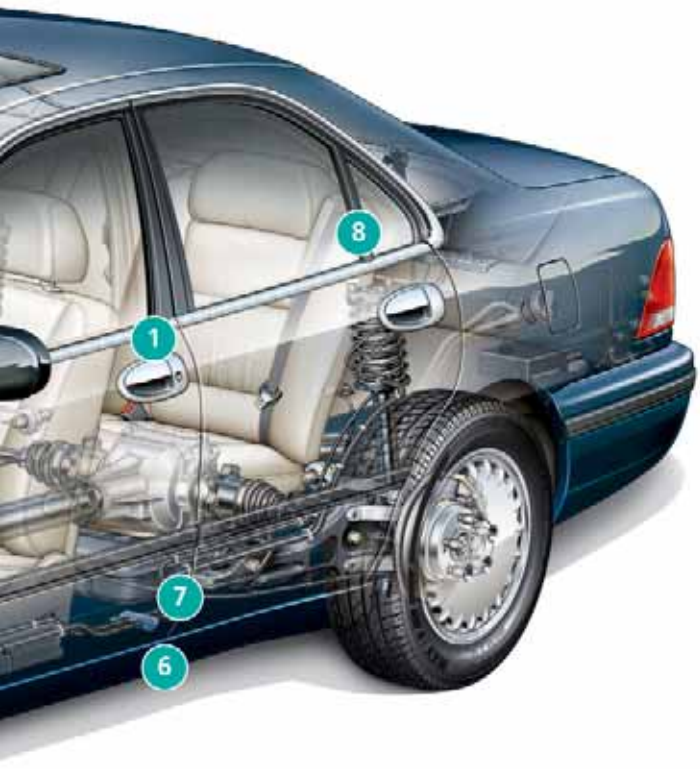

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For the second year, two graduate students have been awarded scholarships in the amount of $2,000 USD each to support new research in polymer composites with relevance to ground transportation as part of the *SPE Automotive Composites Conference & Exhibition* scholarship program.

Uday Sharma of University of Michigan - Dearborn (Dearborn, Mich.) will use his scholarship for research on *Analysis of Thermoplastic Woven Composites at High-Strain Rates*. In explaining the scope of his project, Sharma says: "In recent years, composite materials have increasingly replaced conventional materials in aerospace, marine, civil, and automotive industries as a result of their high specific stiffness, strength, superior corrosion resistance, and low coefficient of thermal expansion. It is important to determine the properties of these composites under dynamic loading for further development in the automotive industry. The objective of the research would be the in-depth study of mechanical behavior shown by thermoplastic woven composites under high strain rates. The research will additionally investigate using a state-of-the-art, non-contact strain measurement system (ARAMIS 3D) to determine the effect of fiber angle and woven architecture on the mechanical behavior of thermoplastic woven composites."

Tobias Potyra of Fraunhofer Institute of Chemical Technology (Pfinztal, Germany) will use his scholarship for work on *New Direct Processing Technology for the Manufacture of SMC Parts (Direct-SMC)*. Discussing his project, Potyra says: "Class A exterior body panels for the automotive industry are often manufactured from sheet-molding compound (SMC). The conventional process can result in fluctuations in the quality of the semi-finished material and therefore also in component quality. Also, since it is discontinuous, it may take several days (or longer) before results of formulation changes can be determined. However, the new direct-SMC process – a continuous process where raw material is converted directly into a molded part within minutes of compounding – avoids many of the previous restrictions and makes it possible to establish a control loop in order to assure high and consistent SMC quality. As a result, both scrap and rework are reduced, improving component costs. The scientific challenges in this project are to establish an integrated process – from raw material to molded part – for SMC applications for the automotive industry. The industrial challenges are to meet automotive market requirements of fast cycle times for high-volume production and to produce high-quality material that meets performance requirements consistently."

Last year's student scholarship winners – Roston Elwell from Texas A&M University and Alejandro Londoño-Hurtado from University of Wisconsin - Madison – are presenting results of their work during this week's show. Sharma and Potyra will do the same at next year's conference, September 15-17, 2009.

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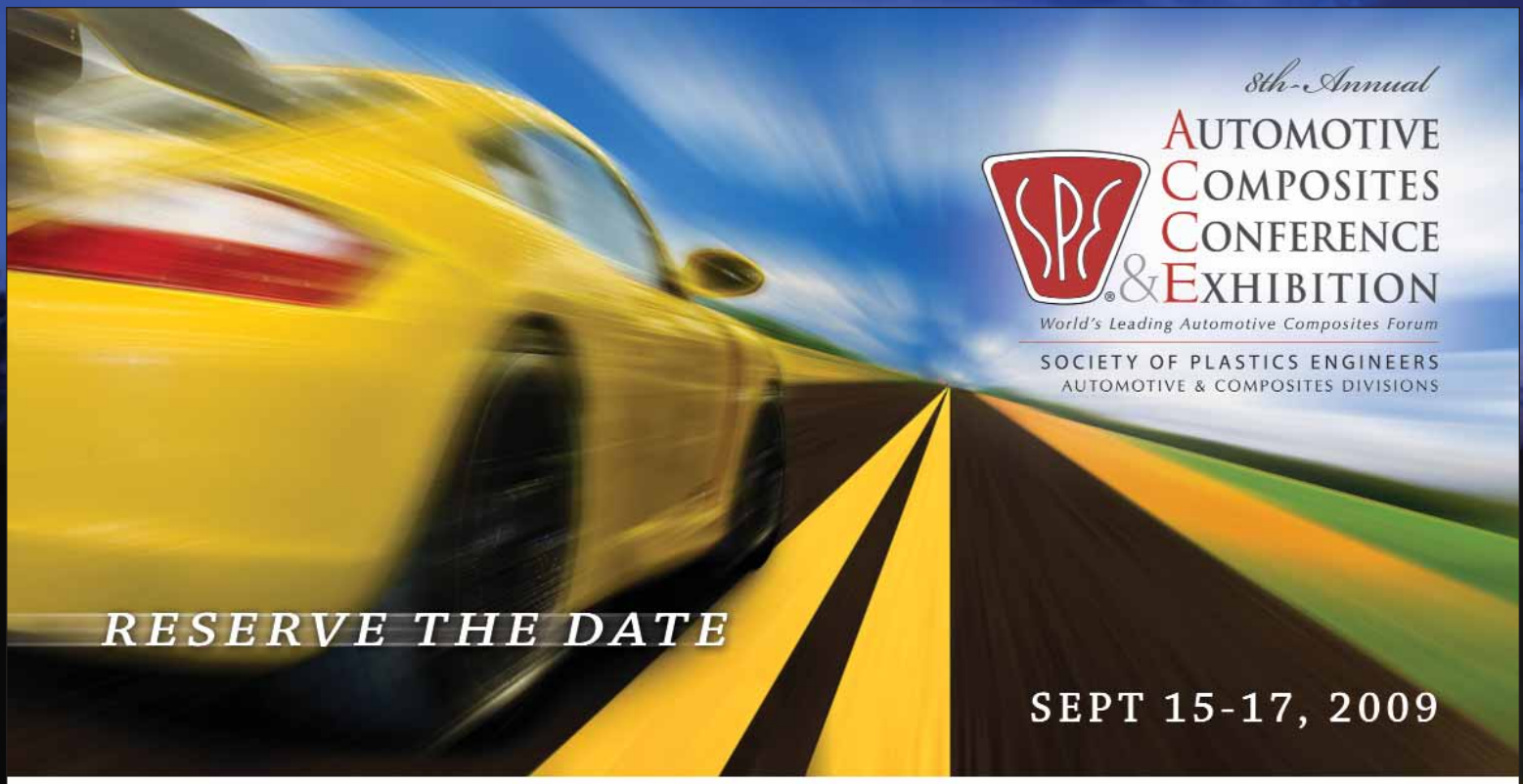

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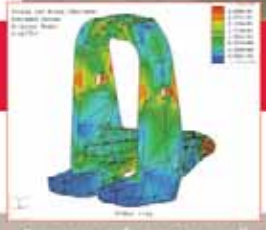

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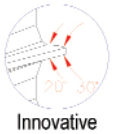

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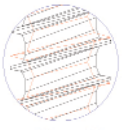
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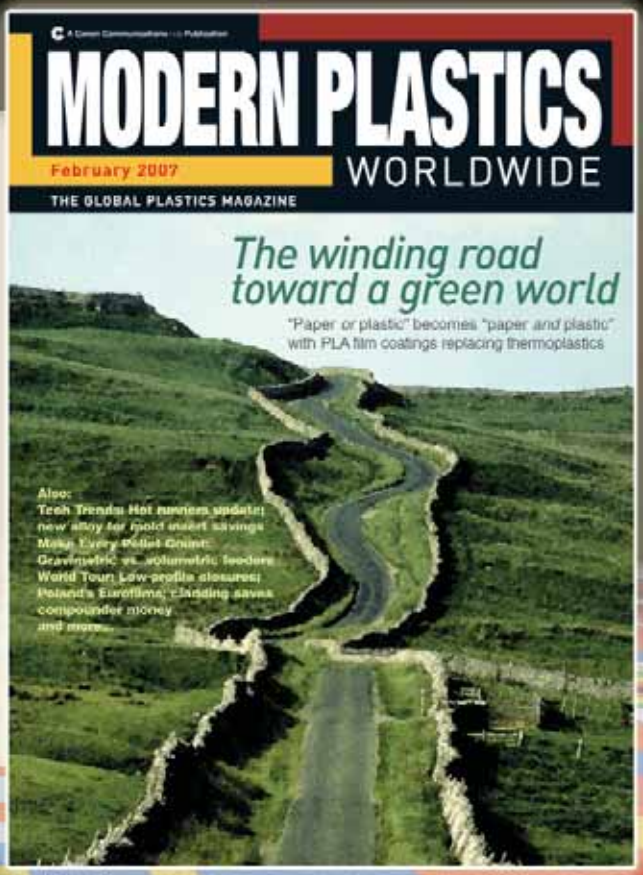

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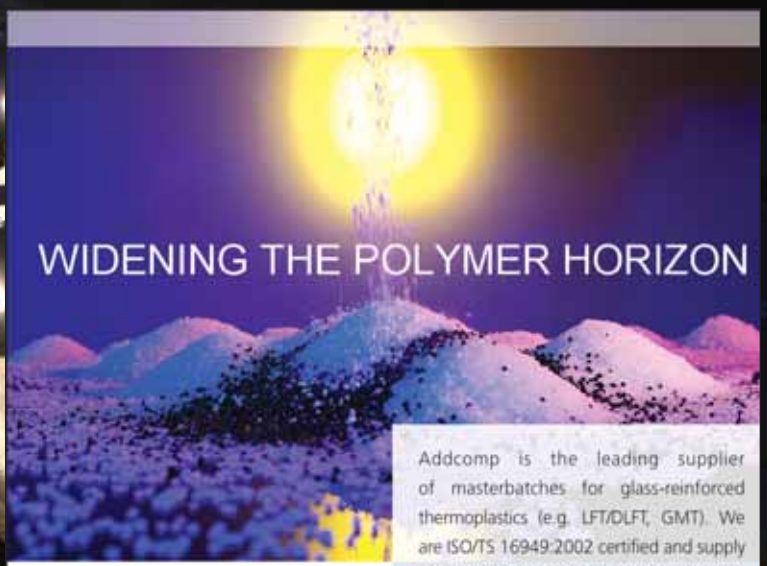

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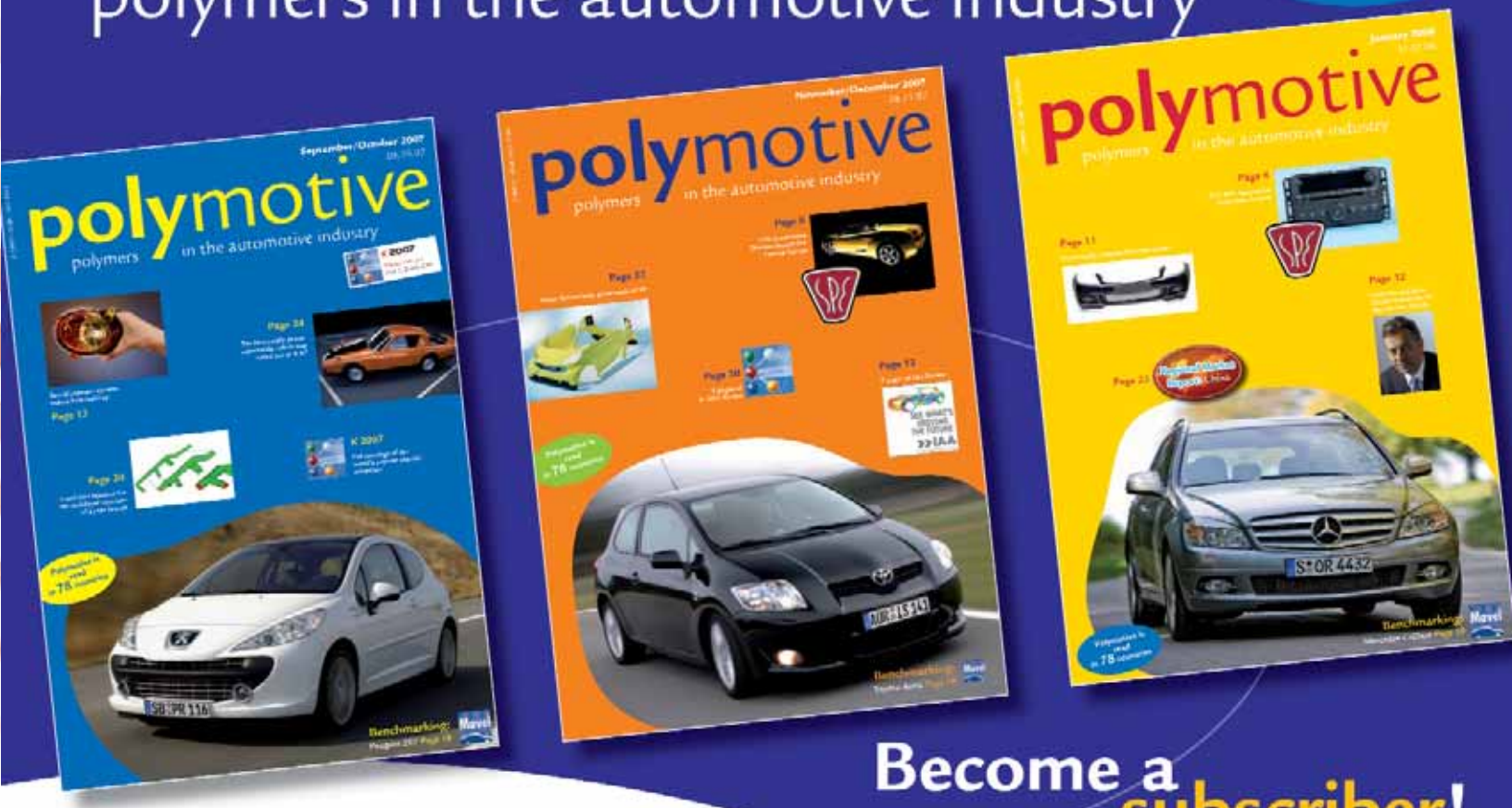

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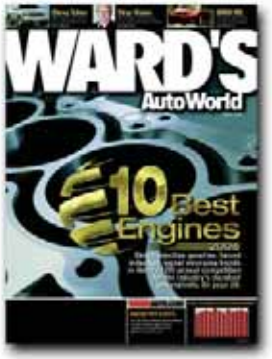

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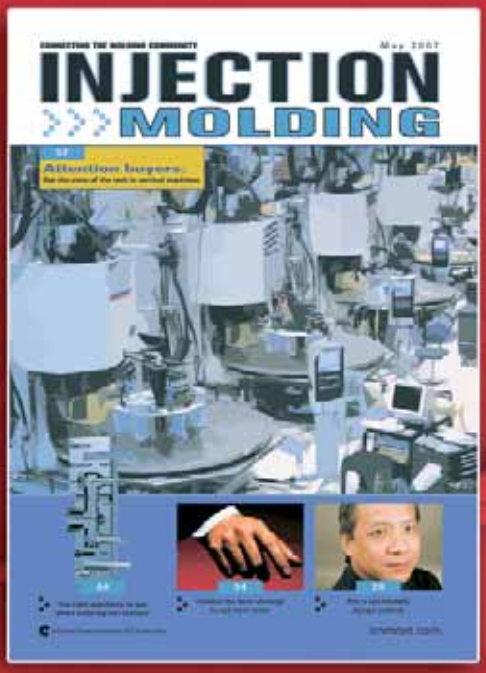

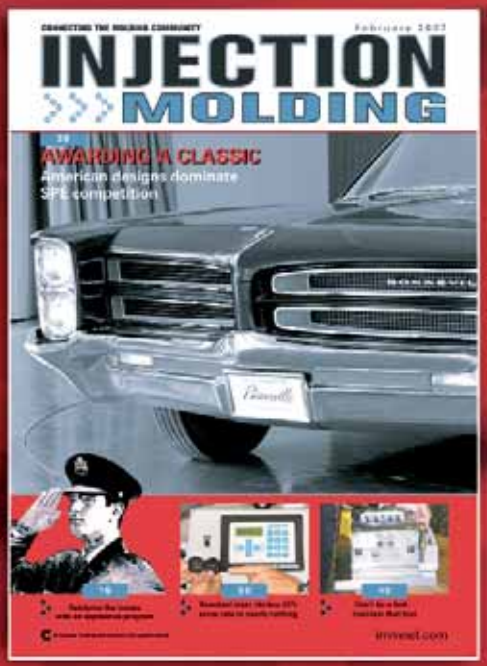

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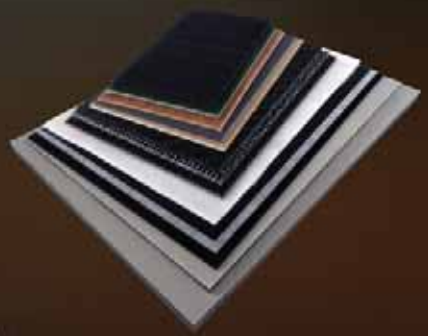

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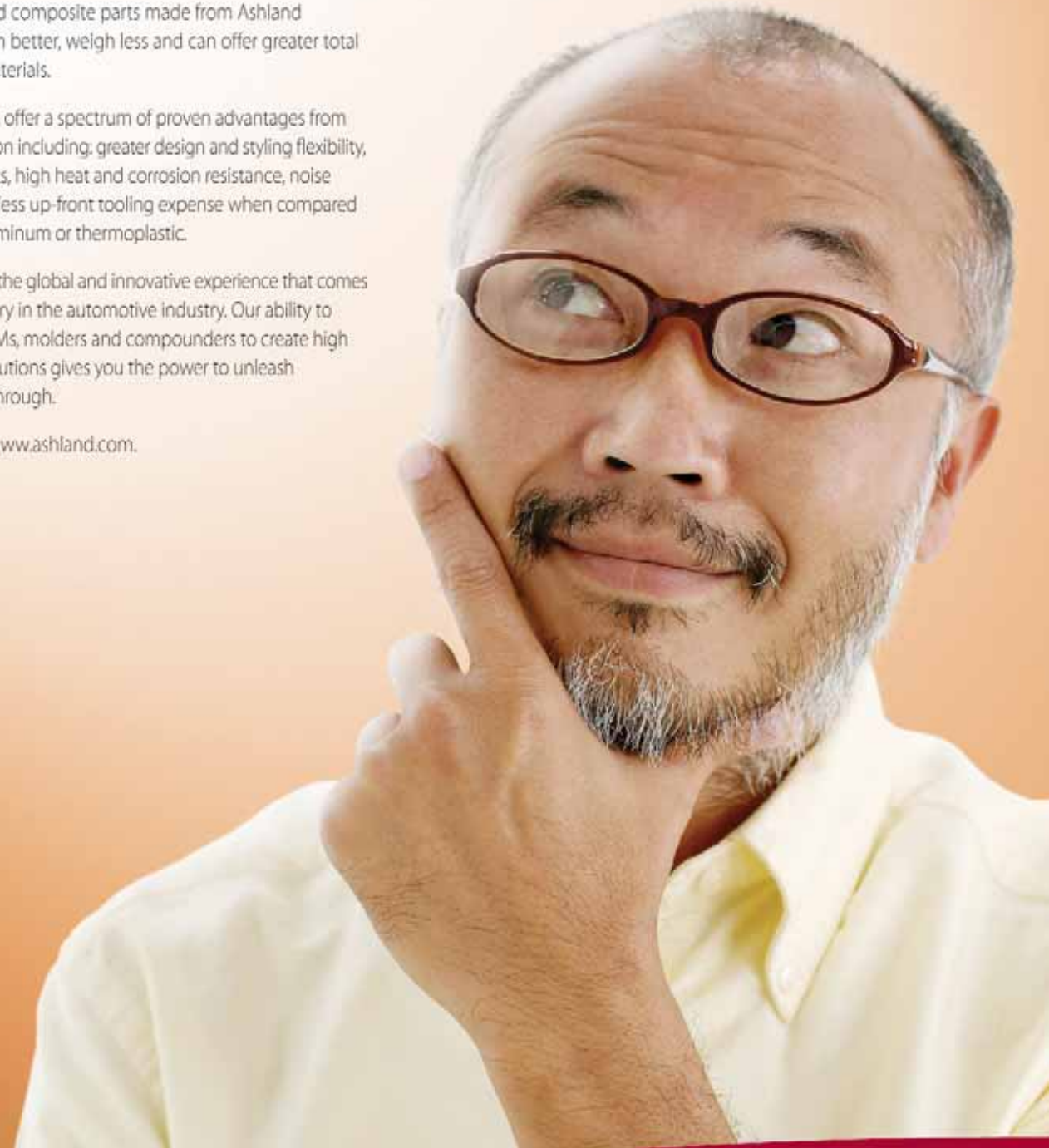

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