

*7th Annual*  
AUTOMOTIVE  
COMPOSITES  
CONFERENCE  
& EXHIBITION

*World's Leading Automotive Composites Forum*

SOCIETY OF PLASTICS ENGINEERS  
AUTOMOTIVE & COMPOSITES DIVISIONS



DRIVING PERFORMANCE  
& PRODUCTIVITY

*Sept 11-13, 2007*

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*p r e s s e s   a n d   m o r e*

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# Welcome to ACCE 2007

On behalf of the Automotive and Composites Divisions of the Society of Plastics Engineers, International (SPE®), welcome to the 7th-Annual *Automotive Composites Conference and Exhibition* (ACCE). This year's theme, "*Driving Performance and Productivity*," reflects the challenges facing automakers and the supply community. Consumers continue to demand higher performance in their vehicles – faster acceleration, better style and comfort, higher electronics content, and improved fuel economy – yet remain unwilling to sacrifice features like cost, safety, and vehicle size. Fortunately, the low mass, energy management, and design freedom of composites can help OEMs achieve these often conflicting objectives. The supply community is working hard to address issues like global competitiveness and cost pressures facing the OEMs, as many of the displays, papers, and keynote addresses presented at this year's ACCE demonstrate.

In the span of seven years, we have become the *World's Leading Automotive Composites Forum*, attracting presenters and attendees year after year from Europe, Asia-Pacific, and the Americas. No other conference offers the range of topics related to composites for ground transportation in the kind of depth as the one you are attending.

This year, we have added some new features and expanded the program in key areas:

- ~ We are awarding **two scholarships** to graduate students performing research in the area of composites for ground transportation. These awards, given in honor of noted journalist Steve Loud, who was a fantastic supporter of this conference, are the start of yet another tradition of the ACCE.
- ~ We are presenting **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 in time to make the conference proceedings, and the authors will be recognized at the start of the conference.
- ~ We have developed a new panel discussion on "**Marketing the Value of Composites**," which focuses on how best to educate designers and OEMs on the value provided by composite solutions. As previous attendees have seen, our panel sessions tend to be both enlightening and, at times, controversial and we expect this one to be no different.
- ~ We have developed a program that includes a **record number of technical papers** across multiple technologies and applications, including a new session titled *Virtual Prototyping & Testing of Composites*, in response to issues raised at a panel session last year.
- ~ We have combined all displays into 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 technology on display.

The members of the SPE Automotive and Composites Divisions on the planning committee now work year round to put on this conference. Many of these volunteers have been associated with the event 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 discover ways to improve both the performance of your products and the productivity of your operations.

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  
2007 SPE Automotive Composites Conference Chair  
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# CONTRIBUTORS 2007



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## PANEL DISCUSSIONS

### WEDNESDAY

COMPOSITES INDUSTRY  
IMPERATIVES TO MEET THE NEEDS  
OF THE NEXT DECADE

**Jim Plaunt (Moderator)**  
AOC Resins

**Gary Flint**  
Honda Motor Co.

**Carl Johnson**  
Ford Motor Co.

**Ed Zenk**  
International Truck

**Tyler Hardy**  
Meridian Automotive Systems

**Tom Hilborn**  
Continental Structural Plastics

**George McCunn**  
John Deere Corporation

### THURSDAY

MARKETING THE VALUE OF  
COMPOSITES

**Jeff Sloan (Moderator)**  
Composites Technology Magazine

**Melanie Cook**  
Azdel Inc.

**Roland Polet**  
Ticona Engineering Polymers

**Lou Luedtke**  
National Composite Center

**David Dyke**  
Meridian Automotive Systems

**Len Nunnery**  
Bulk Molding Compounds Inc.

Design/Pre-Production JPICreative • Signage That Color • Printing JPS Marketing Communications • CDs Media Genesis • Pens/Notepads/Bags Graphic Services Inc.





# TUESDAY, SEPT 11

## IN AUDITORIUM

## IN AMPHITHEATER 101

## IN AMPHITHEATER 102

6:30-7:30	REGISTRATION - Coffee in Mezzanine (Sponsored by Husky Injection Molding Systems Ltd.)		
7:30-9:00	RIBBON-CUTTING CEREMONY; EXHIBITS OPEN Frank Henning		
	CONTINENTAL BREAKFAST SERVED - BALLROOM (Sponsored by PPG Industries)		
9:00-9:30	OPENING REMARKS (Including Best Paper Awards & Student Scholarship Announcements) Dale Brosius		
9:30-10:00	KEYNOTE SPEAKER Michael Fisher, American Chemistry Council, <i>Plastics are for Cars After All - The Rest of the Story</i>		
	<b>ADVANCES IN THERMOPLASTIC COMPOSITES - PART 1:</b> <i>Inline Compounding / D-LFT</i>	<b>VIRTUAL PROTOTYPING &amp; TESTING - PART 1</b>	<b>STRUCTURAL COMPOSITES - PART 1</b>
10:00-10:30	Martin Popella Krauss-Maffei Kunststofftechnik GmbH <i>Injection Molding Compounder - On the Direct Way to Profitability: Production of Long Glass Fiber Reinforced Thermoplastics in a One-Step Inline-Compounding Process</i>	Ba Nghiep Nguyen Pacific Northwest National Laboratory <i>From Process Modeling to Elastic Property Prediction for Long-Fiber Injection-Molded Thermoplastics</i>	Hannes Fuchs Multimatic <i>Development and Build of the Ford Focus FCV Lightweight Carbon Fiber Decklid</i>
10:30-11:00	Ali Mortazavi Husky Injection Molding Systems <i>In-Line Compounding on Injection Molding Machine for Reducing Cost &amp; Improving Performance</i>	Vlastimil Kunc Oak Ridge National Laboratory <i>Fiber Length Distribution Measurement for Long Glass &amp; Carbon Fiber Reinforced Injection Molded Thermoplastics</i>	Karl-Heinz Kalmbach Quadrant Plastic Composites <i>FEM DaimlerChrysler S-Class Coupe in GMTex</i>
11:00-11:30	Jeffrey Robbins Meridian Automotive Systems <i>DLFT: The Long &amp; the Short of It</i>	Aaron Brighton Deakin University <i>Strain Rate Effects on the Energy Absorption of Rapidly Manufactured Composite Tubes</i>	Uday Vaidya University of Alabama at Birmingham <i>Innovative Structural Thermoplastic Air Conditioning Roof Cover Door for Mass Transit Bus</i>
11:30-12:00	Stephen Bowen PlastiComp LLC <i>Direct In-Line Compounding for GMT Applications</i>	J.D. Holbery Pacific Northwest National Laboratory <i>Long Fiber Injection Molded Thermoplastic – Fiber Attrition Analysis and Characterization</i>	
12:00-1:15	LUNCH & EXHIBITS - BALLROOM (Sponsored by DuPont Automotive)		
1:15-1:45	KEYNOTE SPEAKER Chuck Segal, OMNIA LLC <i>Is the Auto Industry Ready for the Carbon Fiber Industry &amp; Vice Versa?</i>		
1:45-2:15	KEYNOTE SPEAKER Victor Liu, AZDEL, Inc. <i>Overview of Use of Composites in China Automotive Industry</i>		
	<b>ADVANCES IN THERMOPLASTIC COMPOSITES - PART 2:</b> <i>New Materials / Formulation Options</i>	<b>VIRTUAL PROTOTYPING &amp; TESTING - PART 2</b>	<b>NEW COMPOSITE MATERIALS &amp; PROCESSES - PART 1</b>
2:15-2:45	Paul Stassen, Addcomp Holland BV & Herbert Engelen, Dow Automotive <i>LFT Material Formulation - A Key to Part Performance</i>	Paolo Feraboli University of Washington <i>Toward the Development of a Test Standard for Characterizing the Energy Absorption of Composite Materials: Part II</i>	Thomas Ebeling AZDEL, Inc. <i>New Long Fiber Thermoplastic Composite Products for the Automotive Industry</i>
2:45-3:15	Jeff Helms Ford Motor Co. <i>Long Fiber Thermoplastic Materials for First Surface Automotive Parts</i>	Xinran (Sharon) Xiao General Motors Corp. <i>Modeling Automotive Composite Structures using LS-DYNA®</i>	Tom Heyer Ticona Engineering Polymers <i>New Processing Method and Materials for Advanced Composite Fabrication</i>
3:15-3:45	Shrish Rane GE Plastics <i>New Long Fiber Reinforced Plastics: A Single Pellet Solution with Enhanced Properties</i>	J.D. Holbery Pacific Northwest National Laboratory <i>X-Ray Computer Tomography and Real Time Ultrasonic Inspection as Process Development Tools for Discontinuous Fiber Composites</i>	Walt Maruszczak Ticona Engineering Polymers <i>Advanced Composite Polymer for Automotive - Long Glass Fiber Linear Polyphenylene Sulfide</i>
3:45-4:30	COFFEE BREAK & EXHIBITS - BALLROOM (Sponsored by Addcomp Holland BV)		
4:30-5:15	KEYNOTE SPEAKER Robert Kisch, The Boeing Company <i>Composite Process Technology &amp; Innovation at Boeing</i>		
5:15-6:45	NETWORKING RECEPTION - BALLROOM (Sponsored by Quadrant Plastic Composites)		

# WEDNESDAY, SEPT 12

## IN AUDITORIUM

## IN AMPHITHEATER 101

## IN AMPHITHEATER 102

6:30-8:00	CONTINENTAL BREAKFAST SERVED & EXHIBITS - BALLROOM (Sponsored by Bayer MaterialScience)		
	<b>ADVANCES IN THERMOSET COMPOSITES - PART 1: <i>Managing Costs</i></b>	<b>NANOCOMPOSITES - PART 1</b>	<b>ENABLING TECHNOLOGIES / FINISHING - PART 1</b>
8:00-8:30	<b>Pat DePalma</b> Meridian Automotive Systems <i>Real Time Production Process Control for the Composites Industry</i>	<b>Vikram Gopal</b> GE Plastics <i>Nano-Fibrillated High-Modulus Ductile (HMD) Technology in Environmentally Sustainable Xenoy iQ* Resins</i>	<b>Harald Herbst</b> Borealis Compounds LLC <i>Differentiated Compression Molding: A New Process Innovation Creates Dramatic Cost Savings &amp; Product Improvements for Compression-Molded Applications</i>
8:30-9:00	<b>Rob Seats</b> Ashland Inc. <i>Applications &amp; Markets for Renewable Resource Based Sheet Molding Compound</i>	<b>Hwanman Park</b> Michigan State University <i>Exfoliated Graphite Nanoplatelet (xGnP) / Polypropylene Nanocomposites</i>	<b>Heinrich Ernst</b> Dieffenbacher GmbH & Co. KG <i>Advanced Processing of Long-Fiber Reinforced Polymers</i>
9:00-9:30	<b>Libby Berger</b> General Motors Corp. <i>Investigation of Sheet Molding Compound Fabricated from Soy-Based &amp; Petroleum-Based Resins</i>	<b>Yuanxin Zhou</b> Tuskegee University <i>Fabrication and Characterization of Neat and Nanophased Polyurethane Foam</i>	<b>Manju Misra</b> Michigan State University <i>Electrospun Nanofiber Architectures: A New Class of Nonwovens for the Transportation Sector</i>
9:30-10:00	<b>Jim Riley</b> Hennecke Machinery <i>Looking Ahead: Positioning Yourself to Pursue Future Markets with Flexible Composite Spray Molding (CSM) Equipment Systems</i>	<b>WanJun Liu</b> Michigan State University <i>Exfoliated Graphite Nanoplatelet - Vinyl Ester Nanocomposites</i>	 <b>Kedzie Fernholz</b> Ford Motor Co. <i>Development of a Tool to Measure Bond-Line Read Through</i>
10:00-10:30	COFFEE BREAK & EXHIBITS - BALLROOM (Sponsored by AOC LLC)		
	<b>ADVANCES IN THERMOSET COMPOSITES - PART 2: <i>Design with Composites</i></b>	<b>NANOCOMPOSITES - PART 2</b>	<b>ENABLING TECHNOLOGIES / FINISHING - PART 2</b>
10:30-11:00	<b>Glenn Mazza</b> Menzolit Compounds International <i>Advanced Compounds for Superior Parts</i>	<b>Péter Krüger</b> Bayer MaterialScience AG <i>Nanocomposites for Automotive Applications</i>	<b>Joe Gobernatz</b> ATF Assembly Solution <i>Delta PT: A Superior Thread-Former for Plastics</i>
11:00-11:30	<b>Matthew Vagi</b> Meridian Automotive Systems <i>Composite Design Innovations: The Nissan Trunk Divider Hybrid Panel</i>	<b>Andy Rich</b> Nanocyl S.A. <i>Carbon Nanotubes: New Markets &amp; Developing Applications</i>	<b>Russell Brynolf</b> FTS Technologies <i>Accelerated Thermo-Molecular Adhesion Process (ATmaP) - An Advanced Surface Treatment Technology</i>
11:30-12:00	<b>Cedric Ball</b> Ashland Inc. <i>Designing with Thermoset Composites</i>	<b>Mahmoodul Haq</b> Michigan State University <i>Development &amp; Thermo-Physical Properties of Bio-Based Polymer / Clay Nanocomposites</i>	<b>Pritam Das</b> National Composite Center <i>Evaluating Extrusion Compression Molding for Imparting Better Surface Finish in Long Fiber Thermoplastics Using In-Mold Film Technology</i>
12:00-1:00	LUNCH & EXHIBITS - BALLROOM (Sponsored by American Chemistry Council)		
1:00-1:30	<b>KEYNOTE SPEAKER</b> Richard Morrison, The Molded Fiber Glass Companies <i>How the Thermoset Composites Industry can Help Meet the Changing Needs of the Transportation Industry</i>		
	<b>ADVANCES IN THERMOSET COMPOSITES - PART 3: <i>New Technologies</i></b>	<b>ADVANCES IN THERMOSET COMPOSITES - PART 4: <i>New Materials</i></b>	<b>ENABLING TECHNOLOGIES / FINISHING - PART 3</b>
1:30-2:00	<b>Mercedes Alcock</b> Composites Innovation Center <i>Near Ready, Real Potential: The Feasibility of Using Natural Fibres for Reinforcing Thermoset Composite Parts for Ground Transportation Applications</i>	<b>Hamid Kia</b> General Motors R&D <i>Plant Trials for Powder Priming of SMC</i>	<b>Rob Sheppard</b> Weber Manufacturing <i>Nickel Vapor Deposition Shell Tooling Applications</i>
2:00-2:30	<b>Frank Mack</b> Coperion Werner & Pfeleiderer <i>New Process Technology for Thermoset Fiber Reinforced Composite Materials with the DTSC Process</i>	<b>Doug Denton</b> Chrysler LLC <i>Reduction of Styrene Evolution from Thermoset Polyester Resin Composites</i>	<b>Arnaud Riva</b> RocTool <i>RTM Technology Improvement with Tool Surface Heating by Induction</i>
2:30-3:00	<b>Ruediger Braeuning</b> Fraunhofer ICT <i>Direct SMC – A New Process for the Production of Fiber Reinforced Thermoset Components through a One-Step Direct Process</i>	<b>Paolo Feraboli</b> University of Washington <i>Characterization of High Performance Short Carbon Fiber / Epoxy Systems: Effect of Fiber Length</i>	<b>Martin Starkey</b> Gurit <i>Integrating Carbon Fibre Closures into Short-Series Premium Vehicles</i>
3:00-3:30		<b>Rob Seats</b> Ashland Inc. <i>Recent Developments in UV Stable SMC Technology</i>	<b>Ronald Cageao</b> Bayer MaterialScience <i>Direct Attachment of Metal Inserts to Baypreg Polyurethane Composites</i>
3:30-4:00	COFFEE BREAK & EXHIBITS - BALLROOM (Sponsored by RTP Company)		
4:00-5:30	<b>PANEL DISCUSSION</b> <i>Composites Industry Imperatives to Meet the Needs of the Next Decade</i> , Moderator: <b>Jim Plaunt, AOC</b>		
5:30-7:00	NETWORKING RECEPTION - BALLROOM (Sponsored by the Automotive Composites Alliance)		

# THURSDAY, SEPT 13

## IN AUDITORIUM

## IN AMPHITHEATER 101

## IN AMPHITHEATER 102

6:30-8:00	CONTINENTAL BREAKFAST SERVED & EXHIBITS - BALLROOM (Sponsored by AZDEL, Inc.)		
8:00-8:30	<b>KEYNOTE SPEAKER</b> Amar Mohanty, Michigan State University <i>Bio-Cars: Where We are &amp; Where We are Moving!</i>		
8:30-9:00	<b>ADVANCES IN THERMOPLASTIC COMPOSITES - PART 3: Applications</b> <b>Thomas Hofmann</b> Quadrant Plastic Composites AG <i>Loadfloor &amp; Rear Seatback for Ford Galaxy &amp; S-Max in SymaLITE</i>	<b>BIO- &amp; NATURAL-FIBER COMPOSITES -PART 1</b> <b>P.K. Mallick</b> University of Michigan-Dearborn <i>Development of Natural Fiber Hybrid Composites with Improved Stiffness</i>	<b>NEW COMPOSITE MATERIALS &amp; PROCESSES - PART 2</b> <b>Vinícius Fernando Mardegan</b> Ticona Engineering Polymers <i>New Composite Material for Automotive Industry: Long Glass Fiber Thermoplastic Polyacetal (LFT-POM)</i>
9:00-9:30	<b>Fred Deans</b> AZDEL, Inc. <i>Advances in GMT Composite Materials &amp; Applications</i>	 <b>Leonardo Simon</b> University of Waterloo <i>Effect of Additives on the Structure and Properties of Wheat Straw-Polypropylene Composites</i>	<b>Jeremy Klug</b> Ticona Engineering Polymers <i>Electrically Conductive Acetals for Fuel Environments</i>
9:30-10:00	<b>Geoffrey Barr</b> Delphi AHG <i>Heavy Duty Truck Plastic Composite Door Module &amp; Trim System</i>	<b>Carl-Heinz Fahnster</b> Quadrant Plastic Composites AG <i>smart Instrument Panel (IP) Board &amp; Knee-Pad made of Natural Fiber Composites</i>	
10:00-10:30	 <b>Derek Buckmaster</b> GE Plastics <i>Pedestrian Safety Validation of a High- Performance thermoPlastic Composite Hood</i>	<b>J.D. Holbery</b> Pacific Northwest National Laboratory <i>Processing Opportunities in Natural Fiber Composites – Retting, Surface Modification, and Preform Manufacturing Synergy</i>	
10:30-11:00	COFFEE BREAK & EXHIBITS - BALLROOM (Sponsored by GE Plastics)		
11:00-11:30	<b>ADVANCES IN THERMOPLASTIC COMPOSITES - PART 4: Materials/Recycling</b> <b>Mark Goldhawk</b> Dow Chemical <i>Injection Molded Long Glass Fibre Polypropylene Composites for Automotive Applications</i>	<b>BIO- &amp; NATURAL-FIBER COMPOSITES -PART 2</b> <b>Manju Misra</b> Michigan State University <i>Natural Fiber Reinforced Biodegradable Polymer Composites for Automotive Applications</i>	
11:30-12:00	<b>Robert Egbers</b> American Commodities Inc. <i>Commercially Viable Recycling Scheme for Long-Fiber Reinforced PP Instrument Panels</i>	<b>Rigoberto Burgueño</b> Michigan State University <i>Hybrid Bio-Based Composites from Nano-Reinforced Bio-Petro Polymer Blends &amp; Natural Fibers</i>	
12:00-12:30	<b>Jian Tao</b> Chrysler LLC <i>Long Fiber Reinforced Thermoplastics for Automotive Applications</i>	<b>Angela Harris</b> Ford Motor Co. <i>Renewable Bio-Composites for Automotive Applications</i>	
12:30-1:30	LUNCH & EXHIBITS - BALLROOM (Sponsored by Ticona Engineering Polymers)		
1:30-2:00	<b>KEYNOTE SPEAKER</b> Abbe Scheiner, Townsend Polymer Services & Information <i>Current &amp; Future Market for Long-Fiber Reinforced Thermoplastics</i>		
2:00-3:30	<b>PANEL DISCUSSION</b> <i>Marketing the Value of Composites</i> , Moderator: Jeff Sloan, Composites Technology Magazine		
3:30-3:45	<b>CLOSING REMARKS</b> Dale Brosius		



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# COMPOSITES TECHNOLOGY

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Each issue of High-Performance Composites and Composites Technology magazines feature the latest information on the design and use of composite materials in automotive and transportation applications — as well as many other markets. We feature in-depth articles and specific case studies, based on first-hand interviews,

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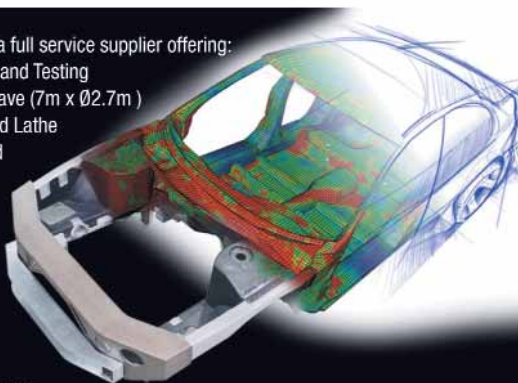
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INSPIRATION. INNOVATION. IMPLEMENTATION.

# ADVANCES IN THERMOPLASTIC COMPOSITES (TUE. & THUR.)

## Part 1: Inline Compounding/D-LFT (Tue.)

### INJECTION MOLDING COMPOUNDER - ON THE DIRECT WAY TO PROFITABILITY: PRODUCTION OF LONG GLASS FIBER REINFORCED THERMOPLASTICS IN A ONE-STEP INLINE-COMPOUNDING PROCESS

Martin Popella

Krauss-Maffei Kunststofftechnik GmbH

*An explanation of the IMC direct process and the main differences and advantages compared with standard injection molding is given. Changes in LFT process technology over the last few years are demonstrated with automotive application examples. Future applications are proposed. In addition the potential of using natural fiber instead of glass fiber with the IMC technology will be discussed. Also the possibility of a local reinforcement with fabrics will be presented to achieve tailored part properties.*

### IN-LINE COMPOUNDING ON INJECTION MOLDING MACHINE FOR REDUCING COST & IMPROVING PERFORMANCE

Ali Mortazavi

Husky Injection Molding Systems

*This presentation introduces the in-line compounding (ILC) process where raw materials, including resin, glass and additives, are directly compounded through a twin-screw extruder directly on an injection molding machine. The benefits of Husky's ILC discontinuous process as well as importance of the hot runner are described. Examples of material mechanical properties, applications and economic case studies are provided.*

### DLFT: THE LONG & THE SHORT OF IT

Jeffrey Robbins

Meridian Automotive Systems

*The presentation describes differences in final product characteristics, between long glass injection molding and long glass compression molding for polypropylene. Specifically, it will demonstrate the significant differences in residual glass length and uniformity in both plaques and finished product, between the two processes, and the subsequent impact on performance.*

### DIRECT IN-LINE COMPOUNDING FOR GMT APPLICATIONS

Stephen Bowen

PlastiComp LLC

*The D-LFT molding process has several very unique attributes, one of which is the ability to control fiber length of the chopped reinforcing fiber roving. With the capability to provide longer reinforcing fibers into the molded part, PlastiComp decided to look at part forming processes beyond injection molding that could preserve the longer fiber length attained with our D-LFT process technology.*

## Part 2: New Materials/Formulation Options (Tue.)

### LFT MATERIAL FORMULATION - A KEY TO PART PERFORMANCE

Paul Stassen, Addcomp Holland BV & Herbert Engelen, Dow Automotive

*Long fiber reinforced thermoplastics are cost-effective materials for substitution of metal and engineering thermoplastics in automotive applications. Key to their success is the opportunity to design maximum mechanical properties and high quality assurance of the final part. New improved black additive and coupling agent formulations address these performance and safety requirements at lower system costs. The presentation will give an overview of the latest generation of LFT materials.*

### LONG FIBER THERMOPLASTIC MATERIALS FOR FIRST SURFACE AUTOMOTIVE PARTS

Jeff Helms

Ford Motor Co.

*Use of long glass fiber thermoplastics continues to grow at phenomenal rates within the automotive industry. Typically, these materials are used in non-visible, semi-structural parts. Recent application launches using these materials in appearance parts will be reviewed. Various appearance propriety parameters will be presented. Future uses of long glass fiber thermoplastic materials in appearance parts will be discussed.*

### NEW LONG FIBER REINFORCED PLASTICS: A SINGLE PELLET SOLUTION WITH ENHANCED PROPERTIES

Shrish Rane

GE Plastics

*A new technology that provides a "single pellet solution" to impart multiple effects in LFRT products has been developed, breaking the limitation of dry blending of colorants, additives, flame retardants or other additives. This presentation reviews three distinct product families that deliver single pellet solutions with enhanced color consistency, robust non-brominated flame retardancy, superior UV and weathering resistance without compromising the balance between stiffness and impact offered by LFRT products.*

## Part 3: Applications (Thur.)

### LOADFLOOR & REAR SEATBACK FOR FORD GALAXY & S-MAX IN SYMALITE

Thomas Hofmann

Quadrant Plastic Composites AG

*During the development of the back seating and the requirement of a totally flat loading compartment, the cladding was designed to take over the function of the load floor as well, which made removal of the 3rd seat row redundant. The application, called "back panel," is made from five SymaLITE parts, processed in low pressure forming and decorated from both sides with cover stock material, integrating fixations and hinges. In competition with wood fibre materials, SymaLITE could save 40% of the weight mainly due to the freedom in wall thickness between 2 and 12 mm while maintaining the same area weight, and the interconnected stiffness and strength variability.*



# ADVANCES IN THERMOPLASTIC COMPOSITES (TUE. & THUR.)

## ADVANCES IN GMT COMPOSITE MATERIALS & APPLICATIONS

Fred Deans  
AZDEL, Inc.

Glass mat thermoplastic (GMT) materials have been associated with many innovative automotive applications. The ability to mold "long fiber," high strength/impact composites that are thermoplastic based has led to many metal-replacing applications. Since 1970, GMT GORs, load floors, bumper beams, IP & seat structures, battery trays, underbody skid plates, covers, and shields have been commercialized on vehicles built around the world. Recent advances in chopped fiber materials, low density GMTs, and thin, stampable GMTs have led to new and improved applications and processes. This paper will illustrate the materials, processes, and applications for these new generations of GMT.

## HEAVY DUTY TRUCK PLASTIC COMPOSITE DOOR MODULE & TRIM SYSTEM

Geoffrey Barr  
Delphi Interiors & Closures

Delphi AHG and Freightliner Corporation have cooperated to design and implement a highly integrated, cost effective and high quality solution in record time for the new Freightliner P3 Class 8 truck door system. The material selected is injection molded 40% glass fiber, mega-coupled polypropylene that meets performance requirements and has a Class A finish, allowing trim to be integrated with the hardware panel for the first time. The design process included extensive FEA, modal analysis and testing to meet extreme environments and high durability expectations for the heavy duty truck market. Details from concept to production stage of this structural, Class A carrier plate are presented.



## PEDESTRIAN SAFETY VALIDATION OF A HIGH-PERFORMANCE THERMOPLASTIC COMPOSITE HOOD

Derek Buckmaster  
GE Plastics

One of the challenges to be met by a new material for hood applications is to meet the new requirements for pedestrian protection that have been introduced in Europe and Japan. As one of the key technology developments carried out for the Hyundai HED-4 QarmaQ advanced technology demonstration vehicle developed by Hyundai and GE Plastics, a new hood design was created for manufacture with the HPPC sandwich. Semi-production compression-molding tooling was built, and parts were produced to enable a series of head impact tests to be completed. The test results indicated that the energy absorption characteristics of HPPC allow such a hood to meet the pedestrian safety requirements without the need for extra intrusion into the engine bay.

## Part 4: Materials / Recycling (Thur.)

### INJECTION MOLDED LONG GLASS FIBRE POLYPROPYLENE COMPOSITES FOR AUTOMOTIVE APPLICATIONS

Mark Goldhawk  
Dow Chemical

Use of long-fibre reinforcements has led to the introduction of many engineered solutions for applications which were once solely the province of metal. Long glass fibre combined with a highly economical and processable polymer like polypropylene offers advantages for both the designer, in terms of weight reduction, design flexibility, and cost savings, as well as to the moulder, in terms of efficiency and productivity. This polymeric solution is further enhanced when combined with unique bonding materials that allow bonding with metal for structural enhancement. This presentation reviews the development of a long glass fibre polypropylene polymer in concert with a unique adhesive solution to form a polymer-metal hybrid solution, which is demonstrated in a structural, modular automotive front end carrier.

### COMMERCIALLY VIABLE RECYCLING SCHEME FOR LONG-FIBER REINFORCED PP INSTRUMENT PANELS

Robert Egbers  
American Commodities Inc.

Soft, padded instrument panels molded from LFPP have areas for HVAC outlets and air bag doors, IP clusters, and glove box doors that are molded over with substrate/urethane foam/skin and then subsequently die-punched out. These areas are molded over to prevent foam bleed to the backside of the IP during the production foaming process. Traditionally, the "punch outs" have gone to landfill. WIPAG Recycling in Germany has developed a process whereby the substrate is recovered from the foam and skin into a pure stream that can subsequently be blended back into virgin production at a specified percentage without affecting physical properties of the LFPP IP substrate. The WIPAG laminate separation process has been in commercial operation at American Commodities Inc. for the past 7 years albeit with SMA, PC/ABS and TPO substrates.

### LONG FIBER REINFORCED THERMOPLASTICS FOR AUTOMOTIVE APPLICATIONS

Jian Tao  
Chrysler LLC

Today's automakers are facing more challenges than ever. The type of plastics being selected for use in future vehicles is driven by economics, fuel efficiency, recyclability, occupant safety, innovations and performance. These factors are resulting in tremendous growth within the automotive industry for long glass fiber reinforced thermoplastics with polypropylene (LGFPP). The presentation will review different LGFPP materials, processes, assembly methods, quality control and structural applications utilized on Chrysler vehicles that are newly introduced into the market.



# VIRTUAL PROTOTYPING & TESTING (TUE.)

## FROM PROCESS MODELING TO ELASTIC PROPERTY PREDICTION FOR LONG-FIBER INJECTION-MOLDED THERMOPLASTICS

Ba Nghiep Nguyen

Pacific Northwest National Laboratory

*This paper presents an experimental-modeling approach to predict the elastic properties of long-fiber injection-molded thermoplastics (LFTs). The approach accounts for fiber length and orientation distributions in LFTs and predictions agree reasonably well with experimental LFT data.*

## FIBER LENGTH DISTRIBUTION MEASUREMENT FOR LONG GLASS & CARBON FIBER REINFORCED INJECTION MOLDED THERMOPLASTICS

Vlastimil Kunc

Oak Ridge National Laboratory

*Procedures for fiber length distribution (FLD) measurement of long fiber reinforced injection molded thermoplastics were refined for glass and carbon fibers. Techniques for sample selection, fiber separation, digitization and length measurement for both fiber types are described in detail. Quantitative FLD results are provided for glass and carbon reinforced polypropylene samples molded with a nominal original fiber length of 12.7 mm (1/2 in.) using equipment optimized for molding short fiber reinforced thermoplastics.*

## STRAIN RATE EFFECTS ON THE ENERGY ABSORPTION OF RAPIDLY MANUFACTURED COMPOSITE TUBES

Aaron Brighton

Deakin University

*As a result of recent increases in fuel prices and the growing number of accident fatalities, the two major concerns of the automotive industry and their customers are now occupant safety and fuel economy. Increasing the amount of energy and optimizing the manner in which energy is absorbed within vehicle crush zones can improve occupant survivability in the event of a crash, while fuel economy is improved through a reduction in weight. Axial crush tests were conducted on tubular specimens of carbon/epoxy and glass/polypropylene. This presentation presents results from the tests conducted at quasi-static rates.*

## LONG FIBER INJECTION MOLDED THERMOPLASTIC – FIBER ATTRITION ANALYSIS AND CHARACTERIZATION

J.D. Holbery

Pacific Northwest National Laboratory

*In fiber reinforced composites, loads are not directly applied to the fibers; rather, loads are applied to the matrix material and transferred to the fibers through fiber ends and the cylindrical surface of the fiber near the ends. With fiber reinforced injection molded composites, understanding the final fiber length and fiber length distribution as a result of processing and equipment parameters is critical to accurately predict the mechanical properties of the final composite. In this study, molding parameters of glass and carbon long fiber polypropylene composites were evaluated for fiber attrition using a variety of techniques.*

## TOWARD THE DEVELOPMENT OF A TEST STANDARD FOR CHARACTERIZING THE ENERGY ABSORPTION OF COMPOSITE MATERIALS: PART II

Paolo Feraboli

University of Washington

*A simple corrugated specimen is proposed as a new test method for determining the crashworthiness energy absorption of composite materials as it offers several advantages over flat plate test specimens.*

## MODELING AUTOMOTIVE COMPOSITE STRUCTURES USING LS-DYNA®

Xinran (Sharon) Xiao

General Motors Corp.

*While the material anisotropy and the tendency to brittle fracture present challenges for constitutive models for composites in general, a reasonable prediction may be achieved for a specific application. This presentation discusses composite material models in LS-DYNA simulations through three examples: a B-Pillar structure, a hood structure and a tubular structure representing the front rail application.*

## X-RAY COMPUTER TOMOGRAPHY AND REAL TIME ULTRASONIC INSPECTION AS PROCESS DEVELOPMENT TOOLS FOR DISCONTINUOUS FIBER COMPOSITES

J.D. Holbery

Pacific Northwest National Laboratory

*X-ray Computer Tomography (XCT) and Real Time Ultrasonic Inspection (RTUIS) have been used to analyze fiber orientation and flow patterns in both discontinuous long-fiber thermoset composites and in long-fiber injection molded composites. PNNL has developed the XCT and RTUIS techniques to be specifically applicable to long-fiber injection molded thermoplastics and random long-fiber thermoset molded composites. These techniques provide a basis for optimizing process parameters and fiber orientations. Examples of the techniques in practice are provided on both injection molded and compression molded parts.*



## STRUCTURAL COMPOSITES (TUE.)

### DEVELOPMENT AND BUILD OF THE FORD FOCUS FCV LIGHTWEIGHT CARBON FIBER DECKLID

Hannes Fuchs  
Multimatic

*Ford Motor Co. contracted Multimatic to develop and supply a niche volume vehicle, low investment cost, and lightweight decklid for the Focus Fuel Cell Vehicle (FCV) program. Aluminum was considered but was considered infeasible. A carbon fiber solution was proposed offering low investment and low weight, but a fully production ready, North American OEM, Class A carbon composite closure had never been attempted at the time of this program. This presentation describes the methodology used to conduct engineering and development of the decklid, which was produced using carbon fiber/epoxy prepreg materials and aramid honeycomb cores that were autoclave cured using single-sided tooling. The final decklid offered 60% mass reduction vs. baseline production of a steel decklid.*

### FEM DAIMLERCHRYSLER S-CLASS COUPE IN GMTex

Karl-Heinz Kalmbach  
Quadrant Plastic Composites

*A new front end design combined with newly developed GMTex materials have recently been launched in a serial production vehicle. Despite very high safety and impact requirements, this new front end is designed without additional metal reinforcement for the first time with thermoplastic composite materials.*

### INNOVATIVE STRUCTURAL THERMOPLASTIC AIR CONDITIONING ROOF COVER DOOR FOR MASS TRANSIT BUS

Uday Vaidya  
University of Alabama at Birmingham

*An aluminum air-conditioning roof cover door for a mass-transit bus was successfully replaced by a thermoplastic composite solution. The innovative thermoplastic composite door was designed and fabricated using a vacuum forming approach, resulting in a weight savings of 39% vs. the metal door.*

## NEW COMPOSITE MATERIALS & PROCESSES (TUE. & THUR.)

### NEW LONG FIBER THERMOPLASTIC COMPOSITE PRODUCTS FOR THE AUTOMOTIVE INDUSTRY

Thomas Ebeling  
AZDEL, Inc.

*To meet the demands of composite sheet applications, a new generation of long-fiber thermoplastic composite products has been developed based on proprietary formulation technology. These innovative products are characterized by improved processability and improved mechanical performance enabling greater freedom in part design and reduced per-part cost. Also included are new products with reduced environmental impact.*

### NEW PROCESSING METHOD AND MATERIALS FOR ADVANCED COMPOSITE FABRICATION

Tom Heyer  
Ticona Engineering Polymers

*Continuous fiber reinforced thermoplastic materials can bring a wide range of benefits to composite designs. The use of appropriately selected continuous fiber reinforced thermoplastic prepregs with the Quickstep process can efficiently produce fully consolidated composites.*

### ADVANCED COMPOSITE POLYMER FOR AUTOMOTIVE - LONG GLASS FIBER LINEAR POLYPHENYLENE SULFIDE

Walt Maruszczak  
Ticona Engineering Polymers

*For engineered component/system applications, long glass fiber linear PPS products provide a strong combination of elevated temperature performance, chemical resistance and enhanced creep properties to compete effectively with both thermoset polymers and various metals. Next generation designs require products that meet the best combination of performance and cost, thereby driving the evolution of alternative materials.*

### NEW COMPOSITE MATERIAL FOR AUTOMOTIVE INDUSTRY: LONG GLASS FIBER THERMOPLASTIC POLYACETAL (LFT-POM)

Vinícius Fernando Mardegan  
Ticona Engineering Polymers

*A long glass fiber polyacetal (POM) material has been developed offering a unique combination of stiffness and impact resistance along with typical POM properties. This presentation provides an overview of the product, its manufacturing process, product properties vs. other commercially available materials, and targeted applications for future development.*

### ELECTRICALLY CONDUCTIVE ACETALS FOR FUEL ENVIRONMENTS

Jeremy Klug  
Ticona Engineering Polymers

*Polyacetal traditionally has found use in applications involving fuel contact due to its inherent strength, stiffness and dimensional stability in these environments. This presentation focuses on conductive acetals including performance after fuel exposure. Different additives used to impart electrical conductivity will be discussed and the challenges involved in formulating a robust material presented.*



# ADVANCES IN THERMOSET COMPOSITES (WED.)

## Part 1: Managing Costs

### REAL TIME PRODUCTION PROCESS CONTROL FOR THE COMPOSITES INDUSTRY

Pat DePalma

Meridian Automotive Systems

*Impedance sensing technology provides a method for thermoset molders to monitor the changing electrical properties of the thermoset as it cures to determine the appropriate time to end the cure. The technology uses low-voltage sensors mounted in the mold and computer software to analyze the resulting signal. This presentation reviews the implementation of impedance sensing technology in thermoset injection and compression applications as well as some results from a few production installations.*

### APPLICATIONS & MARKETS FOR RENEWABLE RESOURCE BASED SHEET MOLDING COMPOUND

Rob Seats

Ashland Inc.

*Unsaturated polyester resins based on renewable resource raw materials (soy and corn) have been commercially available since the late 1990s. These resins have successfully been formulated into sheet molding compound and are compression molded into parts used by the John Deere Corporation to manufacture farm machinery. This presentation will discuss the economics and environmental effects of using renewable resource based composites, describe the current applications where the technology is being used, and consider the future of bio based technology in the composites industry.*

### INVESTIGATION OF SHEET MOLDING COMPOUND FABRICATED FROM SOY-BASED & PETROLEUM-BASED RESINS

Libby Berger

General Motors Corp.

*Plaques fabricated from SMC with soy-based resins in both glass-reinforced and carbon-reinforced versions are compared with the equivalent petroleum-based SMC. These materials potentially provide the automotive industry with a method of decoupling composite materials costs from petroleum prices, and of decreasing the lifecycle CO<sub>2</sub> evolution of our vehicles. Plaques were evaluated for mechanical properties, thermal properties, and humidity aging.*

### LOOKING AHEAD: POSITIONING YOURSELF TO PURSUE FUTURE MARKETS WITH FLEXIBLE COMPOSITE SPRAY MOLDING (CSM) EQUIPMENT SYSTEMS

Jim Riley

Hennecke Machinery

*A company venturing into polyurethane spray molding often experiences some anxiety due to the financial commitment required to purchase the processing equipment. When markets change, continued success is often determined by the flexibility and production capability of the equipment. Spray molders need to purchase spray equipment that is both flexible and versatile and will allow them to pursue new product areas and markets, or adapt to a changing market.*

## Part 2: Design with Composites

### ADVANCED COMPOUNDS FOR SUPERIOR PARTS

Glenn Mazza

Menzolit Compounds International

*The paper shows the rising demands for SMC automotive applications in Europe coming from legislation, environmental pressure and from the OEMs.*

### COMPOSITE DESIGN INNOVATIONS: THE NISSAN TRUNK DIVIDER HYBRID PANEL

Matthew Vagi

Meridian Automotive Systems

*The 2007 redesigned Nissan Sentra includes a unique trunk divider panel system that utilizes several different composite materials. The multi-piece (hybrid) main panel consists of a compression molded SMC 'inner' panel, an in-mold carpeted flax fiber-filled polypropylene 'outer' panel, integral glass-filled grocery hooks, and two-way latching mechanism. This system meets all required cost, mass, performance / functionality, and quality targets. This presentation will focus on the design, development, materials, testing, and manufacturing methods applied to bring this 'hybrid' composite system to market.*

### DESIGNING WITH THERMOSET COMPOSITES

Cedric Ball

Ashland Inc.

*Automotive OEMs cite the difficulty in modeling composites as a significant barrier to their wider use. Accurate materials characterization is increasingly important to create the most cost-effective and reliable designs. This presentation surveys some of the tools available for optimizing high volume automotive designs in thermoset composites, namely sheet molding compound (SMC), and describes the range of resources from qualitative design guides to quantitative prediction models.*



# ADVANCES IN THERMOSET COMPOSITES (WED.)

## Part 3: New Technologies

### NEAR READY, REAL POTENTIAL: THE FEASIBILITY OF USING NATURAL FIBRES FOR REINFORCING THERMOSET COMPOSITE PARTS FOR GROUND TRANSPORTATION APPLICATIONS

Mercedes Alcock  
Composites Innovation Center

*This presentation discusses the feasibility of using natural fibres to replace E-glass reinforcements in the manufacture of thermoset composite parts for the ground transportation market. Performance is evaluated from both an economic and technical perspective, with emphasis on the near-ready potential of natural fibres. Also presented is an overview on the optimization initiatives that have been launched to capitalize on the real potential of natural fibres.*

### NEW PROCESS TECHNOLOGY FOR THERMOSET FIBER REINFORCED COMPOSITE MATERIALS WITH THE D-TSC PROCESS

Frank Mack  
Coperion Werner & Pfleiderer

*Fiber reinforced composite materials based on polyester resins have proven themselves as materials of construction since their market launch in the early 1960s. They are good electrical isolators, offer good thermal and chemical resistance, and freedom of geometry at low tooling costs and low weight, which is why they were established first in the electrical and then in the automotive industries. ETAA (Extrusion of Thermosets for Automotive Applications) is a new process where thermoset composite materials are compounded, extruded, and directly molded into parts.*

### DIRECT SMC — A NEW PROCESS FOR THE PRODUCTION OF FIBER REINFORCED THERMOSET COMPONENTS THROUGH A ONE-STEP DIRECT PROCESS

Ruediger Braeuning  
Fraunhofer ICT

*Today, automotive body panels that meet the requirements for Class A surfaces are often manufactured from sheet molding compound (SMC). This process, that is based on the semi-finished product SMC, results in fluctuations in SMC quality mainly due to the maturation process and therefore also component quality. This presentation reviews the fundamentals of the material system, state of the art and research of the equipment and process technology in the field of manufacturing of composites based on thermoplastic (also direct processes) and thermoset resins as well as the subsequent steps of the process for the production of fiber-reinforced thermoset SMC components through a one-step direct process. Finally the direct process is characterized in respect to surface quality, mechanical properties, as well as the influence of fiber content and length.*

## Part 4: New Materials

### PLANT TRIALS FOR POWDER PRIMING OF SMC

Hamid Kia  
General Motors R&D

*Based on the information generated at the GM R&D Center, six SMC formulations were developed and produced by SMC suppliers and subsequently molded into automotive body panels for powder primer application readiness tests. The panels were evaluated in the lab for shrinkage, moisture absorption, adhesion to the conductive coating, and powder application. Based on the results, which will be presented here, all six formulations were approved for plant trials.*

### REDUCTION OF STYRENE EVOLUTION FROM THERMOSET POLYESTER RESIN COMPOSITES

Doug Denton  
Chrysler LLC

*The odor of styrene from polyester resin composites in the passenger compartment of cars and trucks can be objectionable. Using various test methods and part fabrication approaches, a composite-intensive coupé sports car was developed with low styrene emission rates.*

### CHARACTERIZATION OF HIGH PERFORMANCE SHORT CARBON FIBER / EPOXY SYSTEMS: EFFECT OF FIBER LENGTH

Paolo Feraboli  
University of Washington

*This presentation establishes the relationship between the fiber length and the mechanical and processing behavior of advanced discontinuous carbon/epoxy prepreg systems for compression molding applications.*

### RECENT DEVELOPMENTS IN UV STABLE SMC TECHNOLOGY

Rob Seats  
Ashland Inc.

*The desire for weatherable sheet molding compound (SMC) for use in a wide range of applications is growing due to the potential of eliminating paint or coatings, which can result in significant cost savings and an improved environmental profile for the article. Weatherable SMC technology has been previously available but has been designed for specific applications and transfer of this technology into other application areas has resulted in some performance issues. This presentation discusses new developments in weatherable sheet molding compound technology that allow its use in a wider range of application areas.*



## NANOCOMPOSITES (WED.)

### NANO-FIBRILLATED HIGH-MODULUS DUCTILE (HMD) TECHNOLOGY IN ENVIRONMENTALLY SUSTAINABLE XENOY IQ\* RESINS

Vikram Gopal  
GE Plastics

*High modulus ductile (HMD) products feature a highly fibrillated nano network combined with state-of-the-art mineral filler technology, allowing for retention of impact and tensile properties while increasing the modulus of molded articles. Incorporating this technology in PC/PBT and PC/PET resins results in superior chemical resistance, low CTE, excellent tensile strength, fatigue, and low temperature ductility. We will present a case study where HMD technology was combined with our environmentally sustainable, low carbon footprint resin offering excellent part performance, lighter weight, and increased first-pass yield during processing.*

### EXFOLIATED GRAPHITE NANOPATELET (xGnP) / POLYPROPYLENE NANOCOMPOSITES

Hwanman Park  
Michigan State University

*Graphite is an abundant natural mineral and one of the stiffest materials found in nature, with excellent electrical and thermal conductivity. Polymer matrices reinforced with new exfoliated graphite filler can produce composites with improved mechanical, thermal and electrical properties. Research to explore fabrication method and processing conditions via factorial design of experiments, and how they influence the properties of exfoliated graphite nanoplatelet (xGnP)/PP nanocomposites has been conducted. Results provide a fundamental understanding of how processing and the resulting distribution of xGnP within the final composite can affect the physical and mechanical properties of xGnP/PP nanocomposites.*

### FABRICATION AND CHARACTERIZATION OF NEAT AND NANOPHASED POLYURETHANE FOAM

Yuanxin Zhou  
Tuskegee University

*In this study, 1 wt% carbon nanofiber (CNF) and TiO<sub>2</sub> nanoparticles have been infused in part A of polyurethane (PUR) foam by ultrasound sonication, then mixed with part B of PUR foam by mechanical stirrer. Tensile, flexural and compression tests were performed to evaluate mechanical performance of neat and nanophased PUR foams. Experimental results show that CNF reinforced PUR foam exhibits the highest tensile strength, flexural strength and compression strength vs. other PUR foams.*

### EXFOLIATED GRAPHITE NANOPATELET - VINYL ESTER NANOCOMPOSITES

Wanjun Liu  
Michigan State University

*Recent research has shown that it is possible to exfoliate natural graphite into platelets having thicknesses of less than 10 nm and diameters of any size from sub-micron to 15 microns or greater. Since graphite is one of the stiffest materials found in nature and also has excellent electrical and thermal conductivity, the addition of these nanographite platelets to polymers can impart a combination of desirable mechanical, electrical, thermal and barrier properties to the resulting nanocomposite. We have investigated the addition of exfoliated graphite nanoplatelets (xGnP) to a vinyl ester resin to achieve a nanocomposite with an optimum combination of conductivity and mechanical properties.*

### NANOCOMPOSITES FOR AUTOMOTIVE APPLICATIONS

Péter Krüger  
Bayer MaterialScience AG

*This presentation will discuss nanotechnology with respect to material sciences related to automotive applications, such as nano-enabled intermediates for intelligent materials and surfaces with new and improved properties. Technical aspects of nano-modified coatings raw materials, adhesive raw materials and especially of carbon nanotubes as a novel nano-additive will be highlighted in more detail. Finally the contribution will also briefly refer to responsible-care issues.*

### CARBON NANOTUBES: NEW MARKETS & DEVELOPING APPLICATIONS

Andy Rich  
Nanocyl S.A.

*Once only a few high-end applications could afford the cost, but now carbon nanotubes are serious competition for carbon black because they offer additional performance advantages at a competitive price. Carbon nanotubes can provide ESD properties, heat dissipation, heat distortion improvements, and flame retardance, with minimal negative effects on overall mechanical properties.*

### DEVELOPMENT & THERMO-PHYSICAL PROPERTIES OF BIO-BASED POLYMER / CLAY NANOCOMPOSITES

Mahmoodul Haq  
Michigan State University

*Bio-based resin systems from blends of epoxidized soya bean oil and unsaturated polyester were reinforced with layered silicates. Tensile properties, moisture absorption, and microscopy characterization for diverse material systems are presented. Results showed that a stiffness-toughness balance along with enhancement in hygro-thermal properties can be obtained.*



# ENABLING TECHNOLOGIES / FINISHING (WED.)

## DIFFERENTIATED COMPRESSION MOLDING: A NEW PROCESS INNOVATION CREATES DRAMATIC COST SAVINGS & PRODUCT IMPROVEMENTS FOR COMPRESSION-MOLDED APPLICATIONS

Harald Herbst  
Borealis Compounds LLC

While conducting flow analysis on compression mold tooling, it became clear to the author that there was certain process limiting obstacles that could be overcome by tool modifications. This presentation describes those tool modifications, and the resulting process heretofore known as Differentiated Compression Molding. Mold flow analysis on tools that takes advantage of these modifications has demonstrated that the compression process can be accomplished with roughly 70% lower clamp forces and energy consumption.

## ADVANCED PROCESSING OF LONG-FIBER REINFORCED POLYMERS

Heinrich Ernst  
Dieffenbacher GmbH & Co. KG

This presentation will describe the increase in part performance by local continuous fiber reinforcements as well as the necessary process modifications. Future applications for long-fiber reinforced thermosets are focusing on Class-A body panels. The presentation will give a short introduction about the state-of-the art in advanced SMC molding of the Class-A trunklid of the new Volkswagen EOS as well as an outlook in a new process development for in-line processing of thermoset composites.

## ELECTROSPUN NANOFIBER ARCHITECTURES: A NEW CLASS OF NONWOVENS FOR THE TRANSPORTATION SECTOR

Manju Misra  
Michigan State University

Electrospinning is a rapidly developing technology that provides a unique way to controllably produce nanofibers with diameters typically in the range from 10-500 nm from a variety of solutions or melts. Extraordinary properties arise from the enhanced surface area-to-volume ratio of electrospun nanofibers, which makes them suitable for high value applications such as filtration media, ceramics, composites, biomedical, insulation, and energy storage. Recent developments in design and engineering of novel nonwoven nanofiber architectures through electrospinning along with their applications in the transportation sector will be highlighted in this presentation.



## DEVELOPMENT OF A TOOL TO MEASURE BOND-LINE READ THROUGH

Kedzie Fernholz  
Ford Motor Co.

The Automotive Composites Consortium Joining Working Group (ACCJWG) teamed with Visual Technologies and EOS Technologies to develop a measurement system for quantifying the severity of "bond-line read-through" (BLRT). BLRT is a visual defect that can occur when two panels are bonded together. For the set of panels used to develop the initial algorithm, the score developed was shown to correlate well to the visual assessment of the panels. Furthermore, since the metric is based on measured physical characteristics of the defects, it provides a unique method for objectively quantifying the severity of BLRT defects.

## DELTA PT: A SUPERIOR THREAD-FORMER FOR PLASTICS

Joe Gobernatz  
ATF Assembly Solution

This presentation traces the evolution of thread-forming fasteners for plastics, design consideration for plastic joints, and the development of the Delta PT screw, which reduces radial stress, improves joint stability, offers superior mechanical strength and vibration resistance, and is serviceable.

## ACCELERATED THERMO-MOLECULAR ADHESION PROCESS (ATMAP) — AN ADVANCED SURFACE TREATMENT TECHNOLOGY

Russell Brynolf  
FTS Technologies

This presentation discusses the Accelerated Thermo-Molecular Adhesion Process (ATmaP®) - an advanced surface treatment technology for painting or bonding plastics, metals, and composites, including potential cost and environmental benefits.

## EVALUATING EXTRUSION COMPRESSION MOLDING FOR IMPARTING BETTER SURFACE FINISH IN LONG FIBER THERMOPLASTICS USING IN-MOLD FILM TECHNOLOGY

Pritam Das  
National Composite Center

Extrusion compression molding of long-fiber thermoplastics (LFT) is combined with in-mold thermoplastic olefin (TPO) films to impart a good surface finish. Process variables affecting the quality of the surface film in the final compression-molded parts are investigated using Design of Experiments.

## NICKEL VAPOR DEPOSITION SHELL TOOLING APPLICATIONS

Rob Sheppard  
Weber Manufacturing

This presentation discusses the benefits nickel-vapor-deposition (NVD) tooling can provide applications requiring a leather or technical grain surface. It describes how such tooling is produced and why it provides superior surface detailing and then illustrates current applications making use of NVD tooling.



## ENABLING TECHNOLOGIES / FINISHING (WED.)

### RTM TECHNOLOGY IMPROVEMENT WITH TOOL SURFACE HEATING BY INDUCTION

Arnaud Riva  
RocTool

*This presentation discusses the application of RocTool's inductive surface heating technology to RTM processing to achieve higher speed RTM cycle times.*

### INTEGRATING CARBON FIBRE CLOSURES INTO SHORT-SERIES PREMIUM VEHICLES

Martin Starkey  
Gurit

*Over the last few years the automotive market has continued to adopt carbon fibre taking it from a super car exotic to an engineering material available to the premium car market. This year has seen these technologies reach a significant milestone and this presentation will detail how the productionisation of advanced carbon fibre based Class A body closures has been secured for the premium automobile market, driving performance and productivity of automotive Class A composites.*

### DIRECT ATTACHMENT OF METAL INSERTS TO BAYPREG POLYURETHANE COMPOSITES

Ronald Cageao  
Bayer MaterialScience

*Polyurethane (PUR) honeycomb composite is used for automotive sunshades and load floors due to the material's high stiffness and low weight. A key advantage of urethane composites is the ability to provide parts consolidation. Incorporation of metal connectors or hinges is feasible during molding, eliminating secondary operations that add cost. An obvious concern is how well the metal bonds to the finished part and whether there is a need to treat the metal insert before molding. This presentation discusses work done with steel and aluminum inserts that have been pre-treated in several ways and directly molded with PUR composites. The pull-out forces recorded during testing are compared and conclusions are presented as to the best pre-treatment scenario based upon insert material type.*

## BIO- & NATURAL FIBER COMPOSITES (THUR.)

### DEVELOPMENT OF NATURAL FIBER HYBRID COMPOSITES WITH IMPROVED STIFFNESS

P.K. Mallick  
University of Michigan-Dearborn

*Use of natural fiber composites is increasing in the automotive industry as well as in other industries. A key design issue in many natural fiber composite applications is stiffness. In this study, we combined a natural fiber/polypropylene composite with either directional polypropylene or carbon fibers with the objective of improving the stiffness. Compression molded plates were prepared with various combinations of these materials. Tensile and flexural moduli of the combined materials were determined and are reported in this presentation.*



### EFFECT OF ADDITIVES ON THE STRUCTURE AND PROPERTIES OF WHEAT STRAW-POLYPROPYLENE COMPOSITES

Leonardo Simon  
University of Waterloo

*Natural fibers from agricultural activities can be used as a source of renewable materials for the automotive industry. Residues from certain crops, such as wheat straw, are promising bio-fillers for polypropylene based thermoplastics. However, degradation of such bio-fillers due to temperature during manufacturing or water during its final application are factors that have to be carefully considered.*

### SMART INSTRUMENT PANEL (IP) BOARD & KNEE-PAD MADE OF NATURAL FIBER COMPOSITES

Carl-Heinz Fahnster  
Quadrant Plastic Composites AG

*Carriers of interior automotive parts are more and more made of natural fiber composites due to the advantages of weight reduction as well as the desire to use more renewable resources. This presentation discusses the application of natural fiber composites as carrier materials for the instrument panel decoration and knee-pad of the new smart for two mini car.*

### PROCESSING OPPORTUNITIES IN NATURAL FIBER COMPOSITES – RETTING, SURFACE MODIFICATION, AND PREFORM MANUFACTURING SYNERGY

J.D. Holbery  
Pacific Northwest National Laboratory

*Utilization of lightweight, low-cost natural fibers offers the potential to replace a large segment of the glass and mineral fillers in numerous automotive interior and exterior parts, but major challenges remain in order to achieve large-scale automotive insertion. In this presentation, three critical barriers will be discussed including (1) fiber retting processes and the barrier to rapid fiber preparation, (2) production methods for fiber preforms tailorably to specific applications, and (3) rapid composite molding processes applicable to high-volume manufacture. Alternatives to each of these challenges will be presented and strategies for process development will be discussed.*

### NATURAL FIBER REINFORCED BIODEGRADABLE POLYMER COMPOSITES FOR AUTOMOTIVE APPLICATIONS

Manju Misra  
Michigan State University

*Natural fiber reinforced renewable resource based laminated composites were prepared from biodegradable poly(lactic acid) (PLA) and untreated or surface-treated kenaf fibers and bamboo fibers by compression molding using the film stacking method. This study demonstrated that a laminated composite with good mechanical and thermo-mechanical properties could be successfully developed using kenaf fibers and bamboo as the reinforcing agents and PLA as a matrix. Overall, biodegradable polymer products based on renewable agricultural feedstock can form the basis for a portfolio of eco-efficient products that can compete in a market currently dominated by products based on petroleum feedstock.*



# BIO- & NATURAL FIBER COMPOSITES (THUR.)

## HYBRID BIO-BASED COMPOSITES FROM NANO-REINFORCED BIO-PETRO POLYMER BLENDS & NATURAL FIBERS

Rigoberto Burgueño  
Michigan State University

*Hybrid biocomposites were made from blends of unsaturated polyester and epoxidized soybean oil reinforced with nanoclay and industrial hemp. Tensile properties, moisture absorption, and microscopy observations of fracture surfaces are presented. Results provided an initial benchmark for identifying an optimum material design that maximizes the synergy of the constituents.*

## RENEWABLE BIO-COMPOSITES FOR AUTOMOTIVE APPLICATIONS

Angela Harris  
Ford Motor Co.

*Over recent years, much attention has been given to potential applications of polylactide (PLA), one of the most promising bio-based resins commercially available, as a replacement for petroleum-based polymers. For this study, renewable reinforcements such as soy flour, cellulose, and corn starch, were chosen to make up a fully bio-based composite system for potential automotive applications.*

# KEYNOTE SPEAKERS

## PLASTICS ARE FOR CARS AFTER ALL - THE REST OF THE STORY

Michael Fisher  
American Chemistry Council

*Each day cars are seen by both public and private sectors as targets for change and agents for change toward a sustainable future. Plastics, plastic composites, and indeed the broader business of chemistry are being recognized as the vehicle of choice to lead change and help navigate through change. This presentation continues some of the enabling themes introduced last year that support innovation along with a progress update on key ACC Automotive Group technical and advocacy initiatives such as the PCIV Safety Roadmap in partnership with DOT/NHTSA.*

## IS THE AUTO INDUSTRY READY FOR THE CARBON FIBER INDUSTRY & VICE VERSA?

Chuck Segal  
OMNIA LLC

*Carbon fiber composites have been proposed, and tried, in automotive applications for more than 30 years. While a certain degree of technical success has been realized, the major impediments to wide acceptance have been (a) the price of technically-suitable carbon fibers, (b) inadequate availability of fiber, and (c) the absence of high-speed, low-cost production processes. The good news is that these issues have been addressed, and there are signs that the carbon fiber industry is now ready to service not only today's high-performance vehicles, but also the future everyman's street vehicle. The optimistic view would be that these two industries are ready to move forward on a major scale by the year 2012. The realist will argue that we have claimed to be at this point before. Hopefully, there is no room for pessimism in either industry.*

## OVERVIEW OF USE OF COMPOSITES IN CHINA AUTOMOTIVE INDUSTRY

Victor Liu  
AZDEL, Inc.

*This presentation discusses the use of fiber-reinforced plastic composite materials in Chinese markets, particularly the automotive industry. It also discusses trends for greater composites use and how to do business in China.*

## COMPOSITE PROCESS TECHNOLOGY & INNOVATION AT BOEING

Robert Kisch  
The Boeing Company

*Boeing has been researching advanced carbon composites for over three decades but wide-scale production use has been limited by the costs of the raw materials and fabrication processes. Recent advances in automated processes have allowed a much greater percentage of composites structure on the 787. Advances in these areas make large-scale use of composites more affordable, which will increase usage, and in turn further reduce raw material costs.*

## HOW THE THERMOSET COMPOSITES INDUSTRY CAN HELP MEET THE CHANGING NEEDS OF THE TRANSPORTATION INDUSTRY

Richard Morrison  
The Molded Fiber Glass Companies

*The composites industry has enjoyed many successes in the last decade in a number of industrial segments. Society is imposing new demands on industry for the next decade. We are prepared to meet those challenges but we need to work together to achieve the goals.*

## BIO-CARS: WHERE WE ARE & WHERE WE ARE MOVING!

Amar Mohanty  
Michigan State University

*Sky-rocketing crude-oil prices, national security, and environmental threats are daily headlines. Consumer desire and government push for green products and energy conservation are also major factors driving research toward renewable resource-based materials. R&D has proved the ability of natural fiber composites and biobased materials to replace certain non-renewable materials in several auto-structures, especially interior applications. This presentation highlights the status, opportunities and challenges of bioplastics, natural fiber composites, and biobased materials in designing greener automotive parts.*

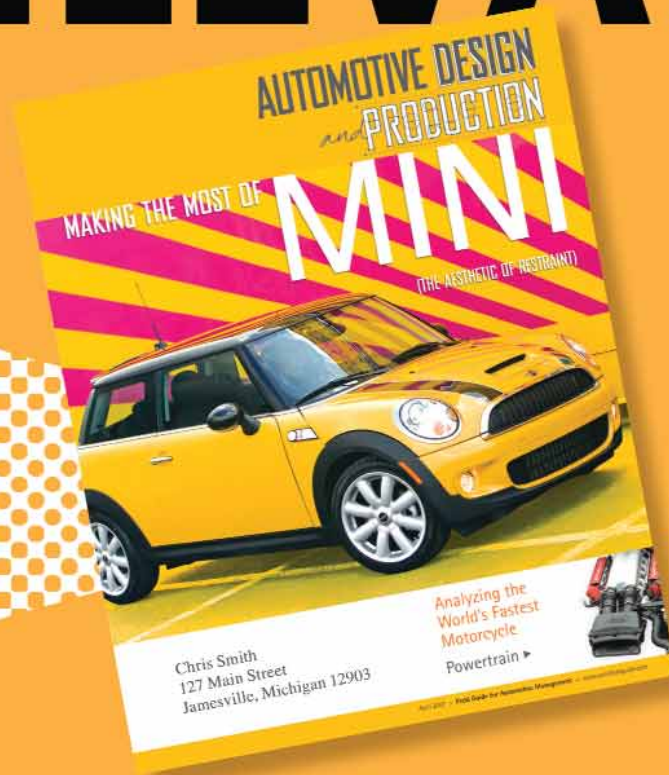
## CURRENT & FUTURE MARKET FOR LONG-FIBER REINFORCED THERMOPLASTICS

Abbe Scheiner  
Townsend Polymer Services & Information

*The LFT automotive market has seen incredible growth in recent years, with significant investments being made in materials and equipment innovations. Designers and engineers now have greater freedom to reduce molded part cost. Overall, the market has been driven by the lowest, cost-in-use of LFT. The presentation will discuss results of a new global study on LFT.*



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## 1ST-SPE ACCE SCHOLARSHIPS FOR GRADUATE RESEARCH IN COMPOSITES GIVEN IN HONOR OF JOURNALIST, STEVE LOUD



The first SPE ACCE scholarships for graduate research in composites are being given this year in honor of longtime composites industry insider and journalist, Steve Loud, who died last summer.

"I think Steve could have easily worn the title of 'Mr. Composite,'" his wife, Susan Loud says. "He was such a believer in the composites industry and did his best to support it and move it forward during his 43-year career."

Steve was born in Detroit and grew up in nearby Birmingham, Mich. in a family that worked for the auto industry. He received a degree in Business from the University of Michigan in 1963 and began his career at Owens Corning in sales and marketing, where he stayed for the next 18 years. In 1981, Steve moved his family to California to become vice-president of Teledyne Ryan before starting his own company, Composites Worldwide. With his wife, Susan, he published award-winning print and online newsletters on high-performance composite materials and processes, plus maintained the Composites News supersite on the Web.

Throughout his career, Steve was a member and supporter of a number of professional organizations and conferences. Both Steve and Susan were also media sponsors and big supporters of the *SPE ACCE* and the *Innovation Awards Gala*, which for them "felt like coming home," said Susan Loud.

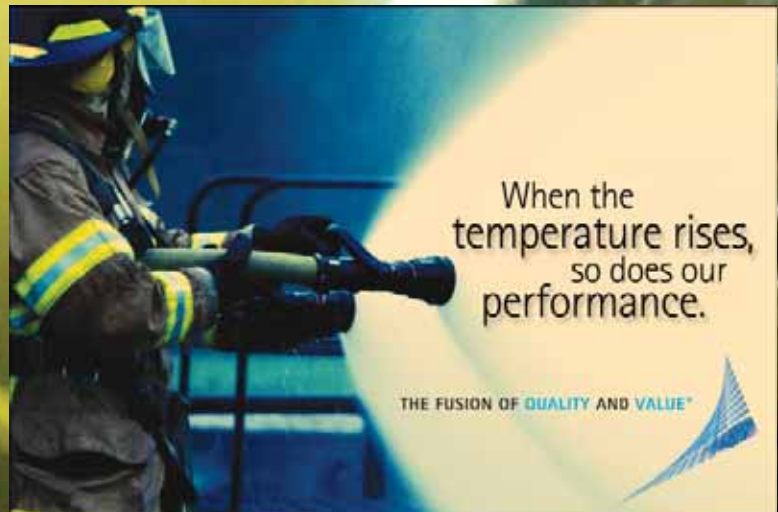
Student winners of the first SPE ACCE graduate-level scholarships for composites research were given to Mr. Roston Elwell from Texas A&M University, whose project on active-core composite sandwich panels will be evaluated for possible use in collision energy absorption systems to improve passenger safety, and to Mr. Alejandro Londono-Hurtado from University of Wisconsin-Madison, for the application of computer simulation and numerical modeling to predict variations in fiber orientation and density distribution during molding of sheet-molding compound and glass-mat thermoplastic composites.



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- Advancements in Closed Molding of Sandwich Structures
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## PEER-REVIEWED TECHNICAL PAPERS

- Enhancing the Surface Finish of LFT Compression Molded Parts via Application of Surface Film
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- Fire Characteristics of Polyester FRP Composites with Different Glass Contents
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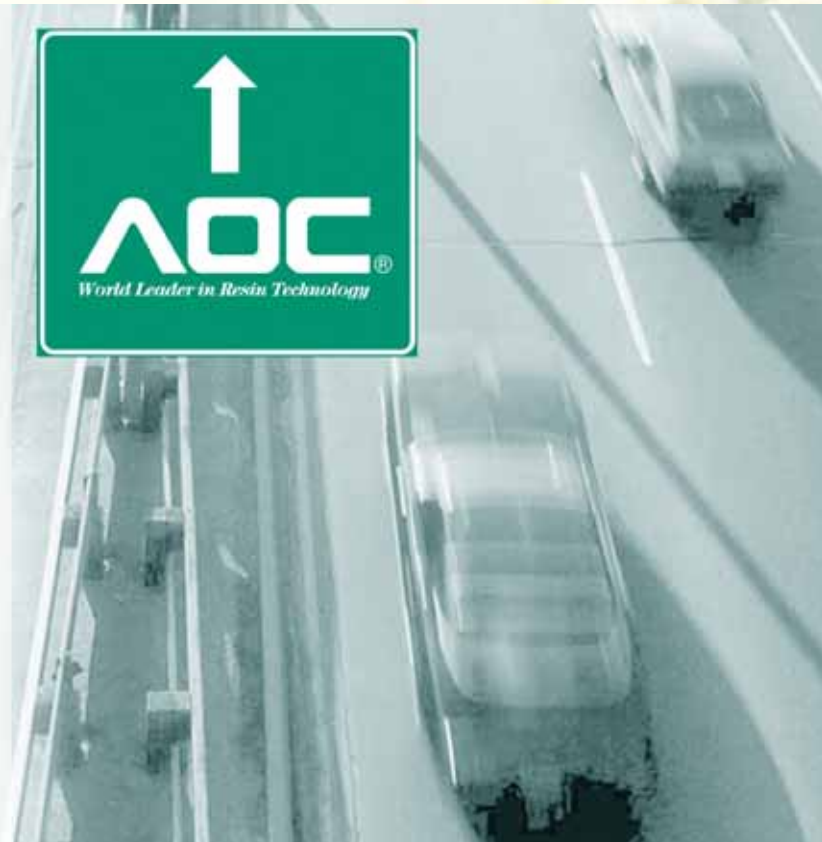
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## Plastics Technology

From the editors of PLASTICS TECHNOLOGY

### Web Exclusives

#### Injection Business Climbs Again

Are things finally starting to perk up in plastics processing? Bill Wood's latest [Injection Molding Business Index](#) suggests the answer might be yes. The index, which measures demand for related parts, increased 1% last month when compared to a year ago. This was on the heels of a 2% hike the month before. Wood believes the index hit a cyclical bottom at the end of 2006, and he is projecting business for molders to rise steadily in the second half of the year and finish its above 2006 numbers. Markets serving the medical, computer, and packaging markets are expected to fare the best.

#### Extrusion Also Creeping Up

In [extrusion](#), meanwhile, business advanced 1% over the last month following a 1% increase the month prior, Wood reports. The extrusion business was down 1% overall in 2006, and was sluggish the first part of 2007, so this is another positive trend. Wood is projecting the extrusion business to increase 4% in 2007 from last year. [Sheet](#) continued to do extremely well, Wood reports, climbing 16% last month after a 14% hike the previous month. [Film](#) climbed 2% last month, following a 10% boost the prior month. The [pipe](#) and [window and door](#) businesses continue to lag as a result of a sluggish construction market.

### Also In This Issue

- Resin prices on the rise again
- Cooling flow extruders in multi-cavity molds
- Mold Chem: Better mold cleaning
- Troubleshooting small rubber injection

### A dryer ain't a dryer ain't a dryer



You might not think there could be much more to say about resin dryers than I packed into my magnum opus in this issue. After interviewing more than a dozen experts, some of whom have spent 20 or 40 years with dryers, I can tell you there's a lot more to say. Resin drying may be the most devilishly complex subject I have ever bumped into in my 34 years in plastics. So many variables affect drying, and there are so many ways to break dryer design and controls to wrestle with those variables. Did you think, A dryer is a dryer is a dryer? [Better think again.](#)

### Extrusion Troubleshooter

#### The Troubleshooter: Getting film wrinkles out

Bubble stability is the number one cause of wrinkles in blown film. Here's [expert advice](#) on how to deal with this issue, as well as handling other common causes of wrinkled film.

Check out our Article Library for solutions to other film extrusion woes:

- [Stopping back neck](#)
- [Don't let the wind burst your bubble](#)
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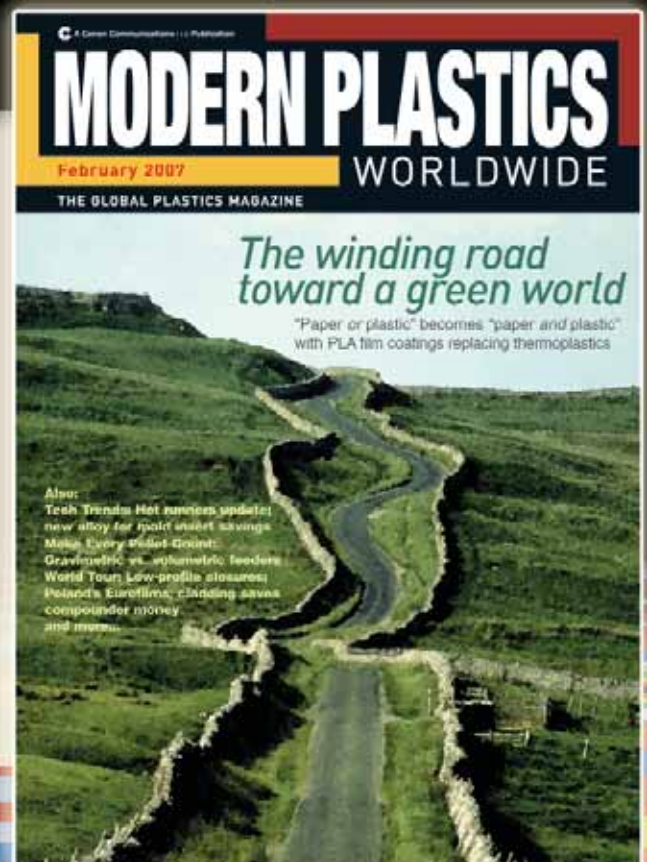
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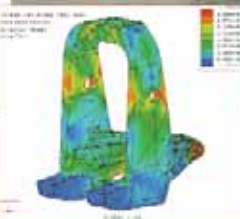
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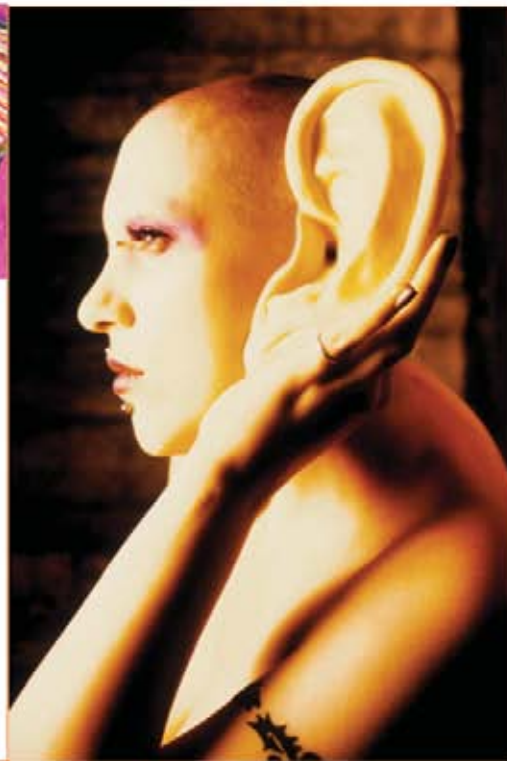


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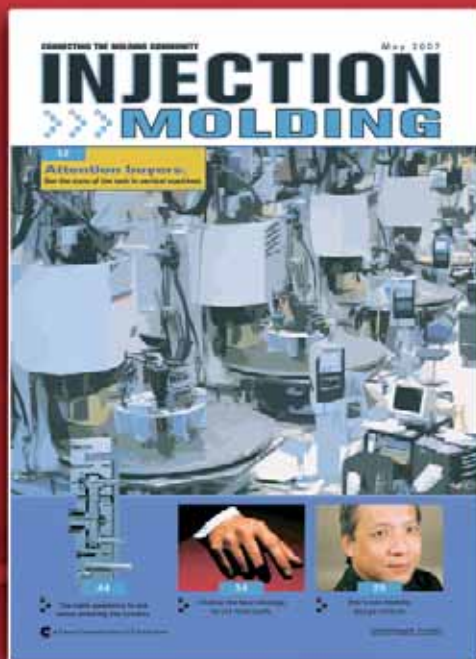
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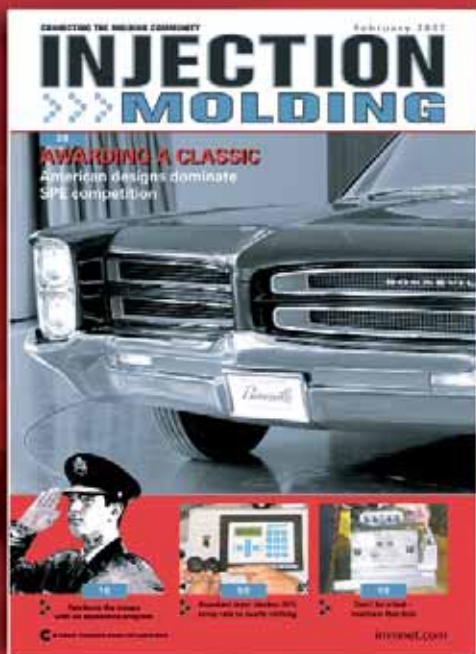
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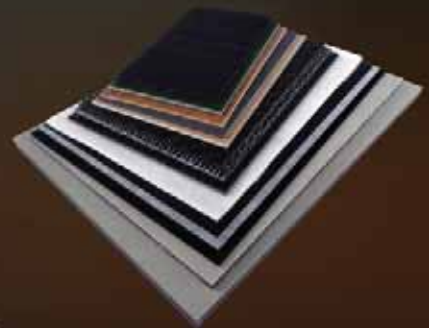
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