

4TH-ANNUAL

SPE AUTOMOTIVE  
COMPOSITES CONFERENCE

*4th-Annual*  
SPE AUTOMOTIVE COMPOSITES  
CONFERENCE



*SOCIETY OF PLASTICS ENGINEERS Automotive & Composites Divisions*

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Presented by  
SOCIETY OF PLASTICS ENGINEERS  
AUTOMOTIVE & COMPOSITES DIVISIONS

*Sept 14-15, 2004*

4th-Annual  
SPE AUTOMOTIVE COMPOSITES  
CONFERENCE

# Welcome

## FROM 2004 ACCE CHAIR

Welcome to our 4th annual SPE Automotive Composites Conference and Exposition (SPE ACCE). Over the last 4 years, we have seen an increasing amount of interest and usage of composite materials and processes in our industry. In fact, at last year's SPE Automotive Innovation Award's program, 4 of the 7 category winners presented papers on their applications at the 2003 SPE ACCE conference. Indeed, composites have become an important OEM material of choice for many applications.

What is new about this year's conference?

A lot! How about:

- The increased use of carbon-fiber composites by OEMs on a global basis;
- More demanding foreign competition;
- New improvements in thermoset and thermoplastic composites;
- An organized approach to thermoplastic composites in Europe (EATC);
- Recycled composites in automotive applications;
- New enabling technologies for composites – paint films, adhesives, tooling, and processes.



You will learn about these topics and much more as well as having an opportunity to meet the people who made them possible.

SPE has a prime goal – educating its members and the plastics industry in general. A lot of people have gone to great lengths to inform you about their technologies, accomplishments, and how to solve mass, performance, and cost issues on various applications. To these technology and business leaders, we owe a great deal. We also owe a great deal to the SPE volunteers who put this program together. To the members of the Automotive and Composites Divisions of SPE, I personally want to thank you for a job well done.

We want to make your attendance and participation a continuing experience. We will make available speaker and presenter information should you want to follow up on any topic of interest. Also, feel free to contact any of our organizing committee to discuss any assistance we may be able to provide.

Once again, thank you for your participation. We look forward to seeing you at future SPE events.

*Frederick S. Deans*

2004 SPE Automotive Composites Conference Chair

CONFERENCE *Organizers*

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**Session Moderators**

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**Panel Discussion Moderator**

**Dale Brosius**  
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	Auditorium	Amplitheatre 101	Amplitheatre 102
7:30 – 8:30	<b>REGISTRATION, BREAKFAST &amp; EXHIBITS</b> Lobby		
8:30 – 8:40	<b>INTRODUCTION/GREETINGS</b> Fred Deans - Conference Chairperson, Azdel - GE Advanced Materials		
8:40 – 9:10	Keynote Speaker - Robert Eller, Robert Eller Associates, Inc., <i>Future Potential and Inter-Materials Competition in Lightweight Composites</i>		
9:10 – 9:40	Keynote Speaker - Robert Nelson, GE Advanced Materials <i>The Savvy Supplier: Serving the Automotive Industry in China and Greater Asia</i>		
	<b>EXTERIOR &amp; STRUCTURAL APPLICATIONS I</b>	<b>COMMERCIAL TRANSPORT</b>	<b>PROCESSING I</b>
9:45 – 10:15	Eric Kleven, Dan Houston and J.T. Lyons Ford Motor Company and Sparta Composites Inc. <i>Advanced Composites on the Ford GT</i>	David Witucki, PE Delphi Corporation  <i>Carbon Fiber Tie Rods for Heavy-Duty Truck Applications</i>	David Cramer Fiberforge, Inc.  <i>Fiberforge: A Novel Approach to Improving Cost-Effective Production of Advanced Composite Structures in High Volume</i>
10:15 – 10:45	<b>COFFEE BREAK &amp; EXHIBITS</b> Lobby & Annex		
10:45 – 11:15	Adam D. Myers  General Motors  <i>GM Moves Toward Composite Transmission Cross Member for Full-Size Trucks</i>	Lynn Klett, Barbara Frame and Vlastimil Kunc Oak Ridge National Laboratory and Oak Ridge Associated Universities <i>Damage at Holes in Bolted Composite/Steel Joints for Heavy Vehicle Chassis Components</i>	C.C. Eberle, C.J. Janke and C.S. Wang Oak Ridge National Laboratory and General Motors <i>Electron Beam Curing Demonstration with Automobile Structures</i>
11:20 – 11:50	Marcia Kurcz, Burak Baser, Harri Dittmar, Joachim Sengbusch, and Hans Pfister Quadrant Plastic Composites, Inc.  <i>The Case for Replacing Steel with Thermoplastic Composites in Spare-Wheel Well Applications</i>	Xin Sun, Elizabeth Stephens and Darrell Herling  Batelle and Pacific Northwest National Laboratory <i>Static and Fatigue Strength Evaluations for Bolted Composite/Steel Joints for Heavy Vehicle Chassis Components</i>	Paul Mills  IST America  <i>UV Cure: The Microwave Popcorn of the Composites Industry</i>
11:50 – 1:10	<b>LUNCH &amp; EXHIBITS</b> Lobby & Annex		
1:10 – 1:40	Keynote Speaker - Duane Priddy, Omnexus/Special Chem <i>Web-Enabled Tools - Generating New Business Globally/Innovation and Solution Resources for Plastics</i>		
	<b>EXTERIOR &amp; STRUCTURAL APPLICATIONS - II</b>	<b>NEW MATERIALS - I</b>	<b>ENABLING TECHNOLOGIES</b>
1:45 – 2:15	Tino Fuhrmann  Volkswagen AG <i>Bonding CFRP-Metal Structures in Vehicles</i>	Jue Lu and Richard P. Wool  University of Delaware <i>Development of New Green SMC Resins and Nanocomposites from Plant Oils</i>	Peter H. Foss, Charles C. Mentzer and Douglas W. Franklin General Motors <i>Design and Validation of a Thermoplastic Composite Liftgate</i>
2:20 – 2:50	Manfred Bruemmer, Heinrich Ernst and Frank Henning Dieffenbacher GmbH and Fraunhofer Institut LFT-D – High Performance Production of an Underbody Cover Utilizing Dieffenbacher Direct Compression Molding Technology	Merry Lo, Suhara Panthapulakkal and Mohini Sain University of Toronto <i>High Performance Natural Fibre Reinforced Sheet Molding Compound for Automotive Applications</i>	Jeffrey Zemsky and Paul J. Gramman, Ph.D. Plug-Power, Inc. and The Madison Group <i>Development of Thermoset Mold Flow Analysis for Thermoset Fuel Cell Stack Plates</i>
2:50 – 3:20	<b>COFFEE BREAK &amp; EXHIBITS</b> Lobby & Annex		
3:20 – 3:50	Richard Broo  Quadrant Plastic Composites, Inc. <i>Advanced GMT Applications in the Automotive Industry</i>	T. Behzad and M. Sain University of Toronto <i>Process for Manufacturing a High Performance Natural Fiber Composite by Sheet Molding</i>	Jim Diehr  Signature Control Systems <i>Sensing When the Molding Cycle is Over: Using In-Mold Impedance Sensors in Thermoset Molding</i>
3:55 – 5:25	<b>PANEL DISCUSSION: The Current Health and Future of Automotive Composites</b> Panel Members: Doug Denton - DCX, Dave Steenkamer - Ford, Michael Bernas - Toyota, Dave Matthis - GM, Jay Batten - Delphi, Gary Lownsdale - TransTech International Moderator: Dale Brosius - Brosius Management Consulting		
5:25 – 6:45	<b>RECEPTION &amp; EXHIBITS</b> Also, Large Part Room Tour & Discussions		

	Auditorium	Amplitheatre 101	Amplitheatre 102
7:30 – 8:30	<b>BREAKFAST &amp; EXHIBITS</b> Lobby		
8:30 – 9:15	Keynote Speaker – Michael Hölscher, Porsche Porsche Carrera GT		
	<b>INTERIOR APPLICATIONS</b>	<b>ADVANCES IN REINFORCEMENTS - I</b>	<b>PROCESSING - II</b>
9:20 – 9:50	Derek Riley Curv Composites Div. of Amoco Fabrics GmbH <i>Affordable, Lightweight Load Floors using 100% Polypropylene Materials</i>	Ron Cageao and Jim Lorenzo Bayer MaterialScience  <i>Baypreg® F Composite Modeling</i>	Klaus Gleich Johns Manville Corporation  <i>D-LFT: Newest Developments – Materials and Their Effects on Process and Economics</i>
9:55 – 10:25	Fred Deans and Amy Conover  Azdel Inc. and GE Advanced Materials  <i>Design and Validation Process for GMT Composite Load Floors</i>	Ignacio G. Osio, Ph.D. and Gregory Linder Bayer MaterialScience  <i>Attachment Strategies for Baypreg® F-Sandwich Composites</i>	Daniel Schwendemann and Gerald Münz Coperion Werner and Pfeleiderer GmbH and Co. KG <i>D-LFT Process: In-Line Compounding &amp; Compression Molding of Long-Glass-Fiber-Reinforced Polymers</i>
10:25 – 10:55	<b>COFFEE BREAK &amp; EXHIBITS</b> Lobby & Annex		
10:55 – 11:25	Rich Simmons, John Stoll and Lloyd Hilligoss  Eleison, Inc. and Venture Industries  <i>Creative Thermoplastic Composite Materials for Use in Automotive Load Floors</i>	Garry E. Balthes and Harry R. Hickey  FlexForm Technologies  <i>Natural Fibers, Thinking Out of the Box</i>	Frank Henning, Richard Brüssel, Oliver Geiger, Steffen Funkhauser and Wolfgang Seib Fraunhofer Institut, Dieffenbacher GmbH and BASF AG <i>Compression Molded LFT Exterior Body Panels - Potential of Paintless Film Molding</i>
11:30 – 12:00	Dr. Matteo Terrangi  Rangerplast S.p.A. <i>Door Module from Fibre Reinforced Plastics - A Positive Contribution to Car Manufacturing</i>	Kurt Feichtinger, Wenguang Ma and Tristan Touzot  Alcan Batek Corporation <i>Novel Thermoplastic Foam Structural Core Material with Enhanced Thermoformability, Fatigue Endurance and Elevated Temperature Properties</i>	Ralf Liese  Krauss Maffei Corporation <i>Krauss Maffei Injection Molding Compounding</i>
12:00 – 1:15	<b>LUNCH &amp; EXHIBITS</b> Lobby & Annex		
1:15 – 1:45	Keynote Speaker – TBD, Mercedes Group, DaimlerChrysler AG <i>Review of Composite Developments for Future Vehicles at Mercedes Group</i>		
1:45 – 2:15	Keynote Speaker – Jason Sprong, Vital Sourcing <i>Finding New Global Sources: The Truth About Sourcing in China</i>		
2:15 – 2:45	<b>COFFEE BREAK &amp; EXHIBITS</b> Lobby & Annex		
	<b>NEW MATERIALS - II</b>	<b>ADVANCES IN REINFORCEMENTS - II</b>	<b>PROCESSING - III</b>
2:45 – 3:15	Michael Shoemaker, Dave Bank and Peter Cate Dow Automotive <i>Cyclic Butylene Terphthalate Oligomers: A New Route to Structural Thermoplastic Polymers for Automotive Applications</i>	Hiroyuki Fukushima, Sung Ho Lee and Lawrence T. Drzal Michigan State University <i>Graphite Platelet/ Nylon Nanocomposites</i>	T. S. Creasy and Y.S. Kim  Texas A&M University <i>Equal-Channel Angular Extrusion of Thermoplastic Matrix Composites for Sheet Forming and Recycling</i>
3:20 – 3:50	Michael E. Gelbin  Crompton Corporation <i>Evaluation of an Aromatic Amine Antioxidant in Glass-filled Poly(propylene)</i>	Hwan-Man Park, Amar K. Mohanty, Manjusri Misra, and Lawrence T. Drzal Michigan State University <i>Development of Sustainable Nanocomposites from Cellulose Ester for Automotive Applications</i>	Ed Wenzel  Delphi Thermal & Interiors <i>Extrusion Compression Molding with In-Line Material Compounding for Instrument Panel Retainers</i>
3:50 – 4:00	<b>CLOSING - Fred Deans</b>		

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CONFERENCE *Presentations***KEYNOTE  
SPEAKERS****Future Potential and Inter-Materials  
Competition in Lightweight Composites**

📍 Robert Eller  
Robert Eller Associates, Inc.,

*KEYNOTE: This presentation will examine the fundamental driving forces propelling market growth for lightweight composites, and how they compete with advanced nonwovens and foams.*

**The Savvy Supplier: Serving the Automotive  
Industry in China and Greater Asia**

📍 Robert Nelson  
GE Advanced Materials

*KEYNOTE: China is the world's fastest growing market for plastics and the Chinese automotive industry plays a significant role in this regard. While there are tremendous opportunities for automotive suppliers in this increasingly important region, the savvy supplier first needs to know how to navigate the country's unique business landscape in order to be successful.*

**Web-Enabled Tools: Generating New  
Business Globally/Innovation & Solution  
Resources for Plastics**

📍 Dr. Duane B. Priddy Jr.  
VP Global Business Development, Omnexus /SpecialChem

*KEYNOTE: Suppliers into the chemicals and plastics industry need efficient ways to generate new business quickly and globally, while OEMs, design engineers & material specifiers require fast access to the latest innovations and solutions to problems.*

**Porsche Carrera GT**

📍 Michael Holscher  
Project Manager Carrera GT  
Dr. Ing. h.c.F. Porsche AG

*KEYNOTE: Presentation of the new 'super-sports car' Porsche Carrera GT based on a body in black.*

**Review of Composite Developments for  
Future Vehicles at Mercedes**

📍 Group Speaker to be Announced  
Mercedes

*No information available at press time.*

**Finding New Global Sources:  
The Truth About Sourcing in China**

📍 Jason Sprong  
Vital Sourcing

*KEYNOTE: Creating a competitive "China Strategy" to access resources, increase sales volume, and reduce unit cost.*

**COMMERCIAL  
TRANSPORT****Carbon Fiber Tie Rods for Heavy-Duty  
Truck Applications**

📍 David E. Witucki, PE  
Delphi Corporation

*This paper describes the design and test methodology for the development of carbon-fiber-reinforced tie-rod tubes currently utilized in heavy-duty truck applications.*

**Damage at Holes in Bolted Composite/Steel Joints  
for Heavy Vehicle Chassis Components**

📍 Lynn Klett, Barbara Frame and Vlastimil Kunc  
Oak Ridge National Laboratory and Oak Ridge  
Associated Universities

*Damage at bolted holes in a pultruded fiberglass composite due to hole fabrication methods and bolt torque level has been investigated to assist in the development of composite/steel joints for the heavy-vehicle chassis environment.*

**Static and Fatigue Strength Evaluations for Bolted  
Composite/Steel Joints for Heavy Vehicle Chassis  
Components**

📍 Xin Sun, Elizabeth Stephens and Darrell Herling  
Batelle and Pacific Northwest National Laboratory

*The static and fatigue strength of composite/steel hybrid joints are studied and the effects of various manufacturing factors and operational conditions on joint strength are also discussed.*

CONFERENCE *Presentations*

## EXTERIOR & STRUCTURAL APPLICATIONS

### Advanced Composites on the Ford GT

☛ Eric Kleven, Dan Houston and J.T. Lyons  
Ford Motor Company and Sparta Composites

*The presentation will review the engineering considerations that led the Ford GT team to the development of the industry's first one-piece carbon fiber inner panel for the rear deck engine cover and the associated manufacturing process.*

### GM Moves Toward Composite Transmission Cross Member for Full-Size Trucks

☛ Adam D. Myers  
General Motors

*General Motors pursues composite cross members for full-size truck frames.*

### The Case for Replacing Steel with Glass-Mat Thermoplastic Composites in Spare-Wheel Well Applications

☛ Marcia Kurcz, Burak Baser, Harri Dittmar, Joachim Sengbusch, and Hans Pfister  
Quadrant Plastic Composites, Inc.

*The glass mat thermoplastic spare wheel well application has been in production for nearly 10 years and successfully translated across multiple OEMs and platforms in Europe. This presentation discusses the application and how the technology benefits the OEMs and tier suppliers.*

### Bonding CFRP-Metal Structures in Vehicles

☛ Tino Fuhrmann  
Volkswagen AG

*The paper shows the characteristic properties of different adhesive systems (e.g. two-component epoxy, polyurethane or methacrylate) in bonded CFRP-metal joints based on quasi-static test results, especially the requirements on withstanding thermomechanical stresses in production and at the vehicle's operating temperature range.*

### LFT-D - High Performance Production of an Underbody Cover Utilizing Dieffenbacher Direct Compression Molding Technology

☛ Manfred Bruemmer, Heinrich Ernst and Frank Henning  
Dieffenbacher GmbH and Fraunhofer Institut

*This presentation discusses large-scale production of underbody panels utilizing in-line compounded PP/Glass LFT materials.*

### Advanced GMT Applications in the Automotive Industry

☛ Richard Broo  
Quadrant Plastic Composites, Inc.

*This presentation will examine European production applications utilizing traditional and advanced GMT composites to meet cost and performance targets for a broad range of applications – from instrument panel carriers, and structural underfloors, to door systems.*

## ENABLING TECHNOLOGIES

### Design and Validation of a Thermoplastic Composite Liftgate

☛ Peter H. Foss, Charles C. Mentzer and Douglas W. Franklin  
General Motors Research and Development Center, Materials and Processes Lab

*A thermoplastic composite version of a typical SUV liftgate was designed and built to investigate mass reduction over the production steel design.*

### Development of Thermoset Mold Flow Analysis for Thermoset Fuel Cell Stack Plates

☛ Jeffrey Zemsky and Paul J. Gramman, Ph.D.  
Plug-Power, Inc. and The Madison Group

*This paper describes the development of mold-flow analysis for highly filled thermoset fuel-cell plates.*

### Sensing When the Molding Cycle is Over: Using In-Mold Impedance Sensors in Thermoset Molding

☛ Jim Diehr  
Signature Control Systems

*Di-Electric Cure Control is the key to Increased thermoset molding productivity and product consistency.*

CONFERENCE *Presentations***PROCESSING****Fiberforge: A Novel Approach to Improving Cost-Effective Production of Advanced Composite Structures in High Volume**

☛ David Cramer  
Fiberforge, Inc.

*Fiberforge has developed a novel process for producing advanced-composite primary vehicle structures cost effectively.*

**Electron Beam Curing Demonstration with Automobile Structures**

☛ C.C. Eberle, C.J. Janke and C.S. Wang  
Oak Ridge National Laboratory and General Motors

*Rapid curing of automotive composite structures was investigated using an electron beam to cure hood panels*

**UV Cure: The Microwave Popcorn of the Composites Industry**

☛ Paul Mills  
IST America

*UV composites - a new technology made possible by replacing traditional peroxides with photoinitiators promise to revolutionize composite manufacturing by both speeding up the curing process by orders of magnitude and by virtually eliminating styrene emissions.*

**D-LFT: Newest Developments – Materials and Their Effects on Process and Economics**

☛ Klaus Gleich  
Johns Manville Corporation.

*The presentation will focus on the newest material developments for D-LFT and their effects on the process as well as on economics.*

**D-LFT Process: In-Line Compounding & Compression Molding of Long-Glass-Fiber-Reinforced Polymers**

☛ Daniel Schwendemann and Gerald Münz  
Coperion Werner and Pfeleiderer GmbH and Co. KG

*Subject of the paper is the In-Line Compounding on a fully intermeshing twin-screw extruder with a variable die and the following conversion of the thickness profiled extrudates in a compression molding process.*

**Compression Molded LFT Exterior Body Panels – Potential of Paintless Film Molding**

☛ Frank Henning, Richard Brüssel, Oliver Geiger, Steffen Funkhauser and Wolfgang Seib  
Fraunhofer Institut, Dieffenbacher GmbH and BASF AG

*LFT materials for compression-molded external body panels utilizing PFM (Paintless-Film-Molding) are discussed.*

**Krauss Maffei Injection Molding Compounding**

☛ Ralf Liese  
Krauss Maffei Corporation

*No information available at press time.*

**Equal-Channel Angular Extrusion of Thermoplastic Matrix Composites for Sheet Forming and Recycling**

☛ Terry S. Creasy and Y.S. Kim  
Texas A&M University

*The ECAE process produces novel composite materials for thermoforming of automotive components and it provides a method of recycling thermoplastic composites into continuous sheets.*

**Extrusion Compression Molding with In-Line Material Compounding for Instrument Panel Retainers**

☛ Ed Wenzel  
Delphi Thermal & Interiors

*Opportunities to reduce manufacturing cost and increase performance of instrument panel carriers are possible via the use of extrusion-compression molding with in-line material compounding process technology.*

CONFERENCE *Presentations*

## NEW MATERIALS

### Development of New Green SMC Resins and Nanocomposites from Plant Oils

☛ Jue Lu and Richard P. Wool  
University of Delaware

*This work presents the synthesis and characterization of new SMC resins from plant oils, and the development of all-natural composites with natural fibers and clay nanocomposites using these new resins.*

### High Performance Natural Fibre Reinforced Sheet Molding Compound for Automotive Applications

☛ Merry Lo, Suhara Panthapulakkal & Mohini Sain  
University of Toronto

*This paper describes the potential use of natural fibre composites prepared by the SMC process for automotive applications.*

### Process for Manufacturing a High Performance Natural Fiber Composite by Sheet Molding

☛ Tayebbeh Behzad  
University of Toronto

*A novel process was developed for manufacturing hemp-fiber reinforced plastic.*

### Cyclic Butylene Terphthalate Oligomers: A New Route to Structural Thermoplastic Polymers for Automotive Applications

☛ Michael Shoemaker, Dave Bank and Peter Cate  
Dow Automotive

*Cyclic Butylene Terphthalate Oligomers: A unique, high-flow material for the production of automotive composites is discussed.*

### Evaluation of an Aromatic Amine Antioxidant in Glass-filled Poly(propylene)

☛ Dr. Michael Gelbin  
Staff Scientist, Crompton Corp.

*An aromatic amine antioxidant, 4,4'-Bis(alpha, alpha-dimethylbenzyl) diphenylamine, gave superior processing stability in a GMT-type application test.*

## INTERIOR APPLICATIONS

### Affordable, Lightweight Load Floors using 100% Polypropylene Materials

☛ Derek Riley  
Curv Composites Div. of Amoco Fabrics GmbH

*A new sandwich construction based on a 100% PP solution could answer the auto industry's need for low cost and full recyclability while also providing light weight, good mechanical performance, resistance to moisture and chemicals, good thermoformability, and a good cost/performance ratio.*

### Design and Validation Process for GMT Composite Load Floors

☛ Fred Deans and Amy Conover  
Azdel Inc. and GE Advanced Materials

*Using FEA techniques, GMT load floor designs can be optimized for weight and performance before tooling and actual part testing is required.*

### Creative Thermoplastic Composite Materials for Use in Automotive Load Floors

☛ Rich Simmons, John Stoll and Lloyd Hilligoss  
Eleison, Inc. and Venture Industries

*This paper offers a glimpse at emerging technology related to the application of polypropylene/fiberglass composites in automotive structures.*

### Door Module from Fibre Reinforced Plastics – A Positive Contribution to Car Manufacturing

☛ Dr. Matteo Terrangi  
Rangerplast S.p.A.

*Composite door systems provide a method for functional integration and cost savings. The Ranger Group will present their examination of several composite materials, performance requirements, and designs to bring this technology from concept into production.*

CONFERENCE *Presentations***ADVANCES IN REINFORCEMENTS****Baypreg® F Composite Modeling**

☞ Ron Cageao & Jim Lorenzo  
Bayer MaterialScience

*This paper discusses the mathematical modeling of light-weight, high-stiffness sandwich composites constructed using Baypreg F polyurethane chemistry.*

**Attachment Strategies for Baypreg® F Sandwich Composites**

☞ Ignacio Osio, Ph.D. and Gregory Linder  
Bayer MaterialScience

*This paper presents test results and evaluates the use of adhesives, embedded inserts, and mechanical fasteners as attachments for Baypreg F-Sandwich composites in automotive components.*

**Natural Fibers, Thinking Out of the Box**

☞ Garry E. Balthes and Harry R. Hickey  
FlexForm Technologies

*When considering the benefits derived from one-step processing and the end cost of the finished component, natural fiber composites become highly competitive through a reduction in both capital and the growing cost of internal labor, as well as the practical economic and environmental benefit of being able to reclaim factory waste, and eventually, end-of-life components.*

**Novel Thermoplastic Foam Structural Core Material with Enhanced Thermoformability, Fatigue Endurance and Elevated Temperature Properties**

☞ Kurt Feichtinger, PhD, Wenguang Ma and Tristan Touzot  
Alcan Baltek Corporation

*Novel foams based on a special grade of thermoplastic polyester were produced and characterized showing low open-cell and water absorption, high chemical and temperature resistance, mechanical properties as good or better than comparable-density polyurethane foams, superior fatigue endurance, capability for simultaneous lamination/thermoforming at 200C between GMT face-sheets, and excellent thermo-formability.*

**Graphite Platelet/Nylon Nanocomposites**

☞ Hiroyuki Fukushima, Sung Ho Lee, and Lawrence T. Drzal  
Michigan State University

*A new, inexpensive nanoreinforcement based on graphite has been exfoliated into sub-micron graphite flakes and fabricated mixed into nylon 66 resulting in inexpensive composites having considerably higher electrical conductivity and modulus than composites made with carbon fibers, vapor-grown carbon fibers, or carbon black.*

**Development of Sustainable Nanocomposites from Cellulose Ester for Automotive Applications**

☞ Hwan-Man Park, Amar K. Mohanty, Manjusri Misra, and Lawrence T. Drzal  
Michigan State University

*'Green' cellulose acetate has been successfully plasticized with an environmentally friendly triethyl citrate (TEC) plasticizer and combined with organically modified clay to produce nanocomposites with optical transparency and superior mechanical properties.*

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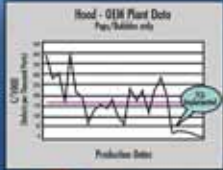



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