



# AUTOMOTIVE PLASTICS NEWS

A PUBLICATION OF THE AUTOMOTIVE DIVISION OF THE SOCIETY OF PLASTICS ENGINEERS

March 2010 - Volume 39, Issue 3

**COMPOSITES:  
SHAPING NEW  
VEHICLES**

SEPT 15-16  
2010

**10TH-ANNUAL AUTOMOTIVE  
COMPOSITES  
CONFERENCE  
& EXHIBITION**

*World's Leading Automotive Composites Forum*

SOCIETY OF PLASTICS ENGINEERS  
AUTOMOTIVE & COMPOSITES DIVISIONS

The organizing committee for the SPE Automotive Composites Conference & Exhibition (ACCE) today announced the dates, theme, and location for this year's show and issued its annual Call for Papers. Now in its 10th year, the ACCE has become the world's leading forum for automotive composites and draws exhibitors, speakers, and attendees from Europe, the Middle East, and Asia / Pacific as well as North America. The event returns September 15-16, 2010 at the MSU Management Education Center in Troy, Mich., U.S.A.

Cedric Ball, marketing projects leader, Ashland Performance Materials and the 2009 and 2010 SPE ACCE conference chair noted, "This year's conference theme is **Composites: Shaping New Vehicles**. Our industry is in the middle of a tremendous shift toward a new generation of vehicles. We're clearly seeing greater interest in and the business case being made for using composite materials. With tremendous pressures to improve fuel economy and lower production costs, we're really in the midst of a 'perfect

storm' of market pressures and industry trends that make composites more attractive for automakers than ever before."

Added returning technical program co-chair, Dev Barpanda, leader - Design & Engineering, Materials Engineering Center, at the Dow Chemical Co., "With the current market trends toward 'greener' vehicles, this is an opportune time for the automotive industry to exploit technology developments in composite materials for vehicle engineering. Our SPE ACCE show provides a great platform that allows industry leaders to discuss challenges as well as opportunities in using composites to address issues like lightweighting and fuel efficiency while still meeting stringent performance requirements and providing trendy styling for discerning customers."

Creig Bowland, technical leader/research associate - Long Fiber Thermoplastics at PPG Industries as well as long-time

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# Treasurer's Report

Yvonne Bankowski

The SPE Automotive Division bank account balance is in good standing with \$99K in checking and \$27K in savings for a total of \$126K. The financial results for the 2009 ACCE are as follows: income, \$80, expenses, \$77.5K, net proceeds, \$2.5K of which \$750 was sent to SPE National.

The 2009 SPE Automotive Innovation Awards Gala financial results are as follows:

Total income \$173K  
Expenses \$144K  
Net proceeds \$29K

## Automotive Division Meeting Schedule and Special-Events Calendar

AutoEPCON Best Western Sterling Inn Sterling Heights, MI	April 27, 2010
ANTEC 2010 Orlando World Center Marriott Resort & Convention Center Orlando, Florida USA	May 16-20, 2010
Division Planning Meeting Location TBD	June 2010
10 <sup>th</sup> -Annual SPE Automotive Composites Conference & Exposition, MSU Management Education Center, Troy, MI	September 15 & 16, 2010
Automotive TPO Global Conference Best Western Sterling Inn	October 3-6, 2010
40 <sup>th</sup> -Annual SPE Automotive Innovation Awards Program & Gala Burton Manor, Livonia, MI	November 2010

Automotive Division Board of Directors meetings are open to all SPE members, and are usually held at the **American Chemistry Council (ACC)** in Troy, MI. Call Maria Ciliberti at (248) 337-6851 for more information.

# Social Chair Report

Bill Pippine

The SPE Automotive Division is continuing to hold social and networking events all around the Detroit area. This is a great opportunity to meet and interact with fellow automotive plastics professionals.

The next SPE Social Night will be Thursday April 29th. Check the SPE Automotive Division website at [www.speautomotive.com](http://www.speautomotive.com) for additional details on this event.

If you have an idea for an event or questions about a future event, please contact Bill Pippine at [social-chair@speautomotive.com](mailto:social-chair@speautomotive.com). Please come and meet fellow professional colleagues from SPE and potential new SPE members. We look forward to seeing you at our next event.

[www.speautomotive.com](http://www.speautomotive.com)

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# Chair's Message

Maria Ciliberti

There are many upcoming SPE Automotive Division activities on the calendar that I would like to highlight in this newsletter. In addition, there are some SPE Automotive Division volunteers that I would like to recognize.

So, let's start with what's on the calendar ahead. The next event to be held by SPE Automotive is AutoEPCON which will take place April 27, 2010 at the MSU Management Education Center in Troy, MI. With over 15 technical papers to be presented, this is a great opportunity to hear about many new plastics and new uses of plastics.

From September 15th and 16th 2010, SPE Automotive will hold its 10th Annual Automotive Composites Conference, also at MSU Management Education Center. This event provides excellent networking opportunities and draws speakers, exhibitors, and attendees from the Americas, Europe, Asia, and the Middle East.

And while it may seem way off in the future, planning for the SPE Innovation Awards Program is in progress under the leadership of Jeff Helms. This year marks the 40th anniversary of the Innovation Awards Program. Special spotlights on various innovations of the past and present will be presented. With broad media coverage ranging from Automotive Engineering to Polymotive out of Europe and over 600 industry attendees, this is truly an event to not only to attend but one for which all should make themselves a contender for recognition. So please get your nominations in for consideration.

Besides these events, I'd like to also highlight some people from the Automotive Division. Let me start by sharing with you some great news: SPE Automotive has been presented with the Marketing Communications Excellence Award from SPE International. This is the first time SPE Automotive has received this award. Winning it was only possible due to the work of some people from the division, in particular, Peggy Malnati but also Kevin Pageau.

The Automotive Division is very fortunate to have Peggy Malnati. She brings over 25 years experience in Marketing Communications having worked for companies such as GE in the past and in recent years as a successful independent entity with clients from around the world. SPE Automotive benefits immensely from Peggy's expertise.

Thanks to Peggy SPE Automotive has the following communication "touchpoints" or elements:

- it's own website which typically receives 10,000 hits per month
- numerous press releases and advertisements every year which publicize our events,
- press release coverage and ad placements in numerous magazines and websites which in turn are viewed by hundreds of thousands of people every year,
- multiple program booklets written and issued in print and electronically for our numerous events such as the Composites Conference and the Innovation Awards Night

The list could go on and on. However, I will stop here.

Not to be forgotten are the efforts of Kevin Pageau, who has the seldom thanked job of pulling together the quarterly newsletter. Between Peggy and Kevin, many people from around the world are able to learn about SPE Automotive and to stay apprised of our activities. Their work enables SPE Automotive to project the image we seek to portray: that is, SPE Automotive is THE professional and technical place to go to for information about plastics in automotive. Therefore, on behalf of the division, I thank you both for your work and commitment. It's what differentiates SPE Automotive from other non-profit technical organizations!

I would also like to recognize, a "changing of the guard", so to speak. Let me start by giving a special thank you to Nippani Rao who has served for the past 6 years as the Automotive Division Councilor. Nippani has represented the division at SPE International, debating and voting on our behalf on many important issues over the years. His term ends at the May 2010 ANTEC meeting.

Replacing Nippani is Tom Pickett. Tom has been a past chair of SPE Automotive as well as the Detroit Section along with many other roles within both groups. Therefore, on behalf of all of SPE Automotive, I would like to thank Nippani for his past service in this role and congratulate Tom as he takes on this role.

So as you can see, many things are going on which in turn, should benefit all of us members. We thank you for your participation and association in SPE Automotive. Any comments or suggestions as to how we can make the organization stronger or better are truly welcomed.

# Board of Directors Meeting Minutes

Monica Prokopysheh

## ATTENDEES

Monica Prokopysheh, Jeff Helms, Nippani Rao, Peggy Malnati, Kevin Pageau, Johanne Wilson, Yvonne Bankowski, Tom Pickett, Anthony Gasbarro, Mike Masserant, Ed Garnham, Mike Whiten, Fred Deans, Bonnie Bennyhof, Suresh Shah

Meeting held on January 8th, 2010 at the American Chemistry Council in Troy, 5:30 p.m. - 8:00 p.m.

December minutes approved.

## Education

Formula SAE (international competition) funded prizes from Automotive Composites & SPE AD in 2009. Fred Deans recommend a \$2000 prize, funded by SPE AD for 2010. Motion approved. Fred Deans to coordinate on behalf of the SPE AD.

## Budget Discussion

Read the Treasurer's report for full details. \$97,000 checking & 27,000 in savings. The IAG showed a surplus. Last year the division voted to donate the rebate to HQ, and recommended the same for this fiscal year.

## Membership

Johanne Wilson sent out the membership initiative request Jan 21. Each board member has been asked to recommend 2 names by the end of the month. Membership was down in 2009.

## SPE Social Programs

11-14 attended the most recent networking event. A membership ski networking event will not be offered this winter.

## Technical Committee

Tom Pickett reported on ANTEC preparations. The automotive session is scheduled for Monday May 16th (pm) at ANTEC (Orlando). There are 2 keynote speakers and 5 papers. The business meeting is scheduled for 5 - 5:30, immediately after the automotive session.

## Councilor's Report

Nippani sent the email for the councilor ballot; a new councilor is needed by ANTECc time (May 15). The councilor needs to attend ANTEC & Connecticut (typically October) meetings and participate in committees. The main function is to interface between SPE AD and headquarters for a 3 year term. Most meetings are Fridays and Saturdays. Tom Pickett expressed interest. Suresh has expressed interest. Feb. 15 deadline for nominations. Tom was elected to the position.

## AutoEPCON

Norm reported that AutoEPCON is scheduled for April 27th, 2010. Details are included in the upcoming newsletter.

## MARCOM

Automotive Composites Conference:

1. 91% reduction in surplus.
2. Still awaiting Composites decision support of 2010 grad. Scholarship. (Scholarship funding reduces surplus to deficit.)
3. New conference banner presented and program guidebook cover art. Composites: Shaping New Vehicles, Sept. 15 and 16 2010. 10th anniversary program year. Have 10 or 11 confirmed sponsors at early bird special rates. First press release approved and distributed.
4. Three keynote speakers have been confirmed Lamborghini (with vehicle), Bentley Motors and CSM Worldwide (vehicle trends).

## Innovation Awards Program

Duplicate plaque orders processed (small surplus). Need to begin work on 2010 program.

## Web traffic

Broke 2 more records for unique web hits: 19,001 (Dec. 2009) and 21,409 (Jan. 2010), a 2-fold traffic increase in a year. Should board member bios be posted on the web site? Peggy is investigating offering ads on the left & right hand sides of the web site.

## Other

Display Plaque for ACC - plastic 9 x 12", Mike Whiten will coordinate a lighted sill plate with the SPE AD logo. Headquarters: Marketing Communications Excellence award received. Great work Peggy!

Swap ads for all 4 events (AutoEPCON, ACCE, TPO & IAG) are being negotiated with 17 magazines, engineering societies and trade associations.

SAE and Automotive newswire have responded that they will support all SPE AD events for 2010.

## Newsletter

Kevin Pageau reported the next newsletter is being put together - goal out before AutoEpccon. Barry Boyce submitted a good article on getting a job in this tough economic climate.

## New Business

The Automotive Division proposed a joint tribute to Fred Schwab with the Detroit Section. A subcommittee will investigate ideas and report back. (Bonny Bennyhof and Josh Madden to coordinate with Irv Posten of the Detroit section.) Preliminary suggestions included a donation to a local park (i.e. bench, tree, etc.)

Jeff Helms sent out the contact list for updates.

# SPE AUTOMOTIVE TPO GLOBAL CONFERENCE

OCTOBER 3<sup>RD</sup> THRU OCTOBER 6<sup>TH</sup>, 2010

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## CALL FOR PAPERS:

ABSTRACT DEADLINE ~ APRIL 26<sup>TH</sup>, 2010  
COMPLETED PAPERS ~ SEPTEMBER 1<sup>ST</sup>, 2010

Be part of the SPE Automotive Global Convergence. This premier conference draws some of the world's most knowledgeable decision makers and industry experts who share their perspective and groundbreaking developments on one of the world's fastest growing polymers.

TPOs have become an essential part of the automotive industry's quest for versatile, economical, lightweight materials that meet the increasing challenges of this dynamic industry.

This conference attracts over 420 professionals sharing leading edge polymer and application technologies. This year's conference includes several important new sessions: **Thermoforming**; **Automotive TPEs**; and **Automotive Polypropylene Compounds** to provide the most extensive review of these innovative polymers in crafting new and robust global automotive growth for the new decade.

The following sessions are planned. **Abstracts must be submitted to these session moderators by April 26, 2010.**

### MATERIAL DEVELOPMENTS

**Anthony Gasbarro** — Advanced Composites  
248-721-0276, anthony.gasbarro@advcmp.com

**Mitesh Shah** — LyondellBasell  
248-760-4438, mitesh.shah@lyondellbasell.com

### THERMOFORMING

**Ed Bearse** — Advanced Plastic Consultants  
989-588-0494, ebearse@advancedplasticsconsultants.com

**David Okonski** — General Motors  
586-986-2767, david.a.okonski@gm.com

### SURFACE ENHANCEMENTS

**Dr. Rose Ryntz** — IAC  
313-240-3881, rryntz@iacna.com

### APPLICATIONS DEVELOPMENT

**Robert Eller** — Robert Eller Associates  
330-670-9566, bobeller@robertellerassoc.com

**Thomas Pickett** — General Motors  
586-492-2454, tompickett@yahoo.com

### AUTOMOTIVE TPEs

**Robert Eller** — Robert Eller Associates  
330-670-9566, bobeller@robertellerassoc.com

**Jeff Valentage** — ExxonMobil Chemical  
281-870-6659, jeff.valentage@exxonmobil.com

### AUTOMOTIVE PP COMPOUNDS

**Mike Balow** — Asahi Kasei Plastics N.A. Inc.  
517-375-2211, mjbalow@asahikaseiplastics.com

**Jeff Smart** — Mitsui Plastics, Inc.  
248-798-4533, j.smart@mitsuiplastics.com

### PROCESS DEVELOPMENT

**Patti Tibbenham** — Ford Motor Company  
313-322-7158, ptibbenh@ford.com

**Dr. Suresh Shah** — Delphi Thermal Systems  
248-732-1547, suresh.d.shah@delphi.com

### PANEL DISCUSSION

**Ron Price** — Global Polymers Solutions  
248-563-6343, rprice525@aol.com

**Robert Eller** — Robert Eller Associates  
330-670-9566, bobeller@robertellerassoc.com

[www.auto-tpo.com](http://www.auto-tpo.com)



### CONFERENCE CO-CHAIRS

**Bill Windscheif** — Advanced Innovative Solutions, Ltd.  
248-375-5055, bill@ais-limited.com

**Dr. Norm Kakarala** — Inteva Products LLC  
248-655-8483, nkakarala@intevaproducts.com

### EXHIBITORS/FACILITIES/PROGRAM BOOK

**Anthony Gasbarro** — Advanced Composites  
248-721-0276, anthony.gasbarro@advcmp.com

**Kelly Beauchamp** — DME  
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### TECHNICAL PROGRAM CHAIRMAN

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### ADVERTISING & COMMUNICATIONS

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**Sanjay Patel** — Flint Hills Resources (Website)  
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### SPONSORSHIP

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586-492-2454, tompickett@yahoo.com

### SCHOLARSHIPS

**Patti Tibbenham** — Ford Motor Company  
**Mitesh Shah** — LyondellBasell  
**Jeff Smart** — Mitsui Plastics

### RESERVATIONS

**Best Western Sterling Inn** — Sterling Heights, MI  
1-800-953-1400 or (586) 979-1400  
Special Rate of \$109.00 (Register for TPO Conference)

**For Information and Registration call Pat at (248) 244-8993, p.levine@yahoo.com**

**A block of rooms have been reserved for the SPE Automotive TPO Global Conference**

# Automotive Composites Conference & Exhibition

Continued from Page 1

SPE ACCE presenter and sponsor and the 2010 technical program co-chair, continued, "The automotive industry needs composites now more than ever before. The low build rates and need for fast development of energy-efficient vehicles means that composites are really the solution. The ACCE offers speakers, exhibitors, and attendees unfettered access to the engineers and decision makers who are tasked with solving these pressing issues. The ACCE's uniquely 'cozy' atmosphere fosters networking and productive, one-on-one meetings."

Those interested in speaking at this year's event should submit abstracts by March 26, 2010 to the review committee via [ACCEpapers@speautomotive.com](mailto:ACCEpapers@speautomotive.com). Full papers or presentations are due May 28, 2010. Authors who submit papers (not presentations) in the proper format by the due date will automatically be eligible for consideration for the conference's Best Paper Awards, which will be presented during the event's opening ceremony.

The ACCE typically draws over 400 speakers, exhibitors, sponsors, and attendees from 14 countries on four continents with fully one-third indicating they work for an OEM involved in ground transportation or aerospace/aviation. Interestingly, over the past few years, the types of transportation OEMs represented at the show have continued to broaden beyond traditional automotive and light truck, to include agriculture, truck & bus, heavy



truck, and aviation. This trend may indicate greater interest in technology sharing among transportation OEMs and suppliers.

Held annually in suburban Detroit, the ACCE provides an environment dedicated solely to discussion and networking about advances in the automotive composites industry. Its global appeal is evident in the diversity of exhibitors, speakers, and attendees who come to the conference from Europe, the Middle East, and Asia / Pacific as well as North America and who represent transportation OEMs and tier suppliers; composite materials, processing equipment, additives, and reinforcement suppliers; trade associations, consultants, university and government labs; media; and investment bankers. The show is sponsored jointly by the SPE Automotive and Composites Divisions.

For more information about the SPE Automotive Composites Conference, visit the Automotive Division's website at [www.speautomotive.com/comp](http://www.speautomotive.com/comp), or the Composites' Division website at [www.4spe.org/communities/divisions/d39.php](http://www.4spe.org/communities/divisions/d39.php), or contact the group at +1.248.244.8993, or write SPE Automotive Division, 1800 Crooks Road, Suite A, Troy, MI 48084, USA.

## Education Report

Monica Prokopyshen

### Explorathon

For the 11th consecutive year, the SPE AD is sponsoring a series of "Designing with Plastics" workshops as part of the AAUW's (American Association of University Women) Explorathon career day. Students in grades 8 through 12 from southeast Michigan attend sessions conducted by professionals working in health science, technology, engineering and mathematics.

### Next Year's Programs

Now is the time to nominate or sponsor a school for the next fiscal year's events, in advance of the SPE AD's annual planning meeting. The SPE AD coordinates with other sections and divisions to bring the hands-on chemistry and plastics school-on-wheels (Plastivan) to schools in the U.S.

If you are interested in volunteering for the education committee or an event, would like to nominate or sponsor a school or have suggestions for our education programs, please contact me through the SPE AD web site, [www.speautomotive.com](http://www.speautomotive.com) "contact us" button.

Visit the SPE International Website for up-to-date information on training, seminars, and other career enhancing information.



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# Design and Development with **Automotive Engineering Plastics**

## **AUTOEPCON**

**One Day Technical Conference & Exhibition**

Date of Conference: Tuesday April 27, 2010

*MSU Management Education Center, Troy, MI*

# Call for Technical Presentations

## Deadline for Presentations

**April 9, 2010**

*No Paper Required*

### **Contact Information:**

#### **Technical Presentations:**

Dr. Norm Kakarala, Inteva Products  
248-655-8483  
nkakarala@intevaproducts.com

#### **Sponsorship:**

Gary Kogowski, ENTEC Polymers  
248-797-7433  
gkogowski@entecresins.com

#### **Registration:**

Pat Levine, SPE  
248-244-8993  
p.levine@yahoo.com  
Fax: 248-244-8925

#### **Program Chair:**

Nippani Rao, RAO Associates  
248-444-1753  
nippanirao@aol.com

**Program Scope:** The **Automotive Division** and **Detroit Section** of the Society of Plastics Engineers (SPE®) International invite you to attend a 1-day technical conference & exhibition showcasing innovative developments in the Design, Materials, Processing, & Use of Engineering Plastics for the Global Automotive Industry.

**Who Should Attend:** This conference is specifically designed to inform, update and educate the OEM & supplier communities about advances in both thermoset & thermoplastic engineering polymers. Learn how these widely-used materials can help improve performance & productivity, while reducing cost and mass.

**Presentations:** Hear Technical Presentations on the Newest Advances in Engineering Materials related to:

- > Design Engineering
- > Materials Development
- > Processing & Enabling Technologies
- > New Applications & More

**Exhibits:** See Exhibits from Engineering Plastics Suppliers, Molders, Compounders, Additives & Reinforcement Suppliers, Design & Engineering Firms, & Machinery Suppliers. Experts will show you how to apply the latest technologies to your next program.

### **Conference Includes:**

Full Day of Technical Presentations, Plenary & Keynote Presentations on Automotive Business Trends, Lunch & Coffee Breaks, and Exhibits of Advanced Technologies.

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

Usama Younes  
Bayer Material Science

Recent advancements in the Polyurethane (PU) Long Fiber Composite Injection (LFI) process have resulted in a dramatic increase in its commercial interest for producing a wide range of products including PWC's, entry door skins, truck body and spa panels. One of the main reasons for this success is a development in the polyurethane chemistry of the LFI process that allows long gel times on an open hot mold yet maintains a relatively short demold time. The chemistry and processing of LFI material will be discussed, with emphasis on structure/property relationship, density reduction through dissolved CO<sub>2</sub>, and in particular, the development of high surface quality (Class A) composites.

We developed two technologies to obtain Class A surfaces on LFI parts: 1) the use of an in-mold, hybrid polyester gel coat which serves both as a barrier to glass read-through as well as the glossy surface; 2) an in-mold polyurethane paint. This technology to produce Class A composites with paint involves the use of in-mold paint, followed by a unique polyurethane barrier coat spray designed to resist both thermal and mechanical deformation, and finally the addition of the long fiber PU material. The use of the polyurethane barrier spray in conjunction with LFI serves to shorten demold time as well as improve the surface quality by preventing the glass from showing through the surface.

However, the use of a barrier spray does not guarantee a good surface, because it can easily be both thermally and mechanically deformed by the reacting LFI, which often results in surface waviness described as orange peel. In this presentation we will describe a new class of PU barrier coat which resists deformation, thus resulting in composite materials with very low orange peel, as measured by a smoothness index of 9 or greater.

## Introduction

One of the major challenges to PU Long Fiber Injection Technology has been the formation of defect-free Class A surfaces. The nature of the LFI process makes it difficult to produce such surfaces because the process itself deposits a mixture of glass PU and air onto the mold surface which results in air bubbles trapped on or near the surface of the part and glass read-through.

One way to overcome these surface defects is to deposit a PU barrier coat between the in-mold paint and the LFI composite. While this eliminates surface defects and the glass read-through, it creates a new problem - increased orange peel. This is attributed to two factors: barrier coat

deformation due to heat generated from the LFI reaction and the difference between the coefficients of linear expansion between the various layers.

## LFI Technology

LFI is a fast growing composite molding technology: chopped glass fibers and liquid PU components are dispensed simultaneously into an open heated mold. The PU components are metered into a specialized mixing head which also chops the glass fiber to specified variable lengths (0.5 to 4 inches long) and coats them with the mixed urethane liquid components. A robot then accurately and consistently positions the yet un-reacted components into the open cavity of a heated mold. After the pour is complete the mold is closed for a specified time. Later the mold is opened and the part is removed.

One of the early challenges to the advancement of LFI technology was its inability to make large parts because current mixing equipment has a maximum through put of 1 to 1.5 lbs. / sec of polyurethane. Therefore, it was up to the PU chemical design to create a longer gel time. Recent developments in polyurethane chemistry for use in the LFI process has extended the gel time on the heated mold to about 120 seconds, as discussed below, enabling the production of large glass reinforced parts weighing more than 200 lbs.

## Gel Time

By controlling the chemistry we are able to extend Gel time on a hot mold, while maintaining a relatively short demold time: Table 1 shows various chemical systems developed and compares Gel time at 70°C versus its demold time. It is important to note here that the gel time determines material flow within the mold, as well as the quality of the part surface. If the material starts to gel prior to mold closing, incomplete mold fill and poor surface result. Therefore, proper selection of gel time to part volume is critical.

Gel time, sec at 70°C	Demold , min	Demold, min with barrier coat
30	3	1.5
45	4	3
70	6	5.5
120	20	7

Table 1

However, lower density LFI systems present a special challenge - since the addition of water as an environmentally friendly blowing agent also decreases the

gel time of the systems, it became important to develop a blowing agent which does not impact the gel time of the polyurethanes. So, dissolved carbon dioxide (CO<sub>2</sub>) was introduced as the blowing agent.. Careful control of the amount of carbon dioxide in either the polyol or the isocyanate is key, as one must stay below the solubility limits of CO<sub>2</sub> in the components, if not, large bubbles will form in the parts. Figure 1 shows the froth density of the polyol at or below its solubility limits.

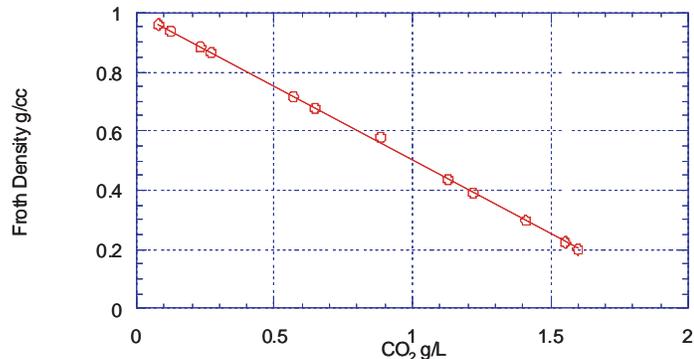


Figure 1

By employing this technology, one can vary the density of the composite by adjusting the amount of CO<sub>2</sub> dissolved in the polyol. By doing so, none of the other process parameters need to change. Table 2 shows properties of LFI composites at various densities, made with 30 wt% glass fibers.

[CO <sub>2</sub> ] in polyol, g/l	0	0.6	0.8	1	1.2
Composite Density, g/cc	1.33	1.12	0.96	0.8	0.64
PU Density, g/cc	0.93	0.78	0.67	0.56	0.45
Inst. Dart Impact, ft-lbs	8.66	7.18	7.2	5.6	3.7
Un. Izod Impact, ft-lbs/in	19.278	14.678	13.876	10.58	8.456
Flexural Strength, psi	38,390	35,773	33,354	15,196	11,066
Flexural Modulus, psi	1,302,088	1,207,804	1,044,759	576,637	382,836

Table 2

Additionally, Figure 2 shows un-notched Izod Impact properties of parts made with the same system but made with different densities by simply controlling the amount of CO<sub>2</sub> dissolved in the polyol.

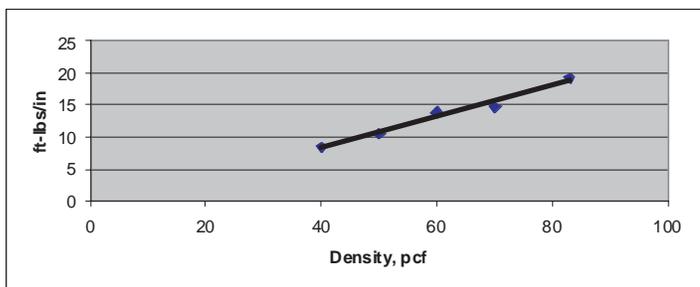


Figure 2: Un-notched Izod of LFI at various densities made with dissolved CO<sub>2</sub>

## Barrier Coat Technology

An attractive feature of polyurethane LFI technology is the elimination of post painting, as the technology allows in-mold painting commonly done on non-smooth Class A surfaces, such a parts with a grained surface. The demand for Class A surfaces, however, has grown over the years, and until recently LFI was capable of delivering such a high quality surface only through the use of painted thermoplastic film. However, our development concentrated on a less costly alternative to painted film, and it involved spraying a polyurethane thermosetting film as a barrier coat between the in-mold paint and the LFI.

The PU thermosetting film provides protection for the thin in-mold paint from glass read-through caused by the LFI process. The development of the proper barrier coat material is critical however, in that it can by itself cause surface defects due to deformation from the heat of the LFI reaction and the differences in the coefficient of linear expansion between it and the LFI composite. This new class of barrier coat was developed to have a high glass transition temperature and a low roughness value as determined by Atomic Force Microscopy (AFM).

## Effect of Crosslink Density on Tg

There are several ways to increase the glass transition temperature of polyurethanes: a typical PU will have a low soft segment transition which is responsible for the elastomeric properties of polyurethanes such as elongation and impact, and a hard segment glass transition which is responsible for such properties as stiffness and heat. The hard segment transition can be increased by increasing the crosslink density of the system as shown in Figure 3.

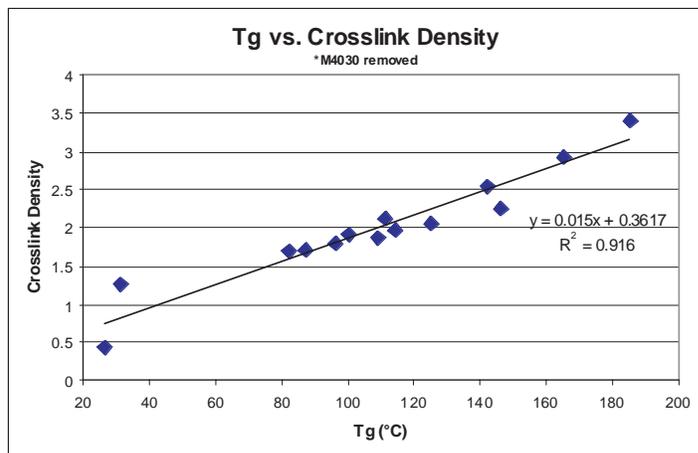


Figure 3

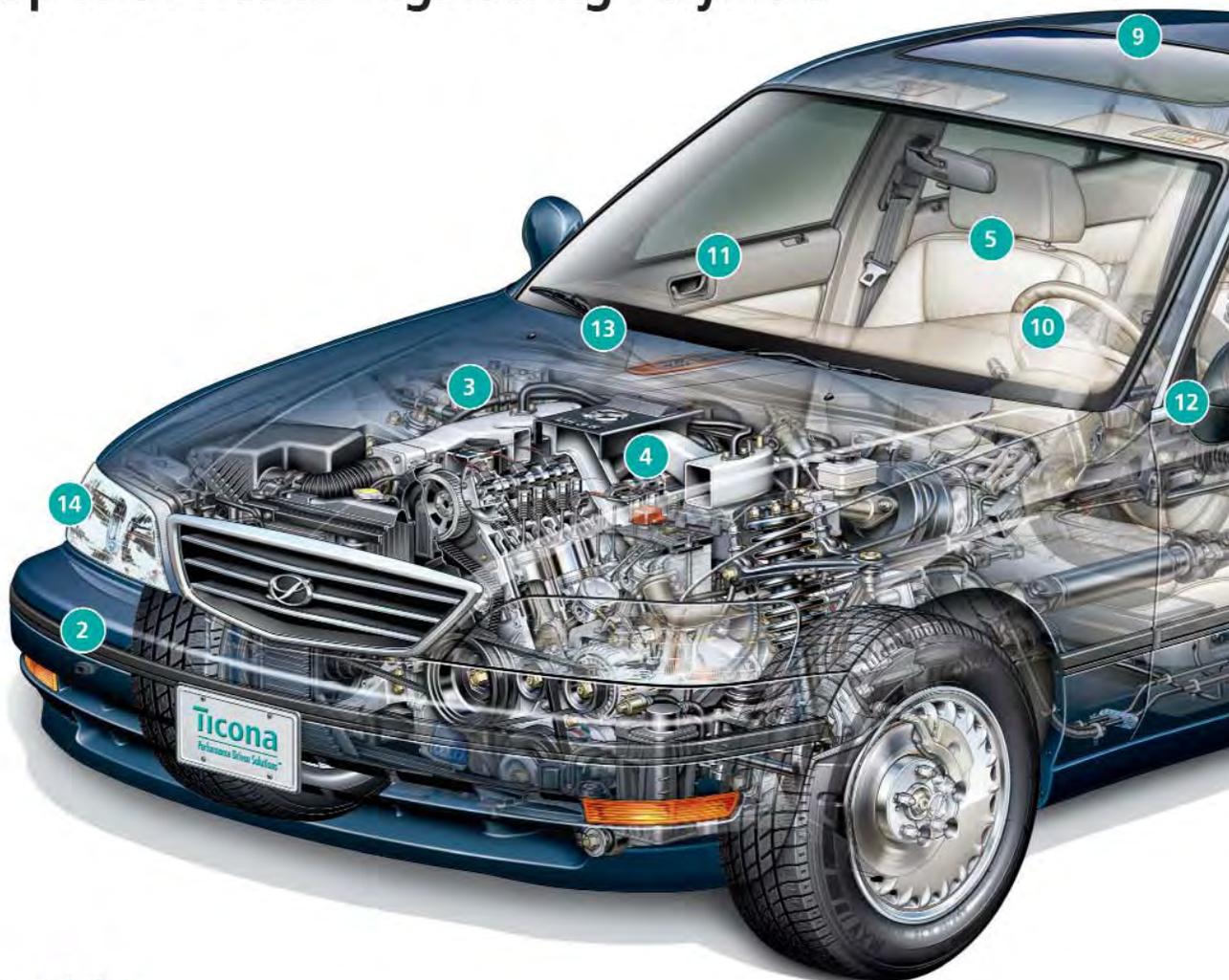
## AFM

The quality of the barrier layer for providing a good Class A finish was determined by (AFM). AFM measures the deflection of a micro scale probe brought about by forces on the surface of the specimens, and change due to chemical

Continued on Page 12

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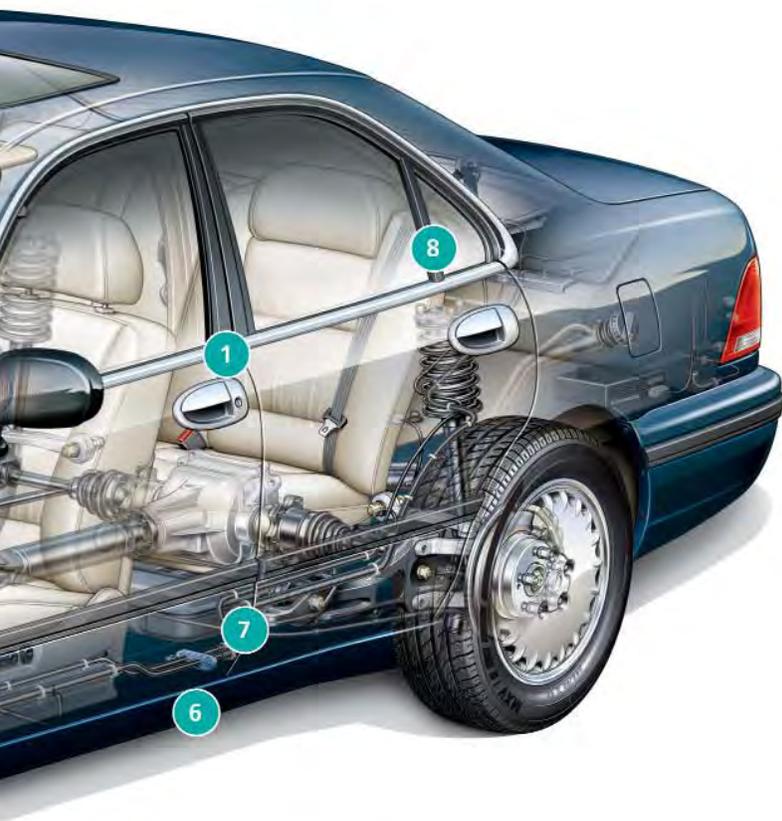
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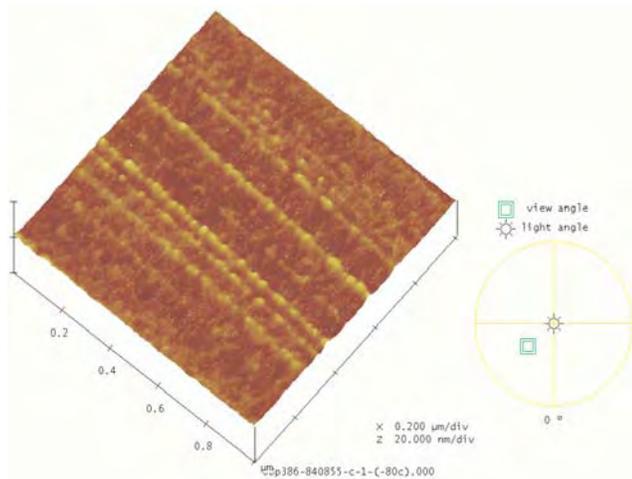
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# Recent Advances in Class “A” Polyurethane Long Fiber Injection (LFI) Composites

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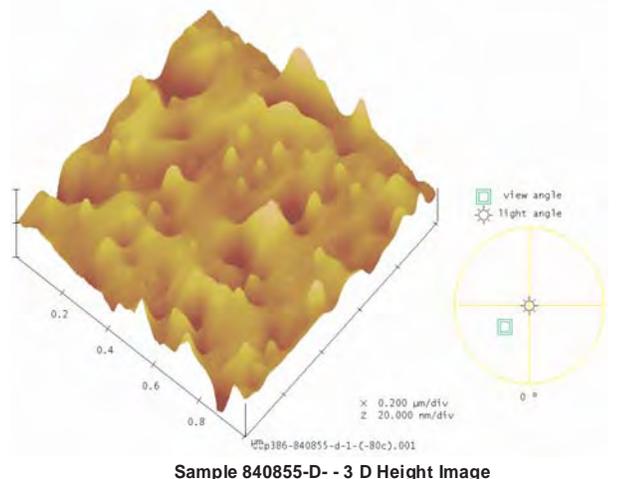
bonding through Van der Waals forces. AFM is capable of resolutions of a fraction of a nanometer. It is superior to SEM in many aspects including its ability to produce three dimensional images, and does not need special surface treatment or high vacuum, as does SEM.

Samples C and D are two different barrier coats of different technologies. Sample C, which has a hard segment glass transition temperature of  $>160^{\circ}\text{C}$  when used in the LFI process, provides excellent Class A surfaces with low orange peel as determined by a smoothness index of 9. While sample D, which exhibits a glass transition of  $<100^{\circ}\text{C}$ , provides poor surfaces with a smoothness index below 6. Examination of AFM 3D height data (Figures 4 and 5) shows a distinct difference in the surface roughness and is calculated to have Root Mean Square (RMS) values of 0.47 and 4.52 for samples C and D, respectively.



Sample 840855-C- - 3 D Height Image

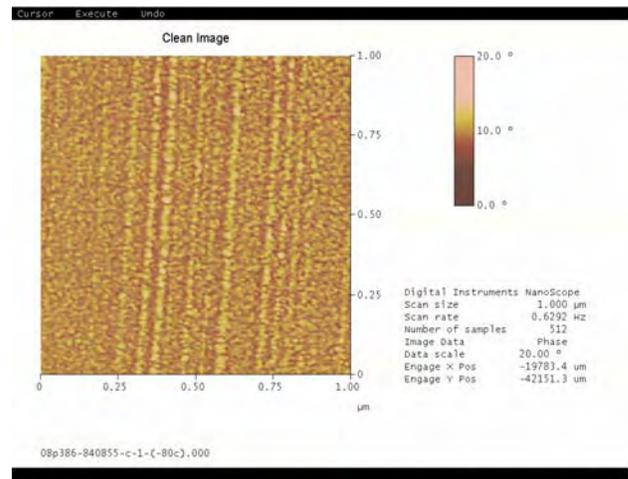
Figure 5



Sample 840855-D- - 3 D Height Image

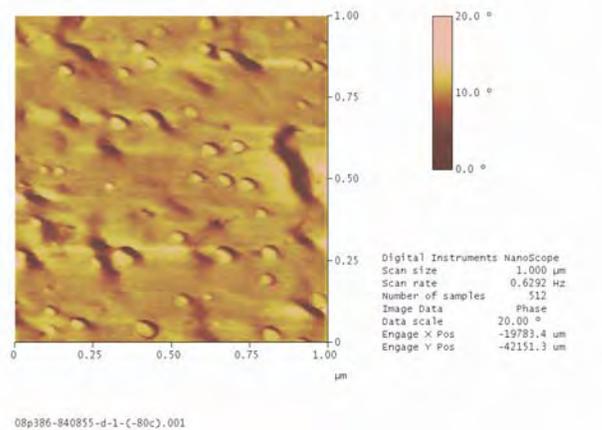
Figure 6

RMS is a statistical parameter determined by the AFM software and is used as a quantitative measure of the extent of surface roughness. This parameter measures deviations of the surface heights from a reference height, namely, the average height, as a function of the surface coordinates  $x$  and  $y$ ). The differences in the sample smoothness are attributed to the hard/soft segment morphology of the PU. The morphologies of the two samples are shown in Figures 6 and 7, and shows the hard segments are more uniformly distributed in the cross-section of sample C compared to sample D, (light colored areas), The hard segment sizes for sample C range between 8.7 and 16 nm, while those of sample D range between 16.7 and 48.6 nm.



Sample 840855-C- - 2 D Phase Image

Figure 6



Sample 840855-D- - 2 D Phase Image

Figure 7

## Conclusion

Two technologies are available to produce Class A surfaces on large LFI composite parts: hybrid polyester gel coat, and an in-mold polyurethane paint. The hybrid polyester gel coat is specially designed to improve adhesion between the outer polyester layer and the polyurethane LFI system.

Continued on Page 14

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

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Depending on its thickness, it may be used alone or with a barrier layer. The in-mold paint technology, on the other hand, must be used with a specially designed polyurethane barrier layer. This is necessary due to the very thin nature of the paint layer, which by itself is not capable of hiding the glass read-through.

### Acknowledgements

- James Kotar, Charles Carpenter for their LFI operation
- Marie Urick on her DSC work
- John Perry for his spray operation
- Farhad Cama for his AFM work

### Biography

Dr. Usama Younes is a Principal Scientist in Polyurethanes at Bayer Material Science LLC. He holds a bachelor of science degree in Chemistry from Warren Wilson College, a master's degree in Inorganic Chemistry from Western Carolina University and a Ph.D. in Organic Chemistry from the University of New Orleans. After a two-year fellowship at Carnegie Mellon University, Dr. Younes worked at ARCO, Lyondell and Bayer. He's been responsible for new developments in polyurethane Long Fiber Injection technology. He holds 46 US patents and 100 foreign patents, and has authored 15 scientific publications.

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# Councilor's Report

Nippani Rao

Participated in a teleconference council meeting on Friday, February 19, 2010 and the following is a brief summary. Details are available on the SPE website.

This is the first online Council meeting, with some 60 councilors from around the world participated and the general consensus was, that it was very successful.

President Paul Andersen in his remarks mentioned about our Innovation Awards Gala and said "It is truly a spectacular event".

## Staff update

Financial status improved, but not sustainable.

SPE efforts will focus on membership recruitment, member value, reposition and grow ANTEC/conferencing and brand and image. Membership ended December 2009 with 14,500. Ended January 2010 with 14,750

Membership growth is the society's single biggest imperative. Aggressive pricing, new dues structure, member get a member program and new benefits, aggressive direct mail & email campaigns are some of the steps being taken immediately.

ANTEC 2010 will be held at the Orlando. Nearly 600 papers have been scheduled. ANTEC 2011 will be Boston, 2012 in Orlando with NPE and the Council approved 2013 ANTEC in Cincinnati.

## Treasurer Report

SPE posted a net gain of roughly \$16,000. SPE foundation posted a net gain of \$75,000. Total net gain is \$92,000 vs budgeted \$104,000. So very close.

The 2010 budget shows : Total income at \$4,015,000 and total expenses of \$3,897,114 resulting in a net income of \$117,866.

Conference committee update indicates a total of 20 TopCons planned for 2010. Typical average in a year is 15.

Automotive Division and Detroit Section were selected for Pinnacle Gold awards. A total of 15 divisions ( out of 26) and 12 Sections( out of 87) were awarded with the Silver and Gold Pinnacle awards.

Next Council meeting is scheduled for May 15 and 16 in Orlando.



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# ANTEC 2010

The SPE Annual Technical Conference (ANTEC) will take place at the Orlando World Center Marriott Resort and Convention Center in Orlando, Florida from May 16 - 20, 2010. It is the world's largest international gathering of engineers, scientists, and business professionals in plastics.

The ANTEC Automotive Session is Monday afternoon May 17, 2010. The session will lead off with two invited guest speakers. Invited guest speaker, Richard Bell, DuPont, will present a talk on Renewably Sourced Engineering Polymers for the Automotive Industry. Also, invited guest speaker Dagmar Van Heur, Dow, will present a talk titled Automotive Plastics for Increased Fuel Efficiency and Customer Appeal. The ANTEC Automotive session has a total seven

presentations. Jay Raisoni is the moderator for the session. At the end of the last presentation on Monday, May 17th at 5:00PM, the SPE Automotive Division Business Meeting will take place.

The Chair of the 2010 ANTEC Automotive Division Session is Tom Pickett. Helping Tom assemble a great group of papers for the ANTEC Automotive Session were Norm Kakarala, Jay Raisoni, and Suresh Shah.

For more information about ANTEC and a detail of the different papers, visit the website: [www.anteq.ws](http://www.anteq.ws), or contact Lesley Kyle by phone at 203-740-5452 or e-mail [lskyle@4spe.org](mailto:lskyle@4spe.org)

## Membership Report

Johanne Wilson

The SPE Automotive Division would like to welcome the following new and renewing members.

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