Automotive Plastics News
Today, Tomorrow - Together
June 2003 Volume 32, Issue 4

2003 Automotive Composites Conference

The organizing committee of the SPE Automotive Composites Conference & Exposition (ACCE), comprised of members of the SPE Automotive and Composites Divisions boards, today announced the format, dates, location, and current technical program offerings for this year's meeting. The ACCE Show is in its 3rd year and will once again be held at the MSU Management Education Center, here, on Tuesday, September 9 & Wednesday, September 10. The conference will feature technical-paper sessions, keynote speakers, and exhibits highlighting advances in materials, processes, and applications for both thermoset and composites for in the automotive industry.

This year's theme ***"Polymer Composites: Cost Effective Solutions for Lighter, Safer Vehicles,"*** was chosen to highlight how well many of the best attributes of polymer composites meet the most pressing needs of automotive engineers in terms of manufacturing lighter, safer, and more affordable passenger vehicles.

This year's conference is chaired by Renita Jones, BP/Amoco and a member of the SPE Composites Division board. "We feel we have an exciting program in place for the Automotive Composites Conference's third year," said Jones. "Owing to early and very positive responses from both authors of technical papers and sponsoring companies, we believe that this year's show will break previous attendance records and clearly demonstrate the great value composite materials offer in solving some of the auto industry's toughest challenges."

According to Michael Connolly, senior scientist at Huntsman Polyurethanes and SPE Automotive Division chair, "The 2003 technical sessions are shaping up very well, with nearly 50 commitments for papers from North America, Europe, and the Pacific Rim. In fact, response to our Call for Papers has been so strong that we even considered adding an extra half-day to the conference to accommodate them all. We currently have 9 technical sessions planned over the 2-day event and invited/keynote lectures scheduled during 3 simultaneous sessions The show promises to be very interesting this year, despite the slow economy."

Continued page 5

Automotive Division Golf Outing

July 28, 2003
Sign up a foursome today!

See Page 15

Treasurer's Report

Stuart C. Cohen

The current assets of the Division are $110,068.

This includes $26,000 that we have so far received from sponsors for the upcoming Composites Conference. The final sponsorship payments have been received for last year's Awards Banquet and this event resulted in a net income of $18,845, an excellent result in light of the economic challenges that we all faced during 2002.

www.speautomotive.com

Automotive Division Meeting Schedule and Special Events Calendar

July 28, 2003 Dunham Hills Golf Club	Automotive Division Golf Outing
September 9-10, 2003 MSU Management Education Center	Automotive Composites Conference
September 29-October 1, 2003 Dearborn, MI	Automotive TPO Global Conference
October 13, 2003 American Plastics Council, Troy, MI	BOD Meeting
November 18, 2003 Burton Manor, Livonia, MI	Innovation Awards Program
December 8, 2003 American Plastics Council, Troy, MI	BOD Meeting
February 9, 2004 American Plastics Council, Troy, MI	BOD Meeting
April 12, 2004 American Plastics Council, Troy, MI	BOD Meeting

Automotive Division Board of Directors meetings are open to all SPE members.
Call Micheal Connolly at 248-322-7416 for more information.

Chairman's Message

Michael Connolly

"It is not necessary to change. Survival is not mandatory"
W. Edwards Deming

The current challenging times in the automotive industry mandate change and flexibility in every way our businesses are run. The SPE Automotive Division is no different. With current work responsibilities, Monica Prokopyshen of DaimlerChrysler has concluded that she will not be able to devote the appropriate time and energy towards serving as the SPE Automotive Division Chair during 2003-2004. Hence, she has relinquished her place as Chair and, as Chair-Elect, I have replaced her for 2003-4 while Monica will assume the role of Chair-Elect to serve as Chair in 2004-5. All members of the Board of Directors (BOD) are dedicated to the vitality and future success of the Automotive Division. Even by temporarily stepping aside, Monica has exemplified the interest BOD members have in a making the Division successful. I will try to maintain that dedication when serving as Chairperson through the remainder of 2003 and the spring of 2004.

Looking back at these Chairperson's Messages over the past several years, one prevailing theme has been encouraging membership involvement. Although it may sound like a broken record (you remember those brittle, black discs with sound quality like a couple of screeching cats!), I will do the same. The Automotive Division needs to continually replenish its members and leadership to maintain its vitality and future strength considering many long time (and very active members) have retired or are on the verge of retiring. Over the past few months, I have spoken with several people who expressed some interest in joining and being active on the Board. The Division needs them all to get involved . I encourage any and all to attend BOD Meetings and contribute to the Division's activities. The schedule of meeting and activity dates is listed elsewhere in this newsletter. If you are interested in participating in any Division activities, please contact the program chairs noted below:

Golf Outing
Jim Staargard 248-351-8445
james.staargard@gep.ge.com

Education Programs
Josh Ullrich 248-375-4300
joshullrich@comcast.net

Automotive Composites Conference
Renita Jones 770-944-4739
jonesrs@bp.com

Innovation Awards Banquet
Stuart Cohen 248-377-6882
stuart.cohen@ticona.com

Automotive Safety Conference
Monica Prokopyshen 248-576-7498
mp5@dcx.com

Safety-in-a-Box
Josh Madden 248-829-6335
joshmadden@comcast.net

I recognize that everyone is stretched very thin these days. We all need to better utilize our available resources. In the current business environment, there is limited company support for membership fees and time to participate in industry activities outside our companies. With members' help, I aim to reach out and develop cooperative agreements with other professional organizations and trade associations to leverage the time and money that are invested. The Automotive Composites Conference which is sponsored jointly by the Automotive and Composites Divisions of SPE is one successful example of this type of resource utilization. These cooperative programs need to meet the vision and strategy of all parties by promoting and broadening the use of plastics and finding better and less expensive means to make quality automotive components. Cooperation could come in the form of bundling meeting registration fees or group memberships, bilateral access to membership lists or development of joint programs or conferences. The SPE-Detroit Section and APC (always a strong collaborators), SAE, SME, ACMA/CFA and SAMPE are all potential partners for the Automotive Division. I welcome any and all suggestions towards developing such outreach programs.

One other area on which I will focus this year is the Website (www.speautomotive.com). An upgrade is needed. My goal is make the Division site 'the web resource for automotive plastics'. However, it won't happen without members' contributions - volunteer to be listed as an 'expert' in materials, processing, manufacturing or design - create and submit a list of useful 'links' on automotive technology - contribute a technical article or technology review. I aim to include selected technical contributions from Division sponsored conferences as well and improve publicity of the Division Education programs such as Plastivan, student scholarships and the joint APC/SPE program at theCenter for Creative Studies (CCS). Finally, we all need to remember the Automotive Division is a global entity so the site needs contributions from places such as Germany, Japan and Korea to fulfill the needs of all members.

Please contact me (michael_connolly@huntsman.com or 248-322-7416) for information on Board participation or if you have any questions about other means to get involved. If more members become active, the workload for activities can be spread out and the Division can offer more and better programs. I am looking forward to serving the members as Division Chairperson in the coming year and welcome any input which can make the Automotive Division more successful.

Third Annual

Automotive Composites Conference

Co-Sponsored by the Automotive and Composites Divisions of SPE

Dates: **Tuesday, September 9th**
Wednesday, September 10th

Location: **MSU Management Education Center**
811 W. Square Lake Road
Troy, MI 48098

Cost: **$295 (SPE Members)**
$395 (Non SPE Members - Includes SPE membership)

TO REGISTER FOR THIS IMPORTANT EVENT:

Complete this form and fax to:
Pat Levine @ Society of Plastics Engineers
Fax number: +1.248.244.8925

Mail checks to:
Society of Plastics Engineers
Attn: Pat Levine
1800 Crooks Road, Suite A
Troy, MI 48084

Please make checks payable to:
SPE AUTOMOTIVE DIVISION

For additional information, please call:
(248) 244-8993 or e-mail spe@plastics.org

Registration includes lunch, refreshments and a cocktail reception after the first day session. Registered attendees will also receive the Conference Proceedings Book, which contains abstracts of the papers *and* a CD with full papers. Registration is not confirmed until payment is received.

FIRST NAME:_____ **LAST NAME:**_____

COMPANY:_____

DIVISION/DEPARTMENT:_____

ADDRESS:_____

CITY:_____ **STATE:**_____ **ZIP:**_____

COUNTRY:_____ **SPE MEMBER** _____ **YES (Membership #)**_____ **NOT A MEMBER**_____

WORK PHONE:_____ **FAX:**_____

E-MAIL ADDRESS:_____

REGISTRATION FEES: **$295.00 MEMBER** **$395.00 NON-MEMBER**** **$85.00 Full-Time STUDENT (with ID)**

Payment Type: Visa/MasterCard/American Express **Card Number:**_____

Name on Card:_____ **Expiration Date:**_____

Check (payable to: *SPE Automotive Division*):_____ **Cash:**_____

**Note: Non-Members Registration fee includes 1 year SPE membership.

Automotive Composites Conference

Continued from Page 1

Topic areas that are being continued from last year's show due to high interest include:

- **New Composite Materials, Processes, & Applications**
- **Composites in Commercial Transportation**
- **Enabling Technologies for Composites**
- **Bonding & Joining of Composites, and**
- **Finishing & Decorating Composites.**

New to the conference this year are 2 additional sessions including:

· **Advancements in Reinforcement Technologies** - about progress in natural fiber, nanoreinforcement, glass veil and glass/thermoplastic hybrid technologies
· **Leading-Edge Composite Cars** - highlights technologies featured in more exotic vehicles that could be translated to the mass-production environment.

Guests of the conference will also have the opportunity to hear the following keynote speeches during the event:

· Journalist and editor of Composites News eNewsletter, **Steve Loud**, will discuss successes and challenges in the automotive composites industry.
· **Sid Diamond**, of the U.S. Department of Energy (DOE), will review the goals and status of several DOE programs to reduce energy consumption in automobiles and other forms of commercial transportation.
· Attorney **Bill Abbatt** of Brooks & Kushman, P.C. will review strategies for intellectual property protection and asset management.
· Writer/consultant **Dale Brosius**, of Brosius Management Consulting will cover the status and outlook of carbon fiber use in automotive applications.
· **Dave Stewart** of Stewart Automotive Research will discuss the importance of making economic analysis an engineering variable during the technology development cycle.

The 2003 Dodge Viper uses carbon fiber SMC in its fender support and door inner systems and long carbon fiber/glass fiber SMC hybrid in the windshield surround (car courtesy of Doug Denton of DaimlerChrysler Corporation)

Conference attendees will also have the opportunity to visit displays by sponsoring companies - which include component manufacturers, materials, equipment, and technology suppliers, and professional organizations - in the main hall throughout the conference. Sponsorship helps, in great part, to underwrite the cost of holding the conference and offering reduced rates and scholarships for students to attend. There are still spots open for companies interested in becoming a sponsor of the event. Current Premier and Associates sponsors, along with lunch sponsors are listed below.

- **Bayer Corporation,**
- **BP/Amoco,**
- **Composites Fabrication Magazine / Composites Fabrication Association (CFA),**
- **Composites Technology / High-Performance Composites Magazines**
- **Dieffenbacher NA,**
- **Equistar,**
- **Hexcel Composites,**
- **Huntsman Polyurethanes,**
- **LNP Engineering Plastics,** a GE Plastics Company,
- **Polywheels Manufacturing,**
- **Quadrant Plastic Composites,**
- **Schmelzer Industries,**
- **Vantico,**
- **Zenith Division of Parker-Hannifin.**

The fee to attend the 2-day event is $295 (USD) / person for SPE members and $395 (USD) / person for

Continued page 6

Loctite was one of the many exhibit booths displayed by sponsors at the 2002 ACCE. There were 25 companies exhibiting.

non-members. The non-members fee also includes a 1-year membership in the Society of Plastics Engineers International and all the privileges membership entails.. Additionally, a special student rate is available (with valid student ID) at $85 (USD) / person. Registration is free for the press

In 2002, the ACCE show's theme was "Composites: Global Technologies for Better Vehicles." The conference had 300 attendees, 25 of whom were from outside the U.S. and nearly 100 of whom were members of the OEM engineering community. During that conference, 46 papers were presented, along with 2 panel discussions. The cost of the event was subsidized through the generous sponsorship of 21 companies and organizations. Undoubtedly, the most popular display was an '03 MY Dodge Viper convertible.

For more information about the SPE Automotive Composites Conference, visit the the Composites' Division website at http://swiki.che.gatech.edu/SPECompositesDivision, the Automotive Division's website at www.speautomotive.com, contact the group at +1.248.244.8993, or write SPE Automotive Division, 1800 Crooks Road, Suite A, Troy, MI 48084, USA.

Councilor's Corner

R. David Arndt

I attended the Council meetings, Divisions Committee, and Conference Committee in Nashville, TN on May 3-4, 2003 . The Council is made of plastics industry volunteers forming a 6 officer Executive Committee including Mike Capelletti, paid Executive Director plus 9 Vice Presidents (3 elected, 6 appointed), 22 elected Division Councilors, and 89 elected regional Section Councilors. The council meets 3 times each year and governs the 23,000 member Society. **"The mission of the Society shall be to provide and promote the knowledge and education of plastics and polymers worldwide."**

Claudius Feger, SPE President, presented an outline of the accomplishments this year under his "Solutions" theme. Mike Capelletti, Executive Director, announced his retirement at the end of the year. He has been with the Society in Brookfield, CT for 20 years. Financial condition of the Society continues to be the key focus of organization. The first quarter results showed ($52,000) net loss from budget. A successful ANTEC could offset this deficit.

I presented 3 major financial contributions the Automotive Division approved at the last Board of Directors meeting: $1000 to the India Section, $1500 to the Harold Giles Scholarship Foundation, $1000 to the SPE Foundation, and $2500 to the Fred Schwab Scholarship Fund. The contribution to the Harold Giles Foundation was from the proceeds of the Composites Division/Automotive Division September 2002 joint conference. Composites Division matched our contribution to that Foundation.

A new "Plastics Engineering Europe" magazine has been developed and was shown for the first time. All of the advertisers are European. Advertising amounted to $50,000 income. A monthly record $125,000 was collected for advertising for Plastics Engineering here in the US. Leslie Kyle, Programs Manager for SPE, announced a multi-year contract with Marrriot for Antecs 2009 in San Antonio, 2010 in Orlando, and 2011 in Boston. This will save the society thousands of dollars over the life of the contract. No buses are required at these sites saving a minimum $30,000 at each location.

Donna Davis became the new SPE President. She works for Exxon Mobil in Houston, TX. She announced the new Executive Committee and committee chairs for 2003-2004. I was asked to chair the Conference Committee for a second year.

I will be attending the next Council meeting at the end of September in Charlotte, NC.

SPE Recognizes Honored Service Members

During the Society's 61st ANTEC, the following 17 SPE members were honored for their contributions to the Society by being elected to the grade of Honored Service Member. Two Automotive Division members, Fred Deans and Norm Kakarala were recognized this year.

"To be elected an Honored Service Member, a candidate shall have demonstrated long term, outstanding service to, and support of, the Society and its objectives; shall be sponsored, in writing, by the Board of Directors of at least one Section or Division." Out of 25,000 members, only 184 members, counting the 2003 inductees, have been elected to this prestigious status since it was established in 1992. This year's Honored Service Members, along with their SPE Division and Section affiliation are:

Elected Member	Section	Division
Barbara Arnold-Feret	North Texas	Product Design and Development
William Bassett III	North Texas	Polymer Modifiers & Additives
Joe Cameron	Upper Midwest	Color and Appearance
A. William Coaker	Cleveland	Vinyl
Frederick Deans	***Northwest Pennsylvania***	***Automotive***
Jerry Golmanavich	Nebraska	Injection Molding
David T. Henry	South Texas	Thermoplastic Materials & Foams
Hormoz Hormozi	Chicago	Thermoplastic Materials & Foams
Dr. Norm Kakarala	***Detroit***	***Automotive***
Dr. Mick Lambert	Southern Medical	Plastics
Salvatore J. Monte	Palisades	Thermoplastic Materials & Foams
Michelle Moran	Chicago	Medical Plastics
David R. Schultz	Akron	Polymer Modifiers & Additives
Raymond J. Shute	Chicago	Thermoplastic Materials & Foams
Johnny Suthers	TN-VA-Holston Valley	Color and Appearance
Ronald L. Walling	Chicago	Plastics Environmental
Thomas Walsh	South Texas	Engineering Properties & Structure

Norm Kakarala receives the Honored Service Member Award from 2002-2003 SPE International President Claudius Feger.

Fred Deans receives the Honored Service Member Award from 2002-2003 SPE International President Claudius Feger.

Automotive Sessions at 2003 ANTEC

Two automotive sessions were held at 2003 ANTEC to cover six presentations on materials characterization topics in the morning session and six process and applications related topics in the afternoon session. Jay Raisoni of Delphi moderated morning session and Mike Shoemaker of Dow moderated the afternoon session. Both sessions were well attended with standing room only on some of the presentations.

Dr. Suresh Shah of Delphi reviewed the materials, process, and design technologies involved in the 2002 Automotive Innovations Award winners and finalists. Also Suresh Shah presented the paper on the Grand Award Winner extrusion film lamination of TPO bumper fascia.

The paper presented by Tom Pickett of GM on "Alternatives to Coating Automotive Plastics" was awarded the best paper award for the automotive sessions at 2003 ANTEC.

Automotive Division business meeting was held at the end of the automotive sessions. Fred Dean conducted the meeting and reviewed the division activities and encouraged more members to join the division and volunteer their services. Fred Dean and Norm Kakarala have received the Honored Service Members Awards at the 2003 ANTEC.

Alternatives to Coatings for Automotive Plastics

The following paper was presented the "Best Paper" award at the Automotive Sessions at ANTEC 2003.

Norm Kakarala
Delphi Automotive Systems
Troy, MI

Tom Pickett
General Motors Corporation
Warren, MI

Abstract

Coatings or paints are generally pigmented polymeric dispersions or powders that are usually applied as a secondary process step to form a layer on the substrate. Eliminating coatings can drastically reduce the cost of the part as well as provide environmental advantages. In recent years there have been major advances in alternatives to coatings for automotive plastic parts. These advances are categorized into two main areas, material development and process development.

From a materials perspective, new colorants and modifiers have been developed as additives to plastic resins that provide the aesthetic and physical and chemical properties required. From a process perspective, advances in process technology in areas of extrusion, co-extrusion, injection molding, laminating films, and thermoforming of multiplayer sheets have been developed. This paper will examine these different alternatives to coatings for automotive plastic applications.

Introduction

Original equipment manufacturers (OEMs) have a strong desire to explore alternatives to coatings. Eliminating coatings can drastically reduce the cost of the part. No extensive investment for painting lines is required. Coating an injection molded part is 60 to 75% of the total part costs (1). There is an environmental advantage by eliminating the pollutants such as volatile organic components (VOC) that exists in coatings. Damaged non-coated parts can be recycled easier since there is no additional cost to remove the coating.

This has led to an increase interest in alternatives to coatings. However, trying to achieve color, gloss, UV stability, scratch and mar resistance, and chemical resistance without using coatings is difficult. Improvements in one property often result in sacrifices in another property. Thus, it results in balancing the trade off in properties. In recent years, there have been major advances in alternatives to coatings. These advances are categorized in the areas of material development and process development.

Materials Development

Advances in additives and colorants have allowed for mold in color automotive plastic parts to meet the aesthetic and property requirements of the automotive industry.

Advances in Property Enhancement Additives

Additives are added to the polymer matrix to improve the processability of polymers and to improve properties of the final plastic product. In this section, we specifically look at additives that improve specific properties of the final plastic product to eliminate coatings. Additives can be used to improve the scuff resistance. In addition, UV stabilizer additives are used to improve the resistance to UV. Furthermore, additives such as flatteners and metal flakes can be added to the polymer matrix to satisfy the range of low as well as high gloss required for interior and exterior automotive applications.

Advances in light stabilizers have allowed plastics to meet the UV stability requirements in automotive exterior and interior applications. Light stabilizers, which are often referred to as UV stabilizers, are used in a variety of resins to prevent degradation by different wavelengths of light. The more common light stabilizers provide protection against photodegradation caused by UV radiation that is a component of sunlight. UV radiation can break certain chemical bonds. This creates free radicals that combine with oxygen to form peroxy radicals. The peroxy radicals attack the polymer chains resulting in deterioration of physical and aesthetic properties.

Light stabilizers are divided into three categories: UV absorbers, free radical terminators, and quenchers (2). UV absorbers will absorb the UV radiation to prevent the formation of free radicals. Hindered-amine light stabilizers (HALS) terminate the free radicals. They are more expensive than UV absorbers. The third category of light stabilizers is quenchers, which are often represented by nickel complexes. Because of toxicity of heavy metals and substances of concern (SOCs) from OEMs and government regulations, quenchers are not as widely used.

Advances in Colorants

Adding color pigments to plastics can achieve the desired color without the need to coat. Colorants are used to integrally color plastic. Colorants of plastics are divided into two categories - pigments and dyes. Pigments are insoluble organic or inorganic particles that are dispersed and suspended in a resin or compound (3). On the other hand, dyes act as colorants that dissolve in the plastic matrix.

Pigments are black, white, or different shades of color. Organic carbon black is a commonly used black pigment. A commonly used white pigment, titanium dioxide and zinc oxide, is inorganic. In recent years, several inorganic pigments have been developed with increased thermal and UV stability. The additional features of these inorganic pigments require higher processing costs and selling prices. On the other hand, organic pigments are complex carbon compounds that offer a wide range of colors. Typically, organic pigments have lower cost and lower stability compared to inorganic pigments (4). Dyes are organic and typically provide brighter colors than pigments (5). Dyes are soluble in plastic and are often used to create transparent tints in clear resins. Dyes offer easy processing and dispersion and are often used to make high gloss pigment based colors. However, dyes typically offer poor thermal and UV stability and have a tendency to plate out with high temperature processing (6).

Colorants are divided into the following categories: dry color, conventional color concentrates, supercons, liquid color, and precolored resin (7). The precolored resin has the color incorporated into the resin when a processor receives it. The new developments in color have allowed colored plastics to match the painted body colors on automobiles. Straight shade body colors are easier to match compared to metallic body colors.

Automotive Applications With Advances In Materials

The advances in property enhancement additives and colorants have led to a number of mold-in-color automotive applications that have traditionally been coated. The term mold in color is commonly used in the automotive industry to refer to plastic parts that have the desired finish and color directly out of the tool or die. Exterior applications such as fascias, moldings, claddings, step pads, bumper rub strips, and rockers have been molded in color. Also, interior applications such as trim panels, door handles, instrument panels have been molded in color. As a result of the advances in new colorants and modifiers, there are automotive applications that are mold in accent color, mold in straight shade body color, and mold in metallic body color.

Process Technology

In addition to the material development, there has been significant process technology development that has allowed alternatives to coating for automotive applications.

Extrusion

Advances in the extrusion process has allowed the elimination of coatings in specific applications. Specifically, development work on screw design, die design, and elimination of the breaker plate has allowed an extrusion process to manufacture high gloss mold in color body side moldings that matched painted body color. Process developments in extrusion have open the way for other exterior and interior trim applications that meet the aesthetic requirements right out of the extrusion die.

Co-extrusion is a process that allows for extrusion of two or more materials. The core layer often uses a less expensive material. The surface layer material is chosen to meet the appearance and performance requirements of the part. The surface layer material is usually more expensive since it has the colorants and property enhancement additives. The co-extrusion process has been successfully used for profile co-extruded body side molding applications.

Injection Molding

Attention given to design for manufacturing has allowed mold in color straight shades to be injection molded. Parts are designed with proper gating and uniform wall thickness. Further advances in close loop process controls have made once challenging parts easier to manufacture. In addition, development of sequential valve gating has allowed more control in the plastic filling of the injection mold. As a result, sequential valve gating has been used successfully in mold in color metallic fascias and trim components. Parts have been made without metallic streaking.

Co-injection molding is a process in which injection molding of parts with a skin of one thermoplastic and a core of another compatible thermoplastic. Like co-extrusion, co-injection molding can offer cost advantages by molding the base layer out of a less expensive material and the top layer or surface layer out of another material that offers the appearance and weatherability. The base layer does not require the expensive pigmentation package.

In-Mold Process Using Dry Films

A painted dry film is unwound across an open mold. The

painted surface of the film is positioned against the mold face. The mold is clamped, and the molten resin is injected into the cavity. As the mold fills, the temperature and pressure of the incoming resin forms the paint film into the shape of the part. When the mold opens, the painted part exits the mold with the paint film bonded to it. This process is limited to applications with simple geometry due to limitations of the film elongation. It has been used successfully in appliques where the part has a flat geometry.

Insert Molding Using Dry Films

A dry paint film sheet is thermoformed and trimmed into the shape of the finished part. The trimmed film (preform) is inserted into the cavity side of the injection mold. The mold is closed and the molten resin is injected into the mold. The backing sheet of the laminate forms a melt bond with the injection molding resin. The part exits the mold with a painted film surface. Using dry paint film, the manufacturer can produce high or low gloss parts that match the painted body color. The film offers the scratch and mar resistance. Metallic and pearlescent color finishes are available. The first application of the dry film was on a 1994 GMC Jimmy sport utility body side molding to give a brushed-aluminum look (8). In 1995, body side moldings were manufactured to match painted body color. This process is used in production in numerous applications such as side view mirror housings, side moldings, and other exterior and interior trim applications.

The dry paint film is made by casting a clear coat and then a base coat in a reverse rollcoating process. A layer of thermoplastic adhesive is applied behind the base coat. The cured paint films layers are then laminated to a thermoplastic back sheet. The dry paint film supplied in roll form to the molder and is thermoformed and trimmed into shape of the finished Class A surface.

One must carefully evaluate the overall costs associated with insert dry film molding compared to coating. Dry film molding requires a thermoform tool, a system to place the preformed film in the injection mold, an injection molding tool, and a trim process.

Insert Molding of Co-extruded Film

Films (0.2 to 1 mm) and sheets (2 to 5 mm) are co-extruded. Co-extruded sheets consisting of multi-layers are thermoformed and inserted into an injection mold. This process is also referred to as overmolding. It is well established for automotive interiors. There are a number of promising developments for exterior applications. It is applicable for simple geometry parts with large surface area.

Advances in both thermoforming and co-extruded sheet material have made this a viable process. Advances in thermoforming have improved the process capability to handle mass production. Film constructions consist of multilayers with each layer having a specific function. For example, there is a surface layer that is clear and functions as a clear coat. It provides the UV, scratch and mar resistance. It is similar to a clear coat in painting. The next layer is an adhesive layer. This is followed by a pigment layer that provides the color. Then there is an adhesive layer followed by the base layer, which acts as a carrier.

There exist advantages of films compared to coating. There is easier color matching between different production sites. Also, it allows for rapid color changes. It eliminates the cost and maintenance of a paint line. Furthermore, it is environmentally friendly.

Extrusion Compression Molding with Film Inserts

A film is placed in a compression mold. Plastic is extruded onto the film. Often times a reinforcing layer such as glass fiber matt is added. The mold is closed. The heat from the extruded plastic will heat the film for forming. The film provides a class A surface part. Films such as poly vinylidene floride / acrylic, polyester, ionomer, and ASA have been used.

The Valyi SFC, Surface Finishing / Compression Molding process, has demonstrated the capability to manufacture large structural panels such as automotive roof tops, hoods, and trunk deck lids (9). The SFC process can be used to manufacture large class "A" exterior finishes parts at a low clamp force. The pre color matched films offer the part appearance in the mold thus eliminating painting.

Thermoform Co-extruded Sheets

A co-extruded multi-layer sheet is thermoformed. As with films, each layer of the sheet has a specific function. The top layer provides the weathering and UV resistance, scratch and mar resistance, hardness, and the gloss. The color layer provides the coloring, additional UV resistance, and adhesion. After the sheet is co-extruded, it is cut to size. The sheet is then heated, thermoformed, and cooled. During thermoforming, the sheet is drawn against the thermoform mold by a vacuum. The surface quality of the thermoformed sheet can equal that of painted panels (10). It must be noted that the surface roughness increases with the depth of thermoforming (11). A thinner residual wall thickness will result in a rougher surface. This will lower the gloss of the finished part. Also, for metallic colors, the greater the number and size of the particles, the rougher the surface (12).

This technology is limited to parts that can be thermoformed. Thermoform tooling is inexpensive. Achieving a high gloss level is difficult with the thermoforming process. Body panels made of PMMA / ABS have a proven track record on the Ligier small vehicles in Europe (13). Also, the Hotzenblitz, an electric car in Germany, and the PIVCO, a Norway electric car, have body panels from PMMA / ABS without painting (14). The PMMA

provides the UV and weather-resistant outer layer. The impact strength at low-temperature is provided by the ABS layer.

Mold in Color with Clearcoat

General Electric Xenoy PC/PBTP with clearcoat PUR is used to mold body panels for the European "Smart Car". The clearcoat offers the UV and scratch and mar protection. Smart Car colors are offered in red, yellow, black and white straight shades. This process still uses a coating, clear coat. However, it eliminates the primer and base coat.

Automotive Applications With Advances in Process Technology

Advances in the extrusion and co-extrusion process have resulted in mold in color exterior and interior automotive plastic trim parts. For example, extrusion process is commonly used for mold in color body side moldings. Mold in color fascias, claddings, exterior and interior trim parts are manufactured by injection molding and co-injection molding. Advancement in both film technology and processing has allowed the manufacture of parts ranging from appliques to whole body panels on vehicles.

Conclusion

Alternatives to coating automotive plastics have received increased attention in developing new materials and process technologies to meet the demands of the automotive industry. These advances have been used successfully in a number of automotive applications. For example, advances in development of new colorants and additives has allowed mold in color to be used in more applications such as mold in accent color, mold in straight shade body color, and mold in body color metallic. In addition, development of extrusion, injection molding, thermoforming, insert molding of films processes has allowed OEMs alternatives to coatings for automotive plastic applications. Challenges still remain. For example, color matching is a real concern with mold in color plastics both initially and after weathering. In the future, continuous advances in both materials and process technologies will allow alternatives to coatings to make further inroads into the automotive plastic applications that are currently coated.

References

1. A Grefenstein. Coextrusion of PMMA Coated Plastic Sheets and Films as an Alternative to Painting of Plastic Body Panels. IBEC '97 Automotive Body Painting, p 89.
2. CJ Reilly. Light Stabilizers. Modern Plastics Encyclopedia '97, 73(12): C 24, 1996.
3. J Cafferty. Colorants. Modern Plastics Encyclopedia '97, 73(12): C 20, 1996.
4. J Cafferty. Colorants. Modern Plastics Encyclopedia '97, 73(12): C 20, 1996.
5. J Cafferty. Colorants. Modern Plastics Encyclopedia '97, 73(12): C 20, 1996.
6. J Cafferty. Colorants. Modern Plastics Encyclopedia '97, 73(12): C 20, 1996.
7. J Cafferty. Colorants. Modern Plastics Encyclopedia '97, 73(12): C 20, 1996.
8. L Debow. Honda Picks Dry Paint Film for Civic Side Moldings. Automotive Plastics 18: February 2001.
9. S McCarthy, Q Guan, C Makadia, T Ellison. Class A Thermoplastic Automotive Part Production Without Painting. ANTEC 2654, 2000.
10. H Kappacher. Car Bodies Made of PMMA/ABS. Piesendorf/Austria.
11. H Kappacher. Car Bodies Made of PMMA/ABS. Piesendorf/Austria.
12. H Kappacher. Car Bodies Made of PMMA/ABS. Piesendorf/Austria.
13. H Kappacher. Car Bodies Made of PMMA/ABS. Piesendorf/Austria.
14. Senotop In Mold Films As A Paint Replacement for Injection Molded Car Body Parts and Car Body Parts Mode of Fiberglass Reinforced Polyurethane. The Senoplast In Mold Film Brochure, 1997.

SPE International Education Award

The SPE International Education Award (in honor of Dr. Fred E. Schwab) for 2003 goes to Charles L. Beatty. The ***Automotive Division*** and ***Detroit Section*** of the Society of Plastics Engineers sponsor this award. SPE's 2002-2003 President, Claudius Feger, made the presentation during the Society's 61st Annual Technical Conference (ANTEC) at the Wednesday evening "SPE Celebrates" Banquet on May 7th, held in the Renaissance Nashville Hotel, Tennessee.

Dr. Charles L. Beatty, Professor in the Materials Science and Engineering Department at the University of Florida, was instrumental in establishing a plastics engineering curriculum there, developing eight core polymer courses for undergraduate and graduate students, and also creating and organizing specialty courses on plastics product design engineering and rapid prototyping. Additionally, while an officer of the SPE Engineering Properties & Structure Division, he led efforts to promote plastics education at the K-12 grade levels.

Dr. Beatty holds a B.S. in chemical engineering from Purdue University, an M.S. in chemical engineering from Case Western Reserve University, and an M.S. and a Ph.D. in polymer science and engineering from the University of Massachusetts. He joined the University of Florida in 1979, and since 1989 he has been director of the university's Polymer Processing and Properties Facility. He is the author of more than 450 technical publications and presentations and 15 U.S. patents, and he serves on the advisory board for the SPE technical journal Polymer Engineering & Science.

The Education Award is one of six awards presented this year by the Society. Each of these awards consists of a $2,500 honorarium and an acrylic plaque. The winner of the International Award receives $5,000 and a gold medal.

(L to R) Mike Kirtly, Detroit Section President, Dr. Charles L. Beatty, 2002-2003 SPE International President Claudius Feger, and Automotive Division past Chair Fred Deans with the SPE International Education Award.

In addition to Dr. Beatty, the additional 2003 honorees are:

The South Texas Section funds the **SPE International Award** to Glenn L. Beall, Glenn Beall Plastics Ltd.

Bayer Corp. & The Southern California Section fund the **SPE Research Award** (in memory of John C. Moricoli) to Dr. Donald G. Baird - Virginia Polytechnic Institute and State University.

Nova Chemicals Ltd. sponsors the **John W. Hyatt Award** to President Jimmy Carter and The Carter Center.

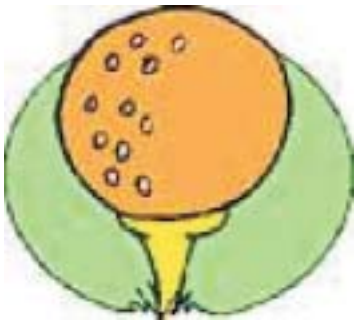
Dow Plastics funds the **Engineering/Technology Award** (in memory of Fred O. Conley) to Dr. Robert A. Weiss, University of Connecticut

Plastics Engineering and Plastics Engineering - Europe Magazines fund the **Business Management Award** to William S. Stavropoulos - The Dow Chemical Company.

Automotive Division Golf Outing

Dunham Hills Golf Club

Hartland, MI (248) 887-9170
Monday, July 28, 2003



Registration/Lunch	11:30
Shot-gun Start	1:00

Join us for a fun afternoon of lunch, golf, refreshments and networking. This outing is a great opportunity to meet people, entertain customers, or just get out. We are limited to 36 foursomes, so register early!

TO REGISTER FOR THIS EVENT:

Complete and fax this form to:
Society of Plastics Engineers
Fax number (248) 244-8925

Mail Checks to:
SPE Automotive Division
1800 Crooks Road, Suite A
Troy, MI 48084

For additional information call Jim Staargaard at (248) 351-8445

Name: _____

Company: _____

Division/Department: _____

Company Address: _____

_____

Phone: _____ Fax: _____ Email _____

Signature of Purchaser: _____

☐ Single Golfer(s) _____ @ $95 each

☐ Foursome(s) _____ @ $380 each

Total amount due: $_____

☐ Check forthcoming or enclosed ☐ Bill my credit card

Type of card: VISA/MC/AmX Card Number: _____

Name on card: _____ Exp. Date: _____

Entry fee includes lunch, greens fees, and cart. Entry is not confirmed until payment is received. Once payment is received, a confirmation fax will be sent to you verifying your order. Golfing Rain or Shine, no refunds. For further information, you may contact SPE by phone at (248) 244-8993 or by e-mail at spe@plastics.org

Automotive Division Directory

Division Officers and Executive Committee

Michael Connolly, Chairman
Huntsman Polyurethanes
(248) 322.7416

Monica Prokopyshen, Chairman-Elect
DaimlerChrysler Corporation
(248) 576.7498

Stuart Cohen, Treasurer
Ticona Polymers
(248) 377.6882

Fred Deans, Secretary
Continental Structural Plastics
(248) 593.9500

David Arndt, Division Councilor
Visteon Automotive Systems
(313) 755.8146

Suzanne Cole, Past-Chairman
Cole and Associates, Inc.
(810) 750.3863

Dr. Fred E. Schwab, Director Emeritus
Group Four Associates
(734) 464.1103

Josh Madden, Director Emeritus
Material Engineering Services
(248) 829.6335

Allan Murray, Director Emeritus
Ecoplexus, Inc.
(248) 851.5377

Gordon Miesel, Director Emeritus
Ashland Chemical
(248) 244.9120

Committee Chairpersons

Jay Raisoni, Technical Programs
Delphi Automotive Systems
(248) 655.8258

Josh Ullrich, Education
Spartech Polycom
(248) 375.4300

Bing Xu, Membership
Ford Motor Company
(313) 337.6836

Stuart Cohen, Awards Program
Ticona Polymers
(248) 377.6882

Teri Chouinard, Newsletter Sponsorship
Intuit Group, LLC
(810) 797.7242

Jim Staargaard, Golf Outing
GE Plastics
(248) 351.8445

Monica Prokopyshen, Safety Conference
DaimlerChrysler Corporation
(248) 576.7498

Renita Jones, Composites Conference
BP
(770) 944.4739

Norm Kakarala, 2003 ANTEC
Delphi Corporation
(248) 655.8483

Darryl Sadowski - Inter-Society
Washington Penn
(248) 475.5906

Peggy Malnati - Publicity
AH&M
(248) 477.3366

Kevin Pageau, Newsletter Editor
Tuscarora, Inc.
(248) 258.0306

Directors to May 2003

Ermanno Ruccolo Basell	(248) 244.1449
Kevin Smith Decoma	(248) 729.2816
Phillip Minaudo General Motors	(810) 986.0432
Darryl Sadowski Washington Penn	(248) 475.5906
Michael Connolly Huntsman	(248) 322.7416
Bing Xu Ford Motor Company	(313) 337.6836

Directors to May 2004

David Reed General Motors Corporation	(810) 986.5336
Jim Staargaard GE Plastics	(248) 351.8445
Nippani Rao DaimlerChrysler Corporation	(248) 576.7483
Terry Cressy DuPont Automotive	(248) 583.8102
Rahul Mukerjee Visteon Corporation	(313) 737.1044
Ed Garnham Engineering Plastic Products, Inc.	(248) 752.6511

Directors to May 2005

Kevin Pageau Tuscarora, Inc	(248) 258.0306
Jitesh Desai Visteon Corporation	(313) 755.4653
Suresh Shah Delphi Corporation	(248) 351.8124
Josh Ullrich Spartech Polycom	(248) 375.4300
Tom Morse CalsonicKansei North America	(248) 848.4729
Jay Raisoni Delphi Corporation	(248) 655.8258

Visit our website at www.speautomotive.com

Automotive Division Hotline - (248) 244-8993

Society of Plastics Engineers
Automotive Division
1800 Crooks Road
Suite A
Troy, MI 48084