PLASTICS: INNOVATION IN MOTION

SPE Innovation Awards
Competition & Gala
HONORING THE BEST IN AUTOMOTIVE PLASTICS

November 9, 2016
FREEDOM of DESIGN

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Welcome to the 46th-annual SPE® Automotive Innovation Awards Gala, sponsored by the Automotive Division of the Society of Plastics Engineers (SPE). I'm honored to once again lead this annual program, the world's oldest and largest recognition event in the automotive and plastics industries. Each year we see the latest and best results of cooperative innovation by automotive engineers, designers, and their suppliers whose combined ingenuity and creativity reinforce the dynamic nature of the automotive industry. My colleagues in the Automotive Division are excited to offer this tribute to the latest innovation in plastics and composites in ground transportation.

This year’s theme, Plastics: Innovation in Motion, reflects the notion of mobility and the changes beginning to take place in the global automotive industry around comfort and convenience while also delivering safe, inspiring, and efficient transportation. Plastics play an important role in delivering what car buyers want. Innovations in lighter weight components, powertrain technologies, and surprise & delight features on new vehicle programs will likely be a differentiating factor in the purchase decisions that we all make when buying our next vehicle. Several of these new technologies, materials, and processes will be presented tonight.

The competition this year was among the most intense in recent years, with a record 75 nominations across 9 different categories. Tonight’s program will recognize the accomplishments of the people and companies involved in this year’s most innovative use of plastics with awards in the following areas:

- Aftermarket
- Body Exterior
- Body Interior
- Lifetime Achievement
- Chassis & Hardware
- Environmental
- Materials
- Powertrain
- Process, Assembly & Enabling Technologies
- Safety
- Grand Award

We also will recognize a new entry into our SPE Automotive Division Hall of Fame and our newest recipient of the Lifetime Achievement Award, which recognizes the technical achievements of individuals whose work – in research, design, and/or engineering – has led to significant integration of polymeric materials on passenger vehicles.

Before we begin tonight’s program, I would like to thank the many volunteers, sponsors, and judges who make this event possible. It is their dedication and commitment – their passion for innovation – that enable the SPE Automotive Division to recognize the industry's most innovative use of plastics and composites in automotive applications.

Once again, welcome to the 2016 SPE Automotive Innovation Awards Gala. Thank you for joining us and we hope you enjoy the event.

Sincerely,

Jeffrey Helms
Innovation Awards Chair 2010-2016
Global Automotive OEM Corporate Accounts Director
Engineered Materials
Celanese
SCHEDULE OF EVENTS

4:30-6:00 pm Reception / Preview of Nominated Parts & Vehicle Displays
6:00 pm Seating Begins
6:45-7:00 pm Welcome / Dinner
Jeffrey Helms, Celanese, ‘11–’16 SPE Automotive Innovation Awards Program Chair
Teri Chouinard, Intuit Group
Verghese Thomas, Chief Technology & Innovation Officer, Celanese
7:00-9:00 pm Gala Program

Aftermarket
Kevin Pageau, International Marketing Alliance

Body Exterior
Tom Pickett, General Motors Co.

Body Interior
Yvonne Merritt, Ford Motor Co.

Lifetime Achievement
Dave Reed, General Motors Corp., retired

Chassis & Hardware
Rose Petrella-Lovasik, Ford Motor Co.

Environmental
Monica Prokopyshen, Chrysler Corp., retired

Hall of Fame
Nippani Rao, Asahi Kasei North America, Inc.

Materials
Suresh Shah, Delphi Corp., retired

Powertrain
Joel Meyers, Hyundai-Kia Technical Center America

Process, Assembly & Enabling Technologies
Steven VanLoosen, BASF Corp.

Safety
Suzanne Cole, Miller Cole LLC

Grand Award
Jeffrey Helms, Celanese

9:00-11:00 pm Afterglow Reception
Everyone Invited to Attend

BLUE RIBBON JUDGES

Suzanne Cole, Miller Cole LLC
David Cole, AutoHarvest; Center for Automotive Research
Subi Dinda, DaimlerChrysler, retired; Oakland University
John Fillion, Chrysler Group LLC, retired
Kerri Jansen, Plastics News magazine
Gary Kogowski, Ravago Holdings Americas
Sean McElroy, Autoline Detroit
Thomas Moore, DaimlerChrysler, retired
Allan Murray, Allied Composite Technologies LLC, SPE Emeritus
Ron Price, Global Polymer Solutions
Nippani Rao, Asahi Kasei Plastics North America, Inc., SPE Emeritus
Tom Russell, Allied Composite Technologies LLC
Lilli Sherman, Plastics Technology magazine
Roy Sjöberg, Team R2S LLP
Chris Theodore, Theodore & Associates LLC
Drew Winter, WardsAutoWorld.com magazine
Conrad Zumhagen, The Zumhagen Company LLC

Special recognition for the rest of the committee members and judging coordinators: Fred Deans, Mark Lapain, Peggy Malnati, Norm Kakarala, Kevin Pageau, Jay Raisoni, Nippani Rao, Suresh Shah, & Dawn Stephens.

Special thanks to our student usher organizers, Teri Chouinard, Crystal van Houten, and Dave Reed.

Design: JPI Creative Group; Signage: That Color;
Printing: Real Green; A/V Support: Concept Productions;
Truffles: Business Design Solutions
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Michiganbusiness.org/brainpower
### Plastics Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ABS</td>
<td>acrylonitrile butadiene styrene</td>
</tr>
<tr>
<td>ACM</td>
<td>alkyl acrylate copolymer</td>
</tr>
<tr>
<td>ASA</td>
<td>acrylic-styrene-acrylonitrile</td>
</tr>
<tr>
<td>CF</td>
<td>carbon fiber</td>
</tr>
<tr>
<td>CFRP</td>
<td>carbon fiber-reinforced plastic</td>
</tr>
<tr>
<td>D-LFT</td>
<td>direct-(ILC) long-fiber thermoplastic</td>
</tr>
<tr>
<td>EPP</td>
<td>expanded polypropylene foam</td>
</tr>
<tr>
<td>EVA</td>
<td>ethylene vinyl acetate</td>
</tr>
<tr>
<td>GF</td>
<td>glass fiber (reinforced)</td>
</tr>
<tr>
<td>GMT</td>
<td>glass-mat thermoplastic</td>
</tr>
<tr>
<td>GR</td>
<td>glass (fiber) reinforced</td>
</tr>
<tr>
<td>HDT</td>
<td>heat-deflection temperature</td>
</tr>
<tr>
<td>ILC</td>
<td>inline compounded</td>
</tr>
<tr>
<td>ITR</td>
<td>isophthalate terephthalate resorcinol</td>
</tr>
<tr>
<td>LCP</td>
<td>liquid crystal polymer</td>
</tr>
<tr>
<td>LFT</td>
<td>long-fiber thermoplastic</td>
</tr>
<tr>
<td>MFI</td>
<td>melt flow index</td>
</tr>
<tr>
<td>MFR</td>
<td>melt flow rate</td>
</tr>
<tr>
<td>MIC</td>
<td>molded-in-color</td>
</tr>
<tr>
<td>MPPE</td>
<td>modified-polyphenylene ether (also called MPPO, modified-polyphenylene oxide)</td>
</tr>
<tr>
<td>OOA</td>
<td>out-of-autoclave (process)</td>
</tr>
<tr>
<td>PA</td>
<td>polyamide (also called nylon)</td>
</tr>
<tr>
<td>PC</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>PC/ABS</td>
<td>polycarbonate/acrylonitrile butadiene styrene</td>
</tr>
<tr>
<td>PC/ASA</td>
<td>polycarbonate/acyrlic-styrene-acrylonitrile</td>
</tr>
<tr>
<td>PC/PBT</td>
<td>polycarbonate/polybutylene terephthalate</td>
</tr>
<tr>
<td>PE</td>
<td>polyethylene</td>
</tr>
<tr>
<td>PEI</td>
<td>polyethytermidine</td>
</tr>
<tr>
<td>PET</td>
<td>polyethylene terephthalate</td>
</tr>
<tr>
<td>PMMA</td>
<td>polymethyl methacrylate (also called acrylic)</td>
</tr>
<tr>
<td>POM</td>
<td>polyoxymethylene (also called acetal)</td>
</tr>
<tr>
<td>PP</td>
<td>polypropylene</td>
</tr>
<tr>
<td>PPA</td>
<td>polyphthalamide</td>
</tr>
<tr>
<td>PPS</td>
<td>polyphenylene sullide</td>
</tr>
<tr>
<td>PTFE</td>
<td>polytetrafluoroethylene</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride (also called vinyl)</td>
</tr>
<tr>
<td>PVBl</td>
<td>polyvinyl butyral</td>
</tr>
<tr>
<td>PVDF</td>
<td>polyvinylidene fluoride or polyvinylidene difluoride</td>
</tr>
<tr>
<td>SMA</td>
<td>styrene maleic anhydride</td>
</tr>
<tr>
<td>SMC</td>
<td>sheet-molding compound</td>
</tr>
<tr>
<td>TiO₂</td>
<td>titanium dioxide</td>
</tr>
<tr>
<td>TPC-ET</td>
<td>thermoplastic copolyester elastomer</td>
</tr>
<tr>
<td>TPE</td>
<td>thermoplastic elastomer</td>
</tr>
<tr>
<td>TPO</td>
<td>thermoplastic polyolefin</td>
</tr>
<tr>
<td>TPV</td>
<td>thermoplastic vulcanizate</td>
</tr>
</tbody>
</table>

### Automotive Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A/C</td>
<td>air conditioning</td>
</tr>
<tr>
<td>AGS</td>
<td>active grille shutter</td>
</tr>
<tr>
<td>BEV</td>
<td>battery-electric vehicle</td>
</tr>
<tr>
<td>BW</td>
<td>body in white</td>
</tr>
<tr>
<td>BSR</td>
<td>buzz/squeak/rattle</td>
</tr>
<tr>
<td>CAD</td>
<td>computer-aided design</td>
</tr>
<tr>
<td>CAE</td>
<td>computer-aided engineering</td>
</tr>
<tr>
<td>CLTE</td>
<td>coefficient of linear thermal expansion</td>
</tr>
<tr>
<td>CNC</td>
<td>computer-numerical control</td>
</tr>
<tr>
<td>CUV</td>
<td>cross-over (sport-utility) vehicle</td>
</tr>
<tr>
<td>EA / EAs</td>
<td>energy absorber(s)</td>
</tr>
<tr>
<td>EGR</td>
<td>exhaust-gas recirculation</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FIP</td>
<td>foam-in-place</td>
</tr>
<tr>
<td>FMVSS</td>
<td>U.S. Federal Motor Vehicle Safety Standard</td>
</tr>
<tr>
<td>GOR</td>
<td>grille-opening reinforcement</td>
</tr>
<tr>
<td>HDT</td>
<td>heat-deflection temperature</td>
</tr>
<tr>
<td>HEV</td>
<td>hybrid-electric vehicle</td>
</tr>
<tr>
<td>HIC</td>
<td>head-injury criterion</td>
</tr>
<tr>
<td>HID</td>
<td>high-intensity discharge</td>
</tr>
<tr>
<td>ICE</td>
<td>internal combustion engine</td>
</tr>
<tr>
<td>IP</td>
<td>instrument panel</td>
</tr>
<tr>
<td>LED</td>
<td>light-emitting diode</td>
</tr>
<tr>
<td>Li-ion</td>
<td>lithium-ion</td>
</tr>
<tr>
<td>MPV</td>
<td>multi-purpose vehicle</td>
</tr>
<tr>
<td>NVH</td>
<td>noise/vibration/harshness</td>
</tr>
<tr>
<td>OEM</td>
<td>original-equipment manufacturer</td>
</tr>
<tr>
<td>PCR</td>
<td>post-consumer recyclate</td>
</tr>
<tr>
<td>ped-pro</td>
<td>pedestrian protection (requirement)</td>
</tr>
<tr>
<td>PHEV</td>
<td>plug-in hybrid-electric vehicle</td>
</tr>
<tr>
<td>PIR</td>
<td>post-industrial recyclate</td>
</tr>
<tr>
<td>SUV</td>
<td>sport-utility vehicle</td>
</tr>
<tr>
<td>TPC-ET</td>
<td>thermoplastic copolyester elastomer</td>
</tr>
<tr>
<td>VOCs</td>
<td>volatile organic compounds</td>
</tr>
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### Other Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D</td>
<td>two-dimensional</td>
</tr>
<tr>
<td>3D</td>
<td>three-dimensional</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
</tr>
<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>ft</td>
<td>foot</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>in</td>
<td>inch</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>kg</td>
<td>kilograms</td>
</tr>
<tr>
<td>lb</td>
<td>pound</td>
</tr>
<tr>
<td>KWH</td>
<td>kilometers/hour</td>
</tr>
<tr>
<td>km/h</td>
<td>kilometers/hour</td>
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<tr>
<td>m</td>
<td>meter(s)</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>MM</td>
<td>million(s)</td>
</tr>
<tr>
<td>MPG</td>
<td>miles/gallon</td>
</tr>
<tr>
<td>MPH</td>
<td>miles/hour</td>
</tr>
<tr>
<td>N</td>
<td>Newtons</td>
</tr>
<tr>
<td>sec</td>
<td>second</td>
</tr>
<tr>
<td>SG</td>
<td>specific gravity</td>
</tr>
<tr>
<td>USD</td>
<td>U.S. dollars</td>
</tr>
</tbody>
</table>
**Aftermarket**

**Wicker Bill Assembly**
2016 General Motors Co.  
Chevrolet Corvette Z06

System Supplier: 3 Dimensional Services Group  
Material Processor: 3 Dimensional Services Group  
Material Supplier: 3M Co.  
Material / Process: 3M 9490LE double-coated tape, 3M 300 MP/300 LSE / injection molding  
Tooling Supplier: 3 Dimensional Services Group

This application uses a proprietary and patented acrylic adhesive whose chemistry does not cause stress cracking when in contact with the injection molded, transparent PC/ITR spoiler substrate. The tape provides excellent adhesion to several families of polymers and is produced in a unique manufacturing process. The spoiler provides added downforce for improved handling and maximizes rear visibility during racing; the tape secures the spoiler for racing, but allows it to be removed when returning to street driving, solving a number of install/uninstall issues.

**Dual-Option Insert Carbon Fiber Composite Fuel-Filler Door**
2017 General Motors Co.  
Chevrolet Camaro

System Supplier: Polytec FOHA Inc.  
Material Processor: NOVO Plastics Inc.  
Material Supplier: Mitshibushi Rayon Co., Ltd., SABIC, Basler  
Material / Process: Pyrofil carbon fiber, Noryl GTX PA 6/MPPE, Urethane TR, clearcoat / injection or compression molding  
Tooling Supplier: Integrity Tool & Mold Inc.

This fuel-filler door design features inserts of either injection molded and painted MPPE/PA6 (in black, metallic silver, or red to match body paint) or compression molded and clear coated carbon fiber-reinforced composite with visible weave. The unique design of the system accommodates either the 2.0 mm-thick injection molded or the 1.0 mm-thick compression molded insert. The specially designed tool enables the Camaro name (with a 0.25 radius) on the fuel-filler door to be painted. Proprietary material is used for the visible-weave carbon composite version and a special clear coat on that insert offers 75% savings.

**Carbon Fiber Composite Spoiler**
2016 General Motors Co.  
Chevrolet Corvette

System Supplier: deBotech, Inc.  
Material Processor: deBotech, Inc.  
Material Supplier: Solvay  
Material / Process: Solvay MTM57 epoxy / autoclave cure  
Tooling Supplier: deBotech, Inc.

This 1-piece aftermarket epoxy/carbon fiber spoiler provides a premium carbon composite appearance and enables the same aerodynamic performance as production 3-piece spoilers with different aero variants while also reducing mass by 40%. The spoiler’s unique design and proprietary tooling combines solid wickerbills and an open cavity blade plus integral threaded inserts to facilitate manufacturing and assembly. The 1-piece construction offers a cleaner appearance due to reduction of fasteners. The spoiler is offered in both clearcoat with exposed weave and painted in carbon flash metallic paint.

**Dual-Option Insert Carbon Fiber Composite Fuel-Filler Door**
2017 General Motors Co.  
Chevrolet Camaro

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Material Processor: NOVO Plastics Inc.  
Material Supplier: Mitshibushi Rayon Co., Ltd., SABIC, Basler  
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Body Exterior

**Structural Front End Module with Active Grille Shutter**
*2016 Ford Motor Co.*
*Ford Super Duty*

- **System Supplier:** Shape Corp.
- **Material Processor:** Shape Corp.
- **Material Supplier:** Celanese Corp.
- **Material / Process:** Celstran GF40-20 40% GR LFT-PP / injection molding
- **Tooling Supplier:** Not available

This all-composite design without metallic reinforcement is the first AGS-capable, injection-molded PP-LFT FEM bolster used on a heavy-duty pickup platform. Replacing steel and plastic/metal hybrids at a 3 lb/1.4 kg and $3 USD savings/vehicle, the design offers parts consolidation with locating features that aid fit & finish, improves airflow, while meeting structural requirements for part deflections of <1mm on this 8,500 lb/3,856 kg class vehicle.

**Lightweight Glass**
*2017 Ford Motor Co.*
*Ford GT40*

- **System Supplier:** Pittsburgh Glass Works LLC
- **Material Processor:** Pittsburgh Glass Works LLC
- **Material Supplier:** Sekisui Chemical Co., Ltd.
- **Material / Process:** PVB / multiple
- **Tooling Supplier:** Pittsburgh Glass Works LLC

Three of 5 glass positions on this vehicle feature chemically tempered glazing that is part of a thin, hybrid laminate solution with an interlayer of solar-control PVB film that reduces glazing weight approximately 37% while lowering heat transmittance to keep interiors cooler. Versus conventional 0.20 in./4.96 mm thick laminates featuring 2 layers of soda-lime glass (SLG) with a PVB interlayer, the new construction features standard-thickness layers of SLG and PVB plus a very-thin (0.03 in./0.7 mm) layer of chemically tempered glass for a total thickness of 0.14 in./3.56 mm. The resulting laminate is thinner, lighter, tougher, and offers optical advantages.

**MIC High Gloss Body Color TPO Fascia**
*2017 Ford Motor Co.*
*Ford Transit Connect*

- **System Supplier:** Magna Exteriors, Inc.
- **Material Processor:** Magna Exteriors, Inc. - Nascote
- **Material Supplier:** Advanced Composites, Inc.
- **Material / Process:** ADX70004WFA TPO / injection molding
- **Tooling Supplier:** Tycos Tool & Die

Painted fascias are prone to chip and peel, which leads to warranty costs and customer unhappiness. Additionally, painting adds significant cost with negative environmental impact. Instead, a high-gloss, weather- and mar-resistant, MIC TPO material matched to vehicle body panel color is used. Rigorous testing was conducted to assure the material was resistant to stone pecking and road chemicals and would not change shape when exposed to high heat. Additionally, a lens-grade mold with SPI diamond polish and gating designed to minimize knitlines was used. The resulting part is 10% lighter, offers $800,000 USD annualized savings, and harmonizes with exterior painted components.

**Low Aerodynamic Drag Bumper System**
*2017 FCA Group*  
*Alfa Romeo Giulia 952*

- **System Supplier:** FCA
- **Material Processor:** FCA
- **Material Supplier:** SABIC
- **Material / Process:** SABIC PP compound; Geloy 8611P (PPc); Geloy HRA170; PP (bumper system); ASA/PC (grille) / injection molding
- **Tooling Supplier:** Sanvito & Somaschini S.p.A.

This front bumper with computer-controlled active air splitter keeps the splitter closed during straight acceleration to direct air under the body and toward the large rear diffuser/extractor, which uses the Venturi effect to convert high-pressure airflow to low pressure. During braking or cornering, the front splitter opens at the correct angle to provide a downforce of 220 lb/100 kg for improved handling. The combined system helps the vehicle achieve a best-in-class, low aerodynamic drag coefficient of 0.32 while supporting signature styling with impact and scratch resistance at lower mass and cost than the previous material.
**Body Exterior**

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**3D Radiator Grille**  
**2017 General Motors Co.**  
**Chevrolet Bolt**

System Supplier: Sam Shin Chemical Co.  
Material Processor: Sam Shin Chemical Co.  
Material Supplier: LG Chem Ltd.  
Material / Process: Lupoy 1000MU PC / injection molding  
Tooling Supplier: A-Tech Solution Co., Ltd.

A new appearance is achieved for this front grille by using “varied contouring” (variable wall thicknesses) on the B side of this injection molded, tinted PC part, which subsequently is UV coated on the A side and receives a 3-coat paint system on the B side. The end result is a unique 3D look on a 2D surface.

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**Tailgate Gap Hider Assembly**  
**2016 Nissan Motor Co. Ltd.**  
**Nissan Titan**

System Supplier: Metelix Products Inc.  
Material Processor: Metelix Products Inc.  
Material Supplier: Washington Penn Plastics Co., Inc.  
Material / Process: PPC1GF2UV-RXF 20% GR-PP / blow molding  
Tooling Supplier: Metelix Products Inc.

This tailgate gap hider provides a structural “bridge” over the gap between the end of the pickup bed and the open tailgate, reducing debris intrusion and withstanding heavy loads without breakage or deformation during loading and unloading. The spring-loaded unit offers 2 installation options and deploys and stows automatically during tailgate operation. A blow molded 20% glass-reinforced PP copolymer reduces mass 20% vs. structural steel solutions and offers better performance than non-structural aftermarket offerings. Special coarse texturing helps match the gap hider to spray-on bed liners while improving surface scratch resistance.
To solve the challenges of conventional seat construction, which limits console storage and rear-seat leg room, this product eliminates molded urethane foam from the seat back and replaces it with an all-plastic shell featuring a larger concave region that enables optimum occupant comfort. An innovative suspension system also is used that consists of a forward plastic seat back panel attached to the frame via spring joints. The technology can increase front console width by ≈ 0.8 in./20 mm and reduce seatback thickness by ≈ 2.1 in./52 mm or reduce overall vehicle cost $35-$40 USD and mass 3-4 kg.

Living-Hinge Cup Holder Adjustment Features
2017 Ford Motor Co.
Ford Super Duty

Cup holders are a focal point for customer critiques of vehicle interiors. Further, they must accommodate a wide range of container sizes without tipping during normal driving conditions. Incorporation of a living hinge (achieved via molded-in “fingers” and a flexible silicone-rubber band) in this cup holder design made it adjustable to accommodate many containers while reducing 10 parts to 3 with no secondary heat-stake operations. Furthermore, the design reduces part costs ≈ $1.50 USD/assembly, lowers tooling expenditure ≈ $100,000 USD, yet delivers equivalent appearance and performance.

Thin-Wall IP Substrate
2017 Ford Motor Co.
Lincoln Continental

Reportedly, this is the thinnest full-size, deep-draw injection molded IP in North America at 1.9 mm/0.07 in. It was achieved by using a 30% glass-reinforced LFT-PP. Versus the 2.4 mm/0.09 in. microcellular foam molded benchmark, this design was 14% lighter, saved over $1 USD in materials as well as the microcellular-foaming investment, and helped optimize packaging. Moldfilling analysis with fiber orientation was used for accurate warpage predictions and to develop tooling countermeasures to facilitate part molding.

2nd-Row Collapsible Under-Seat Bin
2017 Ford Motor Co.
Ford Super Duty

This innovative second-row under-seat storage bin is designed to expand, collapse, and lock from either side of the pickup. When stowed, the bin maintains a low profile (with no mechanisms exposed) to allow use of the load floor. When expanded, it provides a large amount of usable storage. The tough injection molded TPO resin meets all fit/finish and toughness requirements to -30C, while enabling use of a 4-pin hinge design to be molded in a large plastic assembly.

System Supplier: General Motors Co.
Material Processor: USF
Material Supplier: Advanced Composites, Inc.
Material / Process: GMW15548P-PP/PE-M15-Type 6A; GMW15548P-PP/PE-M20 Type 4; GMW16582P-15% GR-PA 6 / injection molding
Tooling Supplier: ToolPlas Systems Inc.

System Supplier: Faurecia Interior Systems / Detroit Manufacturing Systems Ltd., LLC
Material Processor: Faurecia Interior Systems
Material Supplier: SABIC
Material / Process: Stamax 30YK270E 30% GR LFT-PP / injection molding
Tooling Supplier: Lamko Tool & Mold Inc.

System Supplier: Summit Polymers, Inc.
Material Processor: Summit Polymers, Inc.
Material Supplier: Advanced Composites, Inc.
Material / Process: 20% talc-filled PP + EPDM / injection molding
Tooling Supplier: Not available

System Supplier: Yanfeng USA Automotive Trim Systems Company, Inc.
Material Processor: Yanfeng USA Automotive Trim Systems Company, Inc.
Material Supplier: Advanced Composites, Inc.
Material / Process: TPO / injection molding
Tooling Supplier: Circle 5 Tool & Mold
**Body Interior**

### Composite Suspensions for Upper and Lower Backs
2017 Ford Motor Co.  
Lincoln Continental

**System Supplier:** Leggett & Platt Inc., Magna International  
**Material Processor:** Summit Plastic Molding, Century Plastics  
**Material Supplier:** BASF Corp., Advanced Composites, Inc., DuPont Automotive  
**Material / Process:** Ultramid B3ZG7 OSI 35% GR PA OSI; Ultramid B3EG3 15% GR PA; ADX 5017 18% talc-filled UV TPO; Delrin 100 POM / injection molding  
**Tooling Supplier:** Summit Plastic Molding, Mega Mold

Thanks to integrated composite designs, this “perfect position seat” suspension system delivers tuned suspension to optimize occupant comfort by cradling the upper back and providing side-torso support, which flexes to accommodate various occupant sizes. Special attachment features facilitate assembly and service time. The design also creates a robust dynamic crash-energy management system for rear-impact protection. Molded-in-color is used for A surfaces and craftsmanship. The system, for which 83 patents have been filed, reduces total seat weight by 8% and cost by 15% despite adding more features.

### MIC Discrete PAB Cover
2016 Ford Motor Co.  
Ford Ka

**System Supplier:** ZF TRW  
**Material Processor:** Demo do Brasil  
**Material Supplier:** APIGO  
**Material / Process:** Apigo DP 2476 TPO / injection molding  
**Tooling Supplier:** Demo do Brasil

Passenger airbag covers are often painted, which is costly and can lead to warranty issues. Traditionally, molded-in-color was not feasible because the TPO material used did not meet Class A surface requirements. A new MIC cover design with a recessed surface and new styling line improves appearance of the tear line, eliminates painting, and saves 35% of the total cost for these parts. Integrating a new and complex cooling system for both the A and B surfaces helps reduce sinks and gloss variance, while injecting through a rib instead of directly onto the B surface improves aesthetics further.

### Quad-Barrel Convertible Cupholder
2017 Ford Motor Co.  
Ford Super Duty

**System Supplier:** Summit Polymers, Inc.  
**Material Processor:** Summit Polymers, Inc.  
**Material Supplier:** SABIC  
**Material / Process:** Cycolac XCY620 PC/ABS / injection molding  
**Tooling Supplier:** Not available

This console design converts from 2 cupholders plus a bin to 4 cupholders with the help of a patented slider tray assembly for greater user flexibility without the need to remove and stow components when not in use. The design of the injection molded PC/ABS cupholders accommodates beverage containers ranging from small coffee cups and water bottles to large all-day beverage containers while reducing weight 70% vs. the outgoing model and lowering costs $3 USD depending on content replaced.
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Dr. Lawrence Drzal, university distinguished professor of Chemical Engineering and director-Composite Materials and Structures Center at Michigan State University’s College of Engineering (MSU, East Lansing, Mich., U.S.A.), has been named the 2016 Lifetime Achievement Award winner by the Automotive Division of the Society of Plastics Engineers (SPE®). Drzal, the first academic winner of the award, is a composites expert who has specialized in surface and interfacial aspects of adhesively bonded joints plus the fiber / matrix interphase in composite materials and their processing; adhesion fundamentals; sustainable bio-based structural composite materials; and nanocomposite materials. During his career Drzal has given over 400 invited presentations at national and international conferences, published over 375 research papers, and has been awarded 35 patents.

Drzal credits his early engineering and co-op training coupled with his industrial and military service for his “problem-definition” approach to research, which has been characterized by observation of phenomena and identification of unresolved problems with common themes around technological advancement, sustainability, environmental friendliness, and benefit to society.” As a result, Drzal says he always has had the desire to provide both practical knowledge and fundamental knowledge in each research area and the research project he and his students have undertaken.

He is a founding member of both the Adhesion Society and the American Society for Composites and has served as president (1998-1999) of the Adhesion Society. He has chaired the Gordon Conference on Adhesion and the Gordon Conference on Composites and has served in many other professional activities related to chemical engineering, composite materials, and adhesion. He served on the editorial board of journals in the adhesion and composite materials fields (Composites Part A: Applied Science and Manufacturing; Journal of Biobased Materials and Bioenergy; Carbon Letters; and Nanocomposites) and was associate editor of the Journal of Adhesion.

Over his long and distinguished career, Dr. Lawrence Drzal has received numerous honors and awards including:

- 2016, University of Delaware's Medal of Excellence in Composite Materials;
- 2008, Best Technical Paper Award, Thermoset Division, Society of Plastics Engineers;
- 2006, Fellow, Society for the Advancement of Materials and Process Engineering (SAMPE);
Drzal earned a B.S. degree in Chemical Engineering from University of Detroit and a Ph.D. in Chemical Engineering and Polymer Science from Case Western Reserve University. He joined MSU's College of Engineering as a professor of Chemical Engineering in 1985 and became director of the school’s Composite Materials & Structures Center in 1986. A decade later, he became a university distinguished professor of Chemical Engineering & Materials Science.
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Air Induction System Mounting Structure
2016 General Motors Co.
Chevrolet Malibu

System Supplier: Toledo Molding and Die, Inc.
Material Processor: Toledo Molding and Die, Inc.
Material Supplier: Solvay Specialty Polymers
Material / Process: Ryton XK2340 PPS/PA / injection molding
Tooling Supplier: Toledo Molding and Die, Inc.

This air-induction system mounting structure replaced a steel part that was very complex and challenging to manufacture with an injection molded PPS/PA part. The plastic mounting system reduces mass 68%, eliminates an anti-corrosion coating, reduces production costs 64% and brings tooling savings of 50% vs. the previous steel part. Additionally, the polymer part meets all application requirements for thermal stability, chemical resistance, dimensional stability, fatigue resistance, and stiffness.

Strut Mount
2016 General Motors Co.
Cadillac CT6

System Supplier: ContiTech North America, Inc.
Material Processor: ContiTech North America, Inc.
Material Supplier: BASF Corp.
Material / Process: Ultramid A3WG10CR 50% GR-PA 6/6 / injection molding
Tooling Supplier: Not available

This is the first use of a glass-reinforced PA material for strut-mount housings on all 4 corners of a vehicle and the first application of polyamide housings on the front and rear suspension systems. The injection molded parts integrate common components for both front and rear mounts, and employ a special thread assembly method with a locking feature. They reduce mass 30% vs. typical steel and aluminum parts and reduce noise transmission through the suspension system. Thanks to modular assembly, the design also offers greater tuning flexibility.

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Chassis/Hardware

Rear Differential Cross-Member
2016 Daimler AG
Mercedes S-Class

System Supplier: ContiTech North America, Inc.
Material Processor: ContiTech North America, Inc.
Material Supplier: BASF Corp.
Material / Process: Ultramid A3WG10CR 50% GR-PA 6/6 / injection molding
Tooling Supplier: Not available

This is said to be the first application where a PA/glass composite has been used as a cross-member to support the rear differential and complete the rear cradle of a vehicle. By replacing traditional parts in steel or aluminum, the injection molded glass-reinforced PA 6/6 design offered parts integration opportunities, is cost neutral, reduces noise transmission from the drivetrain, and reduces mass 25%, helping improve fuel economy and reduce tailpipe emissions. The grade used has been optimized for dynamic loads and is controlled with tighter production specs.

Dual Snap Hardware Mechanism
2017 Ford Motor Co.
Lincoln Continental

System Supplier: Hi-Lex Corp.
Material Processor: Hi-Lex Corp.
Material Supplier: Celanese Corp.
Material / Process: Celcon POM, Riteflex TPC-ET / 2-shot injection molding
Tooling Supplier: MPP

This is the first rear-door, window-lift carrier-plate mechanism that is all-plastic and features a double (dual) snap. It delivers design flexibility, labor cost savings, and greater design efficiency with multiple glass constructions, meeting project goals to reduce processing and assembly time, maintain rotational stability, and reduce design complexity. An injection molded, 2-shot, TPC-ET overmolded POM design integrates both a down-stop bumper and a glass bumper, eliminating a component and assembly steps. The innovative design also includes an additional snap-feature attachment to support glass tracking during up/down operations.

Latching Refueling Valve
2017 Ford Motor Co.
Ford Fusion & Lincoln MKZ

System Supplier: Continental Automotive
Material Processor: Advanced Molding Tech - USA
Material Supplier: DuPont Automotive
Material / Process: Zytel HTNWRF51G30 30% GR-PPA / injection molding
Tooling Supplier: GBMC Luxshare

This challenging new design demanded a unique material with consistent properties after prolonged exposure to fuels, superior wear characteristics, a stable coefficient of friction over a wide temperature range, superior fuel swell and exposure resistance, and superior molding capabilities to properly fill tight-tolerance micro-features. An injection molded 30% GR-PPA with PTFE micro-powder (to enhance wear characteristics) met all requirements. The application saved over $10 USD/vehicle and reduced energy consumption vs. the previous valve. The novel technology has led to 1 issued and 7 pending patents.

Outer Handle
2017 Ford Motor Co.
Lincoln Continental

System Supplier: ADAC Automotive
Material Processor: ADAC Automotive
Material Supplier: SABIC
Material / Process: Cycoloy C1200HF PC/ABS / injection molding
Tooling Supplier: Xinpoin

This application is industry’s first belt-integrated, outside door handle with switch activation to open both front and rear doors. The slender, minimalist, all-plastic, high-luster chrome-finish handle provides effortless operation, luxury feel, and quiet operation. The injection molded PC/ABS part with integrated zinc casting also features an e-handle with power-release switch to deliver a sleek, uninterrupted form that reduces mass 20% and cost 35% vs. conventional bond-on-bracket designs.
Blow-Molded Grille Reinforcement
2016 Nissan Motor Co. Ltd.
nissan Titan

System Supplier: SRG Global
Material Processor: Metelix Products Inc.
Material Supplier: Washington Penn Plastics Co, Inc.
Material / Process: PPC1GF2UV-RXF 20% GR-PP / blow molding
Tooling Supplier: Metelix Products Inc.

This blow molded grille reinforcement adds stiffness to the chromed ABS grille assembly to meet OEM load/deflection and sightline/aesthetic requirements. The 20% GR-PP part assembles to the B side of the grille assembly within manufacturing tolerances yet meets thermal expansion/contraction characteristics of the grille without affecting the design profile by remaining hidden. Deflection under load for the unreinforced grille was reduced by 66%, while cost and weight were each reduced by 25% vs. a stamped steel reinforcement solution. A single parison is dropped, and excess material is punched out and then reprocessed to form subsequent parts.

Electronic Power-Steering Pulley
2017 General Motors Co.
GMC Acadia

System Supplier: Nexteer Automotive
Material Processor: PRISM Plastics
Material Supplier: DSM Engineering Plastics
Material / Process: Stanyl TW241F12 PA 4/6 / injection molding
Tooling Supplier: Not available

Project goals were to find ways to reduce cost without reducing performance of the electric power-steering gear-assist mechanism by replacing a powdered metal pulley with an injection molded plastic one. A high-flow grade of 60% GR-PA 4/6 that produces a resin-rich surface for improved belt wear was selected. It offers significant cost savings and reduces mass over 50% vs. the metal pulley. Its assembly method eliminates 3 bolts, which are replaced by a retaining ring. The molded torque tooth provides secure orientation and excellent load-carrying capabilities.

High Performance Carbon Composite Strut
2016 Daimler AG
Mercedes-AMG C-Class

System Supplier: Secar Technologie GmbH
Material Processor: Secar Technologie GmbH
Material Supplier: Toho Tenax
Material / Process: epoxy / pultrusion
Tooling Supplier: Not available

A standard steel strut was replaced by a pultruded composite strut with bonded metal joining elements, improving NVH, eliminating corrosion concerns, and optimizing the specific stiffness/weight ratio while reducing mass 45%. The 50K tow unidirectional carbon fiber-reinforced epoxy also features an insulating fiberglass layer to prevent stone chipping and provide galvanic protection. The cost-effective application produces no scrap and is being used on medium-volume vehicles (up to 30,000/year).
Environmental

Closed-Loop Recycling of Bottles
2016 General Motors Co.
Chevrolet Equinox, GMC Terrain

System Supplier: Exo-s
Material Processor: Rogers Foam Co.
Palmetto Synthetics LLC
Unifi Manufacturing Inc.
Material Supplier: Wm. T. Burnett & Co.
Material / Process: Polyester
Tooling Supplier: Not available

This innovative, multi-stakeholder, cost-neutral recycling project protects the environment, grows local economies, creates jobs, and helps people in a sustainable manner. Water bottles collected at GM operations and from the Flint, Michigan area are directed into a supply chain that recycles the material into nonwoven fleece for specific applications including engine manifold cover insulation, insulation for coats that convert to sleeping bags for the homeless and are made by formerly homeless women as part of a jobs program, and air filters that purify the air at numerous GM and other manufacturing operations. Already 3.5-million water bottles have been repurposed.

V6 Engine Timing System Wear Faces
2016 FCA US LLC
Pentastar V6 Engines

System Supplier: Borg Warner Inc.
Material Processor: Century Mold Co, Inc.
Material Supplier: DSM Engineering Plastics
Material / Process: Stanyl HGR1 PA 4/6 / injection molding
Tooling Supplier: Century Mold Co., Inc.

By using injection molded PA 4/6 with a second proprietary polymer to increase surface hardness, contact wear (via chain intrusion into the plastic) was reduced on the wear faces of engine timing systems. Rotational friction torque (measured at the crankshaft) was reduced more than 1 Nm, improving fuel-reduction targets without any modifications to the engine block or system layout. Other benefits include greater durability, lower noise, and less frictional loss. Furthermore, cost was reduced more than 50% vs. competitive alternatives.

Floorboard with Low VOC Emission Resin
2016 General Motors Co.
Chevrolet Corvette

System Supplier: Molded Fiber Glass Companies
Material Processor: MFG Composite Systems Company
Material Supplier: Reichhold LLC
Material / Process: PET & vinyl ester / compression molding
Tooling Supplier: Not available

High-VOC balsa wood cores (from rainforest trees with supply issues as well as variable density and performance) were replaced by low-VOC reclaimed PET foam cores to produce compression molded sandwich-panel composite floorboards. Weight was reduced with no loss of rigidity. NVH values were improved, eliminating the need for a secondary acoustic barrier. Additionally, a low-VOC vinyl ester resin system, which was compatible with the PET cores, was developed for panel skins. The resulting system passes export VOC emissions requirements, reduces cabin odor, diverts material that otherwise would be landfilled, and provides more consistent panel properties.

Environmental

Biomass-Based Polyester Blend
2015 Hyundai Motor Group
Ioniq

System Supplier: Seoyon E-Hwa Interior Systems Manufacturing
Material Supplier: Seoyon E-Hwa Interior Systems Manufacturing
Material Supplier: SK Chemicals
Material / Process: Skytra bio-polyester-based PETG/ABS / injection molding
Tooling Supplier: Not available

The goals of this project were to develop a high-biomass-content thermoplastic polyester blend for window panels and steering-wheel bezels using biomass-based PETG — reportedly the first application in the world. The optimized PETG/ABS composition was used to replace a PC/ABS blend. Benefits include a 57% reduction in carbon emissions (145 tons/year), an 88% reduction in VOCs, and a significant increase in molded part chemical resistance. By weight, the biomass content is 25% and by C14, the biomass content is 14%.
In Memoriam
Terry Cressy
SPE Automotive Division Board Member

“Sadly, former SPE Auto Division Board member Terry Cressy passed away on May 24th in Fort Myers, Florida. Terry had taken early retirement from DuPont, but was still active in automotive industry programs and projects as a ‘snow bird who will travel.’ He made significant contributions to the SPE Automotive Division and Detroit Section over his many decades of work as a board member. He also was a founding members of the SPE AutoEPCON conference and is considered to have been largely responsible for turning the Automotive Innovation Awards event into the gala it is now. Through DuPont support, he greatly increased the audio/visual support and publicity for the Awards Gala, turning it from a local restaurant dinner to the 700+ person international event it is now. We will miss Terry.”

— Al Murray

“If you’ve developed an innovative component made of plastic in the past two decades, you were likely either acquainted with DuPont-retiree Terry Cressy or involved in an SPE program that he touched. In 2016, Cressy passed away in sunny Florida. He shared with SPE the belief that the results of hard work should be amplified and celebrated. He was foundational in elevating the “most innovative use of plastics” awards program, and core in establishing the AutoEPCON event, which honors innovation in thermoplastics. Cressy served as Chair of the SPE Automotive Division and in 2002, he received the SPE Honored Service Award. He will be missed for his quick wit, incisive intelligence, and dedication to excellence.”

— Carole Davies

“I had the pleasure of working with Terry on SPE programs and always admired his marketing expertise, dedication, and integrity. In addition to elevating and improving the SPE Innovation Awards Gala and helping to establish AutoEPCON, he enhanced the abilities of those he worked with through his nurturing leadership. I have often heard him described as ‘the nicest man in the industry’ and he certainly was one of our very finest. Terry was a true gentleman and will be greatly missed.”

— Teri Chouinard

“In Memoriam
Terry Cressy
SPE Automotive Division Board Member

How many ways do you miss a long term friend, an advocate, and innovative leader who brought energy and growth to the plastic industry? Terry was instrumental in making a difference in his many roles leading the SPE Automotive Division and nurturing the Innovations Awards event into one of the most outstanding celebrations of the most innovative automotive plastics developments. I was fortunate to work with Terry for over three decades — from his DuPont days, to the SPE Automotive Division and Detroit Section, the SPE AutoEPCON conference, and on many other SPE/industry projects. Terry was the first person who offered to help me in 2010 when I began producing the 40th Anniversary recognition of the 40th Awards program. I miss this special person and the gift of his many contributions to his friends, to me, and to the automotive plastics business.”

— Ron Price
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Driving Success. Together.
The first use of polycarbonate (PC) to injection mold a hard (painted) instrument panel (IP), featured on the 1977 Econoline® van from Ford Motor Co., has been named the 2016 Hall of Fame winner by the Automotive Division of the Society of Plastics Engineers (SPE®).

To be considered for a Hall of Fame award, an automotive plastic or composite component must have been in continuous service in some form for at least 15 years and preferably have been broadly adopted within the automotive or ground-transportation industries. This application certainly qualifies, as PC and PC blends have been used to injection mold IP retainers, uppers, upper trim, lowers, and lower trim for both hard (painted) and soft (skin & foam) IP systems for the last 39 years. The application has proliferated from its first use on commercial vans to high-volume full-size pickups and a number of passenger cars and sport-utility vehicles (SUVs). To date an estimated 200-million IPs using 2-billion pounds/907,185 tonnes of PC or PC blends have been produced globally in the passenger vehicle market. Several IP design variants have been category or Grand Award winners in past SPE Automotive Innovation Awards Competitions.

Interestingly, the original PC IP was molded in a tool that already had been cut for and was running acrylonitrile butadiene styrene (ABS) resin. Ford’s then Saline plant¹, which molded and assembled the IP for the Econoline van, was able to make a running change because both resins had similar shrinkage values in the tool.

Following the first use on commercial vans, other notable vehicles that highlight the spread of the technology across the industry include:

- In 1978, Ford Thunderbird and Mercury Cougar sedans (both from Ford) converted to PC IPs.
- In 1994, PC IPs debuted on the first cars from then Chrysler Corp. with the Dodge Neon compact car, which initially used PC and later PC/ABS.
- In 1996, the Cadillac Eldorado luxury sedan from then General Motors Corp. (GM) featured a glass-reinforced PC IP plus a styrene maleic anhydride (SMA) retainer.
• By 1997, Jeep Wrangler and Jeep Cherokee SUVs from Chrysler Corp. converted to PC/ABS IP. By 1998, when Chrysler merged with Daimler AG to form DaimlerChrysler, both the Chrysler Concorde and Dodge Intrepid full-size cars were using PC IPs with retainers in modified-polyphenylene ether (MPPE). That same year the Dodge Ram pickup sported the first PC/ABS IPs.

• By 1999, Mitsubishi Motor Corp. used PC/ABS IPs on the company’s Mitsubishi Galant sedans.

• In 2000, PC blends debuted on Buick LeSabre and Pontiac Bonneville lower retainers from GM. Impact-modified PC also debuted that year on active uppers on the Bonneville and Chevrolet Impala sedans. And by 2004, the first integrally molded hidden airbag door chute and cover in PC/ABS were used on Chevrolet Malibu and Pontiac G6 sedans from GM.

• PC and PC blend IPs became the default materials for high-volume full-size pickups produced by the Detroit “Big 3.” For example, GM’s Chevrolet Silverado pickups used PC and PC/ABS IPs between 1999 and 2006, and at peak production, 900,000 vehicles/year were sporting the technology. A similar story occurred with Ford’s F-150 pickups, which used PC/ABS IPs between 1997 and 2004 and also had production volumes of 900,000/year at peak production. Another strong contender was the Dodge Ram pickup from Chrysler and later DaimlerChrysler, which used PC/ABS IP technology between 1994 and 2008 and had peak production volumes of 450,000 units/year.

1 The plant was later owned by Visteon Corp., Ford Motor Co., ACH Holdings LLC, and is currently owned by Faurecia Interior Systems.

Vehicle photo courtesy of Ford Motor Co.

The 2016 SPE Automotive Division Hall of Fame committee was co-chaired by Nippani Rao, Asahi Kasei Plastics North America, Inc. and Dave Reed, General Motors Corp., retired. Committee members include:

• Bonnie Bennhoff, ExxonMobil Chemical Co., retired;
• Fred Deans, Allied Composite Technologies, LLC;
• John Fialka, INEOS Styrolution America, Inc.;
• Jeffrey Helms, Celanese;
• Norm Kakarala, Inteva Products, LLC, retired;
• James Kolb, American Chemistry Council, retired;
• Mark Lapain, Magna International Inc.;
• Gary Lownsdale, TransTech International;
• Allan Murray, Allied Composite Technologies, LLC;
• Kevin Pageau, International Marketing Alliance;
• Tom Pickett, General Motors Co.;
• Irv Poston, General Motors Corp., retired;
• Ron Price, Global Composite Solutions;
• Suresh Shah, Delphi Corp., retired;
• Roy Sjöberg, P.E., Team R-Squared S LLP;
• Venkatakrishnan Umamaheswaran, SABIC;
• Bill Windscheif, Advanced Innovative Solutions, Ltd.; and
• Conrad Zumhagen, The Zumhagen Co. LLC.

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The bed, tailgate, in-bed trunk, and cover on this pickup are compression molded in a new weatherable, UV-stable, MIC, structural SMC using unsaturated polyester resin. In-mold black coloring plus texturing are used to eliminate paint and the need for bed liners plus minimize the appearance of scratches and dings. The lockable trunk is a single molded SMC part that can be converted to a watertight cooler. Extensive development work was done to improve the UV resistance of SMC materials, which traditionally have not been weatherable.

Because aluminum body panels expand at twice the rate that steel ones do, a new baffle sealing package was needed that would maintain adhesion to the substrate during thermal expansion of the aluminum. It also needed to reduce or eliminate NVH throughout the vehicle to improve driver comfort through a quieter interior. A new EVA expandable sealer with a blowing agent that activates during e-coat and produces an innovative elastic cross-linking network was developed to improve hot-tear strength and elongation vs. previous materials. The EVA foam is injection overmolded onto a PA substrate.
EV Home Charging Station
2016 Daimler AG
Daimler EV Fleet

System Supplier: ABL Sursum
Material Processor: ABL Sursum
Material Supplier: Trinseo LLC
Material / Process: Emerge XZ92705.00 PC/Si / injection molded
Tooling Supplier: Not available

To meet demanding performance requirements for EV home charging unit base plates, a special flame-retardant PC/siloxane compound was developed. The material contains no halogenated additives, offers excellent low-temperature toughness and weatherability, plus improved chemical resistance. Additionally, the PC/Si material provides superior moldability for parts with deep cavities and low draft angles, and crack resistance at pinch points, which makes it easier to attach the plate with screws to home or garage.

New PC/ABS for Exterior Applications
2016 General Motors Co.
Opel Astra Sports Tourer

System Supplier: General Motors Europe
Material Processor: SRG Global
Material Supplier: Trinseo LLC
Material / Process: Pulse XT9215 PC/ABS / injection molding
Tooling Supplier: Socem/SRG

Development of new filler technology with very-low CLTE improved dimensional stability and reduced gap sizes for exterior PC/ABS parts, helping improve fit & finish. High gloss and enhanced paint adhesion makes the material an excellent choice for painted applications. The new grade also is lower density (10%) for lighter lower-cost parts, provides excellent impact strength for better durability, and has improved dimensional stability to reduce warpage. And because MFI is increased, parts can be molded faster and in thinner walls. This allowed the new material to replace aluminum at half the weight and 40% cost reduction (excluding tooling).

Window Frame Surround
2015 Daimler AG
Mercedes-Benz GLC, GLC Coupe, & E-Class

System Supplier: Dr. Schneider Automotive Group
Material Processor: Dr. Schneider Automotive Group
Material Supplier: LyondellBasell
Material / Process: Softell TKG 317N PP compound / injection molding
Tooling Supplier: Krumpholz

To meet window-frame surround requirements for high stiffness, low gloss, good surface quality and haptics, colorability with good processability, high scratch and UV resistance, and dimensional stability, a new 25% GR-TPO compound was developed to replace 15% GR-PA 6. The new grade offers higher stiffness, which facilitates thin-wall part design. It does not require drying prior to processing and its properties are not affected by ambient changes in humidity. The result is an 8% weight savings and ≈18% piece-cost savings.

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Materials

Rhapsody Blue MIC Vehicle Environment
2016 Ford Motor Co. Lincoln Continental

System Supplier: Americhem Inc.
Material Processor: Many
Material Supplier: Americhem Inc. & Many
Material / Process: PP, TPO, ABS, PA, POM / injection molding
Tooling Supplier: Many

Project goals were to achieve a unique MIC color space that looks luxurious but appeals to today’s generation. It involved using the first transparent pigment-based interior color deliverable across 76 base resins for the vehicle interior. Once the color was mastered, early attempts showed it was prone to metamerism with a red/green directional hue shift. Numerous attempts to achieve color consistency bidirectionally with standard pigment adjustments did not solve the problem. Finally, the color was remastered using a non-TiO2 system that did not exhibit hue shift, eliminating the need to paint and creating a calming, cool color environment.

Lightweight TPO Bumper Cover
2017 Hyundai Motor Group Hyundai Genesis G90

System Supplier: ECO Plastic
Material Processor: ECO Plastic
Material Supplier: Hanwha Total Petrochemicals Co., Ltd.
Material / Process: NB71 TPO / injection molding
Tooling Supplier: Hyundai Motor Co.

A new, lighter weight TPO bumper cover was developed using high-crystallinity PP, ethylene-octane rubber, and a combination of nano-size talc and micron-size whisker fillers similar to magnesium oxyxulfate. The material provides high mechanical performance, improved dimensional stability, and low CLTE thanks to the high aspect ratio filler. Weight is reduced 7-10% and the material is cost neutral vs. the material it replaced. Additionally, 6 patents have been obtained on the development.

Vacuum Brake Tubes
2016 General Motors Co. Chevrolet Silverado & GMC Sierra

System Supplier: Cooper Standard
Material Processor: Cooper Standard
Material Supplier: DSM Engineering Plastics
Material / Process: Arnitel CM622 TPC-ET / extrusion & 3D post-forming
Tooling Supplier: Not available

A high-performance thermoplastic was needed for vacuum brake tubing to replace reinforced rubber. It needed broad temperature performance (-40-150°C), chemical resistance, burst strength to 60 bar min. and flexural strength to 50 N min. It also had to resist vacuum collapse after 2 hr @ 150°C and provide impact retention after 336 hr @ 150°C. The design was changed to use a smaller diameter, thinner wall to simplify engine/undercarriage routing and eliminate heat shields plus allow quick connects. A TPC-ET elastomer with high thermal oxidative stability was developed. It is 30% lighter, less costly, and eliminates brackets.

Transmission Oil Catcher
2017 Ford Motor Co. Ford F-150

System Supplier: Parker Hannifin Corp
Material Processor: Chomerics Div. of Parker Hannifin Corp.
Material Supplier: DuPont Automotive
Material / Process: Zytel HTN51LG50H5L BK083 PPA / injection molding
Tooling Supplier: Chomerics Div. of Parker Hannifin Corp.

This transmission oil catcher returns transmission oil efficiently to the planetary gear bearings. Since the carrier spins at 7,500 RPMs, is exposed to hot automatic transmission fluid, and has clearances of 0.25 mm, the part cannot warp or creep and must provide excellent chemical resistance. A 50% LF-PPA grade with a complex runner system is used to mold parts with 1.2 mm walls (40% thinner than previous PA grades). The new product improves transmission reliability and lifespan, reduces NVH from gear noise, accommodates tight packaging space, and reduces mass 65% vs. metal designs.
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Transmission Bottom Pan in Long Glass Reinforced Polymer
2017 Ford Motor Co.
Ford F-150

System Supplier: Sogefi Group
Material Processor: Sogefi Group
Material Supplier: DuPont Automotive
Material / Process: Zytel 75LG50HSL BK031 LFT-PA 6/6 / injection molding
Tooling Supplier: Sogefi Group

An injection molded 50% long-glass PA 6/6 serves as the main bottom oil pan for a 10-speed automatic transmission. It not only must provide chemical resistance to hot automatic transmission fluid, and maintain structural and sealing integrity for the life of the vehicle without deflection due to extremely tight stack up, but it also must resist damage from road debris and nearby exhaust plumbing. Furthermore, the pan is required to support the full weight of the transmission when the latter is removed from the vehicle. It reduces weight 55% and cost 15% vs. previous steel pans.

PVC Vent Tube
2016 General Motors Co.
LGE Platform

System Supplier: Chinaust Group
Material Processor: Chinaust Group
Material Supplier: Celanese Corp.
Material / Process: Fortron FX7ST1 PPS / reactive extrusion & thermoforming
Tooling Supplier: Not available

Increased temperatures due to engine downsizing and turbo boosting required the development of a new material with thermal performance to 175°C for the crankcase ventilation tube. Additionally, the team wanted to eliminate metal and rubber parts but retain the flexibility to use quick connectors to the engine during final assembly. A flexible alloy based on unreinforced, impact modified PPS was selected. Parts are formed by reactive extrusion followed by thermoforming at 190°C for 25 minutes. They are 50% lighter than metal and save $3/part. They also offer better temperature and chemical resistance than previous PA 6 tubes.

Torque-Tube Bearing Spacer
2015 General Motors Co.
Buick Envision

System Supplier: American Axle & Manufacturing, Inc.
Material Processor: NN Industrial Molding
Material Supplier: DuPont Automotive
Material / Process: Zytel HTN51LG50HSL BK083 LFT-PPA / injection molding
Tooling Supplier: HS Molds Ltd.

This metal-to-plastic conversion of a torque-tube bearing spacer provides significant weight savings to the drivetrain. The injection molded 50% long-glass PPA material eliminates machining on previous cast housings, provides high stiffness and low creep, outstanding impact resistance, high temperature performance, and holds ID and OD tolerances of ± 50 μ. It also reduces mass 80% and costs 40-60%. Further, the composite spacer improves serviceability / rework and eliminates galling on the torque tube.

Air Intake Manifold
2015 Volkswagen AG
EA21 Engine 1.6L engines

System Supplier: Hua Tao Ltd.
Material Processor: Hua Tao Ltd.
Material Supplier: SABIC
Material / Process: SABIC G3135X PP / injection molding & vibration welding
Tooling Supplier: Not available

This is the first air-intake manifold launched in China using 35% GR-PP to replace PA 6/6. The application provides 25-30% cost reduction and 15-20% molded-part weight reduction while retaining properties at high temperatures and improving weld strength, and NVH by 5 dB. Unique technology involving finer glass fibers and special sizing helps meet performance requirements. Parts are vibration welded.
**Powertrain**

**Transmission Range-Control Module Output Shaft Bearing**
2016 General Motors Co.
Cadillac XT5, Buick Lacrosse, and Chevrolet Bolt

![Image of Transmission Range-Control Module Output Shaft Bearing](image)

System Supplier: Stoneridge, Inc.
Material Processor: Stoneridge, Inc.
Material Supplier: SABIC
Material / Process: Ultem 4001 PEI / injection molding
Tooling Supplier: Not available

This injection molded PTFE-filled PEI bearing replaces powdered metal, which offered limited parts integration and drove the use of additional parts and retention processes. The new design has 3 lobed locking features for bearing retention and integrated locating posts. The ID is the shaft bearing and the OD is the spring driver bearing. Despite design complexity, the part is molded without tooling action. PEI’s moldability, stiffness, and lubricity were key to its selection. The part reduces mass by 45% and cost by 50% vs. the previous metallic part.

**Active Fuel-Management System**
2012 General Motors Co.
5.3L V8 LH6 Engine

![Image of Active Fuel-Management System](image)

System Supplier: Eaton Corp. Plc.
Material Processor: ITW Global Automotive
Material Supplier: SABIC
Material / Process: Ultem 2310 PEI / injection molding
Tooling Supplier: Not available

To boost fuel efficiency and reduce emissions on classic small-block pushrod V8 engines, an inexpensive and simple technology called active fuel management (displacement on demand) was developed. The efficient and precise electro-mechanical hydraulic system deactivates cylinder valves when power is not needed, then reactivates them when power is called for again. An important component of the system's solenoid control valves is injection molded, 30% GR-PEI, used for its high stiffness, creep resistance, thermal and chemical resistance, high knittline strength, and ability to be ultrasonically welded. The system improves fuel efficiency 5.5-7.5% and reduces cost 30% vs. metal.

**2.0L GTDI Turbo Compressor Outlet Duct**
2017 FCA
Alpha Romeo Giulia

![Image of 2.0L GTDI Turbo Compressor Outlet Duct](image)

System Supplier: ABC Group, Inc.
Material Processor: ABC Group, Inc.
Material Supplier: BASF Corp.
Material / Process: Ultramid Endure D5G3 BM PA 6/6 / 3D flashless blow molding
Tooling Supplier: ABC Group, Inc.

To meet more stringent fuel efficiency and tailpipe emissions requirements, engines increasingly are being downsized and turbocharged, but that raises temperatures and pressures that underhood components see during operation. For example, charge air ducts, which take air from the turbocharger to the throttle body, can see continuous-use temps as high as 220 °C and pressures as high as 207 KPa. Further, compact packaging space requires efficient designs. Switching to a heat-stabilized PA 6/6 capable of being 3D flashless blow molded reduces mass 30-40% and cost 20-25% vs. metallic designs.
Precise Integration-Enabled System
2015 General Motors Co.
Chevrolet Volt

System Supplier: ITW Deltar
Material Processor: ITW Deltar
Material Supplier: Celanese Corp.
Material / Process: MetaLX Hostaform POM / injection molding
Tooling Supplier: ITW Deltar

The precision integration-enabled system is a patented locating and attachment feature that minimizes gaps or movement as well as manufacturing variation common with snap fits while leveraging the inherent elastic deformation properties of plastic. No external fixtures are needed, labor is reduced, and ergonomics are improved. This is the first application to use a MIC bezel for the housing that prevented water migration without need for additional seals. Also, the typical tooling action needed to mold snap fits is eliminated, saving tooling time and costs.

Composite Tambour Door
2017 Ford Motor Co.
Lincoln Continental

System Supplier: NBHX Trim GmbH
Material Processor: American Autocoat
Material Supplier: BASF Corp.
Material / Process: Ultramid B3WG13 BK00102 63% GR-PA 6/6 / back injection molding
Tooling Supplier: Classic Die Precision Plastic Molds

This application features an insert-molded wood composite that is back injected via 15 gates to create individual plastic slats that are connected in the back. A 3-axis laser is used to separate wood between slats for a cohesive grain appearance. Unlike conventional flat compression molded wood tambour doors featuring layers of veneer, interply, and adhesive, these doors are curved. The part features 63% GR-PA 6/6 with extremely low shrink (0.05 mm) to match the non-shrinking wood. Use of a large number of gates on a relatively small part eliminates warpage.
Process, Assembly & Enabling Technologies

TPO-Coated Suspension Arm
2015 General Motors Co.
Cadillac ATS

System Supplier: Cymas Enterprises Ltd.
Material Processor: Cymas Enterprises Ltd.
Material Supplier: LyondellBasell
Material / Process: 7905 TPO / powder coating
Tooling Supplier: Not available

By using a cryogenically ground TPO powder coating to protect e-coated steel suspension arms instead of paint, service life is extended from 3-5 years to a decade, the fully encapsulated part gains improved stone-chip resistance and corrosion protection. Overspray can be reused, so the process generates almost zero waste, eliminates VOCs and isocyanates, and produces finished parts much faster than previous alternatives. Since there is no need for a post-bake process, it also saves energy. Thinner gauge, high-tensile steel is used for the suspension arms to save weight.

Hot-gas Welded Thermostat Housing Assembly
2017 Ford Motor Co.
3.5L V6 Cyclone TiVCT GTDI engines

System Supplier: Plastic Tec - Bocar Group
Material Processor: Plastic Tec - Bocar Group
Material Supplier: DuPont Automotive
Material / Process: Zytel HTNS1G35H5LR BK420 35% GR-PPA / injection molding & hot-gas welding
Tooling Supplier: Schweiger GmbH & Co. KG

Hot-gas welding joins both halves of this 35% GR-PPA thermostat housing assembly. The part has a small welding-flange footprint but high weld strength because there is no fiber/material degradation during the joining process. In fact, it is the only welding process that permits bridging of glass across the joint. The weld distance is held within 0.1 mm, enabling parts to package into very limited spaces with tight tolerances. Since the part is not touched during welding, there is no sticking. Versus previous aluminum solutions, the PPA assembly is 30% lighter and 40% less costly.

Two-Shot Map Lamp Lens
2017 Ford Motor Co.
Lincoln Continental

System Supplier: Flex Auto (Flextronics)
Material Processor: Flex Auto (Flextronics)
Material Supplier: SABIC
Material / Process: Lexan 143R, HFD1830 PC / 2-shot injection molding
Tooling Supplier: Flex Auto (Flextronics)

A redesigned capacitive touch lens produced via 2-shot molding eliminates molding defects while maintaining an ideal bonding surface and clear aperture for best light intensity. Eliminating a second tool, the Fresnel pattern is molded into the core of the first shot, which becomes the cavity of the second shot as the latter is layered over the former, keeping both outer surfaces smooth. Using 2 grades of PC with a 40° difference in HDT solves the problem of the second shot melting the first during overmolding. Eliminating a tool reduced costs 25%.
Chrome-plated ABS vane caps with a contoured edge create unique styling and a new decorative finish to A/C register vanes without jeopardizing vane surface appearance. An automated process is used to apply adhesive bonding material to the vane cap and then assemble the vane to the vane body with zero-gap margins for excellent fit & finish. The process eliminates appearance defects due to mechanical locks on the vane body and permits parts to be handled within 20 sec.

Laser Ablation to Improve Bond Adhesion
2016 General Motors Co.
Chevrolet Corvette

Previously used to clean mold surfaces in the composites industry, a modified laser system is used to improve bond adhesion on composite parts. Replacing hand sanding, the robotic laser-ablation program reduces labor, benefits industrial hygiene (no dust, self-contained system), improves consistency and repeatability, shortens cycle time, eliminates perishable items (e.g. masks, sandpaper, and wipes), and lowers cost an average of 15%. The system’s flexibility permits program path, angle of attack, and energy level to be customized for each part’s unique material and geometry.

Carbon Core Structural Components
2015 BMW Group
BMW 7 Series Sedan

Carbon fiber-reinforced fast-cure epoxy and high-pressure RTM and liquid compression molding (LCM) are used to produce 27 CFRP parts for the vehicle’s mixed-material BIW structure to support production volumes of 80,000+ vehicles/year. The HP-RTM roof arc follows the shapes of the car body and offers an outstanding weight/performance ratio. The LCM tunnel reinforcement improves the vehicle’s torsional stiffness and is produced in <1 min. These “carbon core” parts replace metal, improve stiffness, ride/handling, and safety while reducing vehicle mass 40 kg for better fuel efficiency and tailpipe emissions.
Process, Assembly & Enabling Technologies

See the nominations that were accepted into the competition from 1999-2016.

Robotic Laser Cutting and Welding of TPO Fascia
2017 General Motors Co.
Chevrolet Camaro ZL1

System Supplier: Magna Exteriors, Inc.
Material Processor: Magna Exteriors, Inc. / DexSys
Material Supplier: LyondellBasell
Material / Process: Hifax TYC1168X TPO / injection molding + robotic laser cutting & welding
Tooling Supplier: Jenoptik AG

A hydraulic punch and sonic welding operation was replaced by robotic laser cutting and welding of a Class A exterior fascia. Unlike other welding processes, it is not necessary to thicken wallstock in weld areas to prevent readthrough with robotic laser welding of brackets on the backside of the part, and that reduces weight slightly. It also eliminates the need for contoured horns and punches. Clean cuts can be made in 1 sec on the painted side of the part. The dual-function process provides greater flexibility between programs and reduces floor space and tooling costs.

Power Head Restraint Guide Sleeves
2017 Ford Motor Co.
Lincoln Continental

System Supplier: Grammer AG
Material Processor: Treck Plastics
Material Supplier: DuPont Automotive
Material / Process: Delrin 100 POM / injection molding
Tooling Supplier: HS Die & Engineering

This project created robust modular assembly features to allow quick connection of electrical connectors/wiring at lower cost for the power head restraint system. By integrating the electrical connector receptacle and wiring assembly into the injection molded POM guide sleeves, proper connector alignment is assured and power head restraints can be assembled in a similar manner and time as manual head restraints. This reduces assembly time, complexity, investment, and quality issues and has led to 2 patents being filed.

Assisted Positive-Locking Junction Box
2016 General Motors Co.
Chevrolet Camaro

System Supplier: Yazaki North America Inc.
Material Processor: Yazaki North America Inc.
Material Supplier: DuPont Automotive
Material / Process: Not available
Tooling Supplier: Yazaki North America Inc.

This tool-less, single-lever, self-locking underhood bussed electrical center (UBEC) guarantees proper connections for 4 connectors from 4 different wire harnesses using 1 hand and low assembly effort. There is no need to re-orient the UBEC to install mating connectors during OEM assembly. The result is a robust, high-circuit-capacity design that is ergonomically friendly to assembly-line workers. Additional benefits are a 7% weight savings, 8% additional spare electrical content, 10% reduction in overall footprint, better water-ingress protection, and 30% less assembly time.

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Safety

Seat Cushion Frame and Storage Door  
2016 Ford Motor Co.  
Ford Super Duty

System Supplier: Royal Technologies Corp.  
Material Processor: Royal Technologies Corp.  
Material Supplier: Celanese Corp.  
Material / Process: Celstran GF40-20 LFT-PP / injection molding  
Tooling Supplier: Vortec Tooling Solutions, Inc.

For the first time, a polymer composite has replaced magnesium in a structural seat-cushion frame and under-seat storage lid for a front center 20% seat with integrated restraint system. The application is weight neutral and lower cost (~$4 USD/unit), and satisfies all safety and crashworthiness requirements. Its flexible architecture allows for updates with future enhancements. Injection molded 40% LFT-PP is used to mold the frame, which also features an EPP antisubmarine foam block and a lockable ergo-latch. The assembly represents a significant reduction in carbon footprint vs. magnesium and has yielded 2 awarded and 2 pending patents.

Airbag Support  
2017 Ford Motor Co.  
Ford Explorer

System Supplier: ZF TRW  
Material Processor: The Woodbridge Group  
Material Supplier: JSP  
Material / Process: Arpro EPP / steam-chest molding  
Tooling Supplier: The Woodbridge Group

This is the first known application where EPP foam replaces stamped steel for a passenger knee airbag support bracket. The 15 lb/ft³/240 kg/m³ density foam sustains airbag deployment reaction loads at all environmental conditions and reduces mass 88% and piece cost 55% vs. the incumbent design. The weight reduction led to other benefits, including elimination of 2 assembly-aid clips, ergonomic improvements, improved vehicle fuel economy, and reduced shipping costs. The simplified manufacturing process involves no secondary processes, eliminates 3 torque monitoring joints for additional manufacturing savings, and is backward compatible for serviceability.

Modular Composite Front-Seat Cushion Pan  
2017 Ford Motor Co.  
Lincoln Continental

System Supplier: Leggett & Platt / Great Lakes Trim / Grammer Industries  
Material Processor: Engineered Plastics/Grand Traverse Plastics / Johnson Electric  
Material Supplier: BASF Corp. / Advanced Composites, Inc. / DuPont Automotive  
Material / Process: Ultramid B3ZG7 OSI 35% GR-PA; ADX 5017 18% talc-filled UV-TPO; Delrin 100P NC010 POM / injection molding  
Tooling Supplier: MacLean-Fog/Commercial Tool & Die / Johnson Electric

This patent-pending, plastics-intensive, modular composite front seat-cushion pan (in impact-modified 35% GR-PA), side-airbag deployment back panel (in talc-filled TPO), and power head-restraint drive nut (in POM) create a robust and dynamic crash-energy management system for front impact protection, side airbag deployment, and energy management for occupant impact protection. Further, the system enables modular assembly and scalable features for assembly ease. Already 83 patents have been filed and 12 granted on this innovative seat system.

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Safety

Next-Generation Armrest for Side Impact
2016 Ford Motor Co.
Ford Super Duty

System Supplier: Yanfeng USA Automotive Trim Systems Company, Inc.
Material Processor: Yanfeng USA Automotive Trim Systems Company, Inc.
Material Supplier: LyondellBasell
Material / Process: SG702 PP / injection molding
Tooling Supplier: ToolPlas Systems Inc.

Minimizing door intrusion during side impacts usually requires intensive body-structure countermeasures. Abdomen criteria for 5th and 50th percentile dummies are primarily driven by door-trim armrest stiffness during side impacts. This new door-trim armrest improves safety as a tuning component by acting as a load limiter and absorbing energy. Comprised of a skin, foam pad, PP-nonwoven trampoline fabric, ABS armrest substrate, and PP trampoline frame, the system is significantly softer than previous designs, substantially outperforming static and dynamic functional requirements without adding countermeasures, cost, or weight. Further, armrest durability improves 6x, and costs and weight are reduced $31.80 and 3.8 kg per vehicle.

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Integrated Fascia Stiffener
2017 MY Ford Motor Co.
Ford Escape

System Supplier: Plastic Omnium
Material Processor: Plastic Omnium
Material Supplier: SABIC
Material / Process: Stamax 2700 40% GR LFT-PP / injection molding
Tooling Supplier: Basis

This patent-pending lower fascia (belly pan) stiffener is designed to balance the load requirements of both lower-leg pedestrian protection and low-speed damageability in a single component using a series of integrated stiffeners. Replacing plastic/metal hybrid and all-metal designs, all required features (including variations in material thickness, ribs, and various sections) are contained on the B side of the component and molded in a single tool, lowering assembly time, eliminating straps, and lowering BSR. The stiffener removes 1.5 kg of mass and saves $2 USD/vehicle piece cost plus an additional $50,000 USD in tooling avoidance.

Crash Box Integrated Rear Bumper Beam
2016 Hyundai Motor Group
Ioniq

System Supplier: LG Hausys
Material Processor: Najung ENG
Material Supplier: LG Hausys (CFT) / LG CHEM (TPO)
Material / Process: LG Chem TPO / compression & injection overmolding
Tooling Supplier: Najung ENG

This crash box-integrated plastic rear bumper back beam meets Korean regulations and RCAR requirements at 21% lower weight and 39% lower cost than the conventional steel rear beam it replaced. The center of the hybrid beam is compression molded from continuous-fiber-reinforced PP/glass composite to induce effective front impact energy absorption. The entire back-beam shape and crash boxes on either end are injection overmolded using 60% GR-TPO, which has been modified for low-temperature performance.
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The SPE® Automotive and Composites Divisions, in conjunction with The SPE Foundation®, have formed an endowed scholarship to honor the memory of Dr. Jackie Rehkopf and are still accepting donations. The groups hope to raise funds for a sufficiently large endowment to allow annual scholarships to be given to deserving undergraduate or graduate students studying engineering or science and with plans to work in the field of transportation composites.

Rehkopf spent her career doing research in the field of automotive plastics and composites. She was a long-time SPE ACCE committee member, session organizer, and two-times technical program co-chair. She also served on the SPE Automotive Division board as a director from 2005 through 2014, plus was intersociety chair for 2 years and treasurer for 2 years. She was active from the mid-1990s until 2014 with SAE International®, helping organize a large plastics session for over a decade for SAE Congress. Additionally, she wrote a book in 2011 entitled Automotive Carbon Fiber Composites: From Evolution to Implementation that was published by SAE. She was awarded an SAE Outstanding Technical Contribution Award for her work in co-developing and sponsoring the SAE Standard J2749 High Strain Rate Tensile Testing of Polymers. She authored many publications and presented at numerous technical conferences during her 20 year career.

In both academia and industry, Rehkopf’s research interests were in mechanics of materials. After earning both B.S. and Ph.D. degrees in Civil Engineering from the University of Waterloo in Canada, she moved to the Detroit area and began work in 1994 as a materials engineer for Ford Motor Co. After 4 years, she became a technical specialist at Ford in the company’s Research Lab Safety Department (from 1998-2003) and later in the Materials Engineering Department (from 2003-2006). She left the automaker in 2006 to join Exponent as a senior engineer and consultant in the areas of mechanics of materials, structural mechanics and dynamics, experimental testing, and failure analysis. Rehkopf’s expertise was in high-strain-rate behavior of both metallic and polymeric materials, and fatigue and creep of reinforced and non-reinforced plastics. In 2010, she joined the R&D department of Plasan Carbon Composites as a senior researcher working on carbon fiber-reinforced composites. During her first 2 years at Plasan, she split her time between the company’s Customer Development Center in Michigan and offices at Oak Ridge National Laboratory where she was principal investigator for a 3-year U.S. Department of Energy (DOE)-sponsored project that Plasan participated in on predictive modeling of carbon fiber composites in automotive crash. In 2013, Rehkopf became director of research at Plasan with a focus on developing new materials systems to facilitate the use of carbon fiber composites in mainstream automotive applications. She lost a year-long battle to cancer in 2014.

Those interested in contributing to the Dr. Jackie Rehkopf endowed scholarship should send a check (made out to The SPE Foundation) to:

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<th>Year</th>
<th>OEM</th>
<th>Application</th>
<th>Material</th>
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<td>GMT Composite Bumper</td>
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<td>Blow-Molded CVJ Half-Shaft Drive-Axle Boot</td>
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<td>Fan Shroud</td>
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<td>RIM-PUR</td>
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<td>Guide-Flex Energy Absorbers</td>
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<td>Headlamp Assembly</td>
<td>PC</td>
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<td>Front/Rear Bumper Covers</td>
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<td>Tilt Steering-Wheel Centering Sphere</td>
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<td>Emissions Control Canister</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>OEM</th>
<th>Application</th>
<th>Material</th>
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<td>General Motors Co.</td>
<td>Ultralight Class A Body Panels</td>
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<td>All-Olefin, Soft Skin, Stitched Full IP System</td>
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<td>Shielded Plastic Case Radio</td>
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<td>Twin-Sheet Blow-Molded Fuel System</td>
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<td>Backlighting with Color-Converting Plastic</td>
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<td>Honda Motor Co.</td>
<td>Composite In-Bed Trunk</td>
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<td>Door Trim with Integrated Acoustic Chamber and Subwoofer</td>
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<td>&quot;I&quot; Section Bumper Beam</td>
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<td>1998</td>
<td>Mitsubishi Motors</td>
<td>&quot;Carpet to Car Parts&quot;</td>
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<td>PC/ABS</td>
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<td>Front Fender</td>
<td>MPPE/PA</td>
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<td>Quarter-Panel Assembly – Sportside</td>
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<td>Quarter Window</td>
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<td>General Motors Corp.</td>
<td>Windshield with Anti-Lacerative Layer</td>
<td>Polyvinyl Butyral/PE Film</td>
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<td>Drive Shaft</td>
<td>Vinylester/Graphite/Glass</td>
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<td>Exterior Body Panels</td>
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<td>Tailgate Assembly</td>
<td>SMC</td>
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<td>Radiator-Core End Caps</td>
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<td>Rear-Axle Leaf Spring</td>
<td>Epoxy</td>
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<td>Fender Aprons</td>
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<td>RIM-PUR</td>
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<td>Fascia and Rear Bumper Cover</td>
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</table>
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