

Prime Time **for Composites**

Composites, which typically weigh 30 to 40 percent less than steel in automotive applications, are making major inroads in 2007-model cars, SUVs and trucks. Promising new technology provides an even brighter outlook as automakers strive to reduce vehicle weight against a background of higher fuel prices and instability in oil producing countries.

Besides weight savings, composites also boast numerous other advantages over metals. Of course, corrosion problems are eliminated. Composites also have innate advantages, thanks to their molding flexibility, in designing components for both aesthetic and structural applications. And groups of components can be consolidated into one part to provide modules ready for installation at assembly plants at lower overall cost. In addition, the move by automakers toward lower builds per model makes SMC an even more attractive material choice because its tooling cost is most competitive for exterior panels with annual volumes under 125,000 per year, and structural applications at any volume.

Painting exterior SMC panels to provide a finish comparable to steel has been the subject of many experiments over the years. However, with the advent of Tough Class A® SMC in recent years, the goal has been met. Also gaining attention through testing has been the trend by some



automakers to substitute powder for liquid primer traditionally used in automotive paint lines.

General Motors and DaimlerChrysler are using powder prime systems at assembly plants to reduce emissions, improve paint quality and reduce paint waste. But that means all materials must be capable of running through a plant's powder primer line. This is conducive to metals but not SMC at this point.

Raw materials suppliers, molders and the automakers are working on numerous

possible solutions. GM, in collaboration with suppliers Meridian, AOC, Ashland and Owens Corning, has undertaken a series of tests and experiments, including in-plant trials of Hummer H2 fenders from newly formulated SMC derivatives. These studies, headed by Dr. Hamid G. Kia, GM's lab group manager-composite structures, are reported in a recent research paper entitled "New Developments in Powder Priming SMC."

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The 2007 Jeep Wrangler sports a "Freedom Top" on the two- and four-door models. The roof is molded from SMC and is comprised of three removable panels.

When DaimlerChrysler's Chrysler Group was developing the all-new 2007 Jeep JK Wrangler that replaces the TJ, it wanted unique features that stand out.

New 2007 Jeep Wrangler Features Lightweight SMC Roof Panels

One result is the new "Freedom Top" removable roof molded from sheet molding composite (SMC) that provides the flexibility of eight configurations. There are two front roof panels above the driver and passenger that were designed and engineered by Chrysler; either one or both can be removed and stowed behind the rear seat. The rear roof assembly, designed and engineered by Meridian Automotive Systems, also can be completely removed. This assembly is common on both the 2-door and all new 4-door versions and includes the rear

windows and heated liftglass and rear wiper assembly.

Meridian produces all of the SMC components and the rear roof assemblies at its Huntington, IN, facility. The roof interior is molded-in white and the exterior surface is "spatter" painted for a rugged appearance. It is available in black or khaki topcoat.



Carbon Fibers Grow

Carbon fiber composite technology is growing, according to MFG (Molded Fiberglass Corp.) in Ashtabula, Ohio. "Most of our structural components, such as front-end modules, are moving into higher strength carbon fiber composite," says Keith Bihary, MFG's automotive sales manager.

The Chevrolet Corvette's floor boards, exterior fenders and front wheelhouse all are molded by MFG of carbon fiber composites for an overall weight savings of 40% for these components, he says. MFG molds the floorboards using Alcan Baltek's Balsicore® balsa wood technology as a key ingredient in the total weight savings.



Ford Motor Co.'s re-designed SMC composite box on the 2007 Sport Trac went through some tough tests to validate the material's durability. The seven-piece box, molded by Continental Structural Plastics (formerly ThyssenKrupp Budd) uses Owens Corning glass technology.

Ashland Introduces Low-Mass SMC

Ashland Inc.'s Performance Materials Group has commercialized a variety of low-density (1.2-1.45 specific gravity)

tough Class A formulations that don't require glass microspheres, Robert Seats, senior development chemist, reports in a paper delivered at Composites 2006. Although providing lower density, "the glass microspheres are difficult to disperse, can be crushed (thus) minimizing their effectiveness, typically results in a drop in mechanical properties, and makes painting the part difficult to impossible after sanding and repair," he says.

"Improvements in tough low-mass SMC have been made that allow for easier and less costly processing, less sensitivity to molding conditions, and low water absorption properties," says Seats. These improvements were obtained through selection and optimization of nanoclay products and development of an improved thickening system. These advances will allow the industry to look again to low-mass technologies to reduce total part cost and vehicle weight."

Average Retail Fuel Prices Around the World

Country	USD/gallon Regular Unleaded
PRC/Hong Kong	\$6.54
UK/London	\$6.36
Belgium/Brussels	\$6.33
Japan/Tokyo	\$4.93
Brazil/Brasilia	\$4.60
RSA/Johannesburg	\$3.70
United States	\$2.90
PRC/Beijing	\$2.40
Mexico/Mexico City	\$2.25

Sources: Ashland, money.cnn.com
Prices May 2006

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GM conducted two assembly plant trials using molded H2 fenders. In the first, 20 panels were sent through the ELPO and powder primer process. "All panels accepted the powder without popping" when the elapsed time between the ELPO and powder primer was less than approximately two hours. In the second trial, 12 panels went through the same processes, but the elapsed time was 96 hours (four days) and the panels showed popping out of the oven, according to the report.

"There is a need to develop a new generation of conductive coatings that can slow down the moisture penetration in the powder primer," the Kia report concludes.

The Chrysler Group, which switched to the powder primer paint system 10 years ago, is bullish that a solution to painting SMC through such systems is imminent. Nippani Rao, senior specialist of the Chrysler Group, said: "We (the industry) are in the final stages; I'd say we're 90 to 95 percent there."

The Ford Motor Co., however, continues to use liquid primers with great success. An excellent example of this is with the new 2007 Lincoln Navigator hood, which debuted in July 2006 and is expected to reach annual sales volumes up to 40,000 units.

At the Automotive Composites Conference and Expo (ACCE) held in September 2006, a Ford spokesperson said that, at this time, the automaker doesn't have plans to adopt dry powder prime systems. He added that Ford is processing SMC with the same level of quality and first-time-through success as metal panels.

As the economic climate and styling trends continue to move toward differentiation, exterior composites usage is poised to grow significantly as the primary material of choice for automakers worldwide.

Meridian Takes SMC Sky-High



THAT'S A SATURN? Yes, the two-seater Sky and companion Pontiac Solstice, both feature SMC "tulip" panels that include "flip doors" for ease of top storage. Sky's SMC front fenders sport designed-in air extractors.

Meridian Automotive Systems is making light weight, durable and corrosion-free front fenders and "tulip" panels, or twin humps, behind the front seats on the Saturn Sky two-seat sports car; the tulip panel on the Pontiac Solstice, Sky's twin in the GM family; the inner and outer raised dome hood on the Cadillac STS V-Series; the sophisticated cargo box on the Honda Ridgeline pickups; and the roof on the all-new Jeep Wrangler.

Tyler Hardy, Meridian's engineering director-composite products, says that in each case the components Meridian molds and paints are shipped directly to GM assembly plants ready for installation.

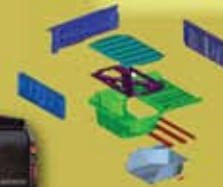
Reichhold Develops New Composites

Reichhold, Inc. has developed two new composites for automotive customers, says John Ilkka, closed mold business development manager.

One is a polyester hybrid for under hood applications such as valve covers. The material "allows fabricators to do the entire piece" at less cost than "the more expensive resins currently used" but with equal performance, says Ilkka. More than 7 million valve covers using the technology have been produced, he says.

The resin costs between 10 and 15% more than vinyl esters traditionally used, but this is more than offset in fabrication savings, he says.

Reichhold also has developed a urethane hybrid SMC resin for structural applications such as in pickup boxes, which he says exhibits high strength and boasts three times the impact resistance of competing materials.



Honda's Ridgeline pickup bowed in 2005 and its unique SMC box went on to win SPE's Grand Award. The box contains seven high-strength SMC pieces and features antiskid spatter-coated paint.

Composites Score Gains in Big Trucks

From underhood components to cabs, versatile composites are making gains in heavy-duty trucks. The multi-piece RRIM hood and front bumper assemblies on the new Peterbilt cab, molded and fully assembled by Meridian Automotive Systems, boasts "extreme" impact resistance and low tooling costs.



Mack diesel engine valve cover features a metallic silver topcoat.



Peterbilt cab has a one-piece RRIM outer with five bonded inner reinforcements. Front bumper is also an RRIM component.

Meridian also has developed a valve cover assembly made of Derakane® epoxy vinyl ester SMC for the Mack MD11 diesel engine. The high-heat-resistant component, unlike aluminum, needs no machining. Painted metallic silver, it's believed to be the first top-coated valve cover.

AOC Eyes SMC Composite That Needs No Paint Line

Composite pickup boxes today are typically painted black. AOC, LLC, however, cites emerging technology in structural grade sheet molding compound (SMC) that's ultraviolet stable and can be processed without needing painting.

Field testing already is underway in Florida and Arizona, says Mike Dettre, AOC business manager - Auto Sector. "This requires not only new resins, but total reformulation," he says.

Dettre says the composite is not yet commercially available but is being evaluated by automakers.

Bayer MaterialScience Composite Supports Zafira

The innovative optional integrated roof module offered in the new German Adam Opel AG Zafira small van is supported by a lightweight structure using Bayer MaterialScience's Baydur® LFT (long fiber technology) structural reaction injection molding (SRIM) process. Bayer's Don Schomer says the structure reduces weight by 30 to 40% compared to steel, yet is equally as strong.

In the Baydur LFT process, long glass fibers are mixed with polyurethane resin and dispensed into an open mold in a one-step process. In-mold paint can be applied directly into the mold cavity, eliminating the need for a costly paint line.

The structure serves as the backbone of a multifaceted roof module complete with wiring, gear assemblies, skylights and overhead storage compartments that run vertically down the roof's center.

Zafira is the first vehicle to use Bayer's Baydur LFT composite for the basic structure of an integrated roof module, says Schomer. (Opel is a subsidiary of GM).



Integrated lightweight structure offers a panoramic view – plus added storage – in Opel's popular Zafira small van.

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