Rich past, bright future for SRIM composites

With its revolutionary fiberglass body construction, the 1953 **Chevrolet** Corvette introduced the car-buying public—and competitive design engineers—to structural composite materials as viable replacements for metal. Although development work on composite materials previously had taken place in other industries, this was truly the first application where the technology was unveiled to the general public.

Bayer's HD-SRIM and glass mat reinforcement for the load floor of this DaimlerChrysler minivan provides a weight savings versus a steel panel.

An Audi A4 spare tire cover uses Bayer's Baypreg F sandwich composite, which includes glass mats and paper honeycomb.

The Corvette dramatically demonstrated how combining the formability of polyester resins with the strength of fiberglass created a composite material that could be used to mold very strong, lightweight body components to safely replace heavier metal parts at a relatively lower cost. The sleek design of the classic Corvette provided a showcase for these new "fiberglass" parts that were not only eye-catching, but also tough and dent-resistant. The car-buying public loved the combination of sleek lines and functionality.

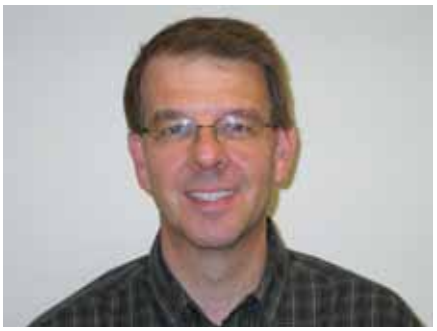
For many years after their introduction, polyester resin-based composites remained the standard in composite technology. That changed in the early 1980s, with the advent of a new line of composite products that combined conventional urethane and fiberglass reinforcing materials in the reaction injection molding (RIM) process to form materials possessing structural-member strength. This process became known as structural RIM, or SRIM.

Automakers such as **General Motors**, **DaimlerChrysler**, **BMW**, and **Audi**, among others, are finding SRIM composites—with their desirable combination of lighter weight, good strength, and increased design freedom—a good alternative to other materials for interior and exterior parts.

Today, many automotive interior applications for SRIM composites include door trim substrates, instrument panel retainers, spare tire covers, and sunshades. For interior applications, in almost every instance, the lighter weight and good strength of the composite material have led to its selection over competitive alternatives.

Generally speaking, there are two traditional polyurethane systems technologies that have been used to date to produce nearly all commercial SRIM composite parts: Low-density SRIM (LD-SRIM), which uses a polyurethane foam polymer in combination with glass reinforcements, and high-density SRIM (HD-SRIM), which combines a solid elastomer with glass reinforcements.

In one recent application, DaimlerChrysler introduced a new minivan using a composite load floor panel that covers the in-floor storage bin in which the second-row seating is stored. The composite load floor panel uses a HD-SRIM (with glass mat reinforcement) to provide weight savings compared to a steel panel without sacrificing performance.



Bayer MaterialScience Market Channel Manager Terry Seagrave says use of sandwich composite is gaining momentum in the automotive industry.

For exterior automotive applications, SRIM composites are typically used in one or two general ways. One use is for reinforced structural parts that replace steel structures—for example, bumper beams and underbody structures. Several General Motors and DaimlerChrysler vehicles have gainfully used such technology at one time or another.

A second exterior use is for load-bearing surfaces. SRIM technology is ideal for light truck boxes and tailgates. For instance, both the Chevrolet Avalanche and **Cadillac** Escalade EXT SUVs use HD-SRIM composites to mold their mid-gate panels. As in the case of interior applications, the HD-SRIM technology weighs less than alternative materials while providing good impact, abrasion, and corrosion resistance.

Another new SRIM composite technology allows the design engineer to choose from several different reinforcing materials to develop a part with very specific performance characteristics. For instance, **Bayer**'s polyurethane system can be used with natural fiber mat reinforcements to produce a very thin composite substrate. Or, it can be used with a core spacing material (such as paper honeycomb, aluminum honeycomb, plastic honeycomb, or balsa wood) that is overlaid with glass mats or natural fiber mats to form a much thicker "sandwich" composite. The result in either case is a lighter-weight composite than ever before, with exceptional load-bearing properties. Use of sandwich composite is gaining momentum. It is becoming quite popular for sunshades, spare tire covers, and load floors.

Innovation in SRIM technology will continue, as today's competitive environment further intensifies the need for manufacturers to seek out the best-performing product at the lowest possible cost. In this marketplace, versatile SRIM composites are increasingly more desirable, as they allow automotive designers and engineers to better answer the everlasting demand for lighter, more fuel efficient cars and trucks.

The growth opportunities for SRIM composite materials are quite promising. Primary drivers leading the market to composites include lighter-weight vehicles for better fuel efficiencies; low-production vehicle builds, which favor composites over other more expensive manufacturing processes; and multifunctional designs that can be combined with the SRIM molding process. Interior applications will account for the majority of the growth in the areas of load floors, sunshades, instrument panels, and other trim parts.

This article was written by **Terry Seagrave**, Market Channel Manager, Bayer MaterialScience.

Hoeganaes high on powder metal

Automakers and suppliers are beginning to use powder metal in original designs for engine, transmission, and other parts, according to the market development manager of a major powder metal supplier, giving a lift to the technology.

Eric Boreczky of **Hoeganaes** said that use of powder metallurgy previously owed mainly to companies converting to it from traditional metal-working technologies after learning of its benefits, among them low cost. Recent improvements in alloy development, powder making, binders, lubricants, and parts production methods are making it an increasingly better choice, he said.

Those improvements now make it possible to produce powder-metal parts with one press and one sinter operation, rather than two each, greatly reducing production costs, according to Boreczky.

North America is a particularly good market for powder metal, he said, because of the high take rate on automatic transmissions, many parts of which are or can be made of powder metal. Boreczky sees North America as the "commercial and technological hub" of powder metal technology. He forecasts an increase in North American powder metal usage of 1-1.5 lb (0.5-0.7 kg) per vehicle annually for the next several years. The average new vehicle sold in North America contains about 43.5 lb (19.7 kg) of powder metal, he said

Lubricant synthesis is performed by a Hoeganaes researcher at the company's technical center in Cinnaminson, NJ.

Hoeganaes is the world's largest producer of powder metals, according to the company.

Patrick Ponticel

Demand heating up for brazed copper-brass radiators

Worldwide use of brazed copper-brass heat exchangers will climb to 1 million units by 2007, Staffan Anger, President of **Outokumpu Copper Strip** Oy, said at the **SAE** 2005 World Congress in April.

Sweden-based Outokumpu makes copper and brass strip, and is a member of the **CuproBraze Alliance**, which is promoting brazed copper-brass heat exchangers over aluminum and soldered-brass types because of the formers' advantages in durability and efficiency.

Young Touchstone, a Wabtec subsidiary and member of the CuproBraze Alliance, produces these Flat-Round tubes. (Photo courtesy of Young Touchstone)

At a press conference, Anger said, "The growth in CuproBraze production in the past three years has been spectacular."

There are nine companies in production with the technology, and another 13 are about to make a decision on whether to begin production, Anger said. "And with about 80 more companies currently evaluating the technology, these numbers are skyrocketing. As a result, the CuproBraze Alliance predicts 500,000 heat exchangers in service by the close of 2005 and more than a million in service by the close of 2006."

CuproBraze technology was conceived in the 1990s to compete against the aluminum-brazing process for a wide range of mobile heat-exchanger applications. The technology is now beginning to take off, with **SHAAZ** of Shadrinsk, Russia, opening a plant employing CubroBraze technology in February 2003. The most recent major development in CuproBraze was the opening of a plant in Nanning, China, operated by **Nanning Baling Technology**.

"The CuproBraze Alliance has proven that it can ramp up manufacturing capacity to any level required, including high-volume production for OEM manufacturers," said Anger. "We knew that competitive high-volume manufacturing processes could easily be developed because of the inherent simplicity of CuproBraze technology."

CuproBraze results in more durable, more efficient heat exchangers compared to alternative materials technologies such as aluminum or soldered copper-brass. Brazing occurs at higher temperatures than soldering, so brazed joints are much stronger than soldered joints.

According to Anger, another factor that has contributed to the rise in interest is that CuproBraze remains strong at high temperatures—temperatures that would turn aluminum into putty. The operating temperatures of charge air coolers (CACs) are increasing from 150°C (300°F) level up to 300°C (570°F) level. The strength of CuproBraze fin and tube alloys will be good enough at these elevated temperatures whereas aluminum will lose its strength at much lower temperatures. For this reason, the alliance expects CuproBraze to take market share from aluminum in CACs in heavy-duty trucks within the next few years.

Strength at elevated temperatures is in great demand for new clean diesel engines. The adoption of CuproBraze technology is being driven by the more stringent diesel emissions standards scheduled to take effect around the globe over the next few years.

With more and more CuproBraze heat exchangers in service, the door is open for copper-brass radiators to make a comeback in passenger cars, where aluminum has dominated since the 1980s. "Since under-the-hood temperature in passenger cars is predicted to rise in the years ahead, some major vehicle manufacturers have shown considerable interest even towards this market segment," Anger said.

Patrick Ponticel

Toyota gives Tundra interior the 'boot'

Toyota is offering buyers of the Toyota Tundra Double Cab in several Gulf States an interior with leather from **Lucchese Boot**. Lucchese makes leather boots in San Antonio, where Toyota will open a new manufacturing plant for Tundra production next year. The special dealer-installed Lucchese package includes sandstone brown leather with ostrich leather accents, Lucchese-embossed headrests, and special exterior badging. The seats will also feature liquid-filled padding between the seat padding and cushion.

Patrick Ponticel

Lucchese leather is offered as a dealer-installed option on the Toyota Tundra Double Cab.