

# Keep on Truckin'

## Composites in heavy trucks

By Brian Buda

On a pound-per-vehicle basis, heavy trucks are the largest users of composites in the transportation industry. As shown in Figure 1, the importance of composites in the heavy truck market continues to grow. Domestic original equipment manufacturers (OEMs) are experiencing numerous external pressures from EPA emission and anti-idle requirements, rising diesel and material prices, and increased international competition. OEMs are looking for lightweight and innovative solutions to mitigate the impact of these pressures, and they are asking composite suppliers to be part of the solution.

### Historical Perspective

Composites have been used on heavy trucks since the 1950s. Truck builders were among the first major users of thermoset composites, selecting them for their low mass, low tooling investment and design versatility. Traditionally, the heavy truck industry has used a wide variety of composite materials and processes in its units, including SMC (Sheet Molding Compound), RTM (Resin Transfer Molding), open mold processing, spray-up and Balsa cores. Most recently, there has been an increase in demand for materials such as DCPD (DiCycloPentaDiene) and thermoplastic composites for certain applications.

### Current Applications

Composites are used in a wide variety of applications in the heavy truck industry, and the degree to which each OEM uses these materials varies greatly. Some OEMs use composites as stand-alone components, such as battery boxes, hood assemblies, roof assemblies, door assemblies, fairings, engine covers, sun visors and bumpers. A few customers have fully embraced the advantage of consolidating components by using

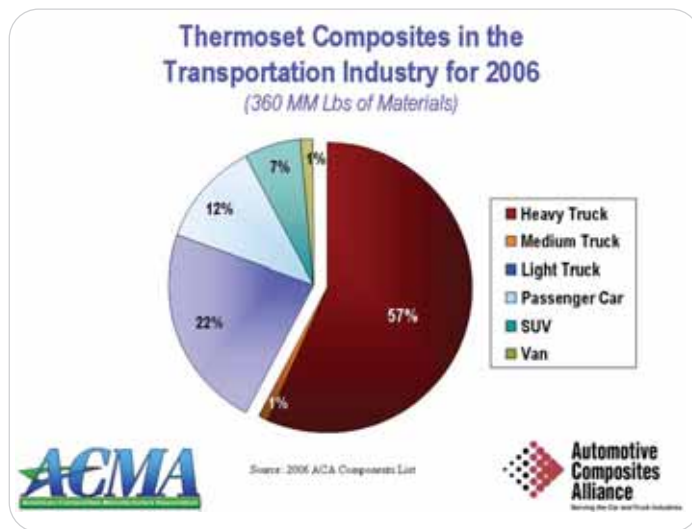


Figure 1



Freightliner Cascadia SMC Hood



Peterbilt DCPD Hood

composites in full body/cab structures. The following are seven trends affecting the heavy truck industry:

#### *EPA and Anti-idle Requirements*

Strict federal EPA requirements were implemented in 2007, and the required improvements for 2010 have a significant impact on the weight of heavy truck tractors. Customers want to reduce weight and look to composite suppliers for these solutions. They request lower specific gravity materials with lower panel thickness. The combination of these two panel considerations has a significant weight impact on heavy truck components due to the sheer size of the panels and can equate to more than 20 pounds in mass savings for hood and roof panels/assemblies.

In addition to the new equipment requirements for EPA07, new anti-idle laws are being required of operators. The sleeper boxes of the tractors require higher levels of insulation to better manage temperature conditions within the cabs. Due to the inherent properties of composites, they serve as better insulating materials than the traditional metallic materials used on a large number of cabs today.

#### *Rising Diesel and Material Prices*

Everyone feels the impact of rising fuel prices, and the heavy truck market is no exception. Diesel prices for operators have been on the rise and have set a record for the third consecutive week as the national average rose 3.4 cents a gallon to \$4.177, according to data from the Department of Energy (Transport Topics, May 5, 2008 Edition). A significant opportunity lies ahead for composites, as we can provide lightweight solutions over steel components. Every pound we can save on a tractor equates to improved fuel economy for the operators.



Mack MD11 Litre SMC Engine Cover

#### *Composite Material Pressures*

As thermoplastics develop, they are increasingly used in the heavy truck industry. There has been a trend in the conversion of components—which typically would be thermoset composites—to thermoplastics. Thermoplastics are gaining momentum on side fairings and side deflectors. This shift stresses the importance to the industry to continue to develop new lightweight composite materials.

#### *Cost Pressures*

Steel and aluminum raw material costs have skyrocketed. Numerous heavy truck customers rely on aluminum and steel for a significant portion of their tractors' components. This spike in raw material costs alone will open the door for composites as the rate of raw material costs are increasing at a slower rate than aluminum and steel.

(“Keep On Truckin’” continues on p. 54.)

*A significant opportunity lies ahead for composites, as we can provide lightweight solutions over steel components.*

("Keep On Truckin" from p. 22.)

### *Rising Demand for Composite Materials*

New composite materials are gaining traction in the heavy truck market. Two of these materials are thermoplastic composites and DCPD. Thermoplastic composites offer lightweight solutions at typically lower piece price costs than other composite materials, but approximately the same tool costs as SMC compression molds. Likewise, DCPD shows growth in the heavy truck market. Contrary to thermoplastic composites, its piece price is usually higher than an SMC assembly with a lower tooling investment.

Both thermoplastic composites and DCPD materials have pros and cons relative to typical thermoset composites. One advantage is weight. DCPD has a specific gravity of 1.03 and thermoplastic composites range from 1.1 to 1.3 vs. 1.3 to 1.9 for thermoset composites. A second advantage is the impact resistance of DCPD. This material is suitable for components that require high impact performance. There are trade-offs, however, as the DCPD and thermoplastic composite materials do not perform well under high heat applications, where traditional thermoset materials far exceed in performance.

### *Changes in the Thermoset Composite Market*

One change is a trend away from open molding to closed molding. Due to emissions regulations and the high VOCs that result from the open molding process, heavy truck customers are primarily looking to the closed molding process to mitigate this environmental concern. In fact, some customers are even looking at converting existing components from the open mold process to the closed mold process before product model changes.

The composites industry also is developing advanced compounds using carbon fibers, nano-fillers and bio-based resins to increase mechanical properties, reduce mass and improve environmental friendliness.

### *New North American OEMs*

A new opportunity for all heavy truck composite suppliers is the increase of customers. HINO Motors is opening a new plant in the United States with planned production of medium-



Battery Box Daimler Truck North America

duty trucks in the next year. Also, Nissan recently announced that they are developing plans to begin production of commercial vehicles in the United States by 2010.

### **The Future of Composites and the Heavy Truck Market**

Looking to the future, it is critical that suppliers reinforce to customers the importance of upfront design involvement to fully utilize the benefits of composites. Looking at the proposed customer application from just a component standpoint is not nearly as valuable as looking at the overall system to provide the most financially advantageous solutions through system integration. Composites have the ability to offset heavy trucks' weight increases resulting from addition components that are necessary to meet EPA emission requirements. With the increase in diesel prices and in aluminum material costs, this is our opportunity to reinforce the importance of composites as the most viable solution. Our materials directly impact the bottom line of owner-operators and fleets by reducing diesel consumption, and we must continue to strive to develop unique and innovative materials that reduce weight. **CM**

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