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Adhesives, structural foams deliver lighter, tougher vehicles



Henkel provides advanced bonding technologies to Thomas Built Buses, resulting in the world's first mass-produced school bus, the Saf-T-Liner C2, that uses room-temperature-curing structural adhesives as a primary fastening method.



There are interesting contradictions that the automotive industry faces every day. How do OEMs and their suppliers manufacture a vehicle that is lighter, yet has increased strength? How can automakers deliver a vehicle that is more fuel efficient, but is cost effective to produce?

In the past, the response to demands for more strength was simple—just add supports and welds. However, this adds costs and increases weight and manufacturing complexity. Today, the industry is looking to chemical bonding and structural foam technologies to help deliver more robust, yet lighter and more fuel-efficient vehicles.

Premier automakers already rely on structural foams and adhesives to help improve vehicle strength and performance. In fact, structural adhesives can replace many of the average passenger vehicle's 1400 welds. Depending on the application, these adhesives also have the potential to reduce costs by up to \$80 per vehicle.

As technology advances, structural adhesives and foams, bonding tapes, and foam reinforcement parts will continue to



Henkel's Loctite H9000 structural adhesive is strong enough to exceed standardized federal joint strength requirements. Components such as this exterior roof panel adhere to the bus frame with metal-to-metal bonding.

replace or significantly augment traditional fasteners, welds, and supports on vehicles.

While a growing number of vehicle manufacturers are discovering the benefits of using adhesives as a significant structural bonding method, a recent application launched by **Thomas Built Buses** provides insight into the future potential of adhesives.

The new Thomas Built Buses Saf-T-Liner C2 is the first mass-produced school bus using room-temperature-curing structural adhesives as a primary fastening method. The adhesive, **Henkel's Loctite H9000**, is strong enough to exceed standardized federal joint strength requirements. It also leads to enhanced corrosion performance, eliminates the need for most of the screws and rivets, and has good impact resistance. From roof to side sheet subassembly, interior headers to roof sheets, interior side sheets to roof caps—every component adheres to the bus frame with metal-to-metal bonding, creating a dependable, structurally sound vehicle.

To meet structural requirements for other applications, bonding technologies, such as cold-applied adhesives that provide a range of key benefits, are offered by Henkel. Cold-applied adhesives help lower costs by simplifying passenger-vehicle assembly and providing effective bonding under the variety of process conditions found in body shops. These adhesives increase struc-

tural integrity of the vehicle body, leading to potential improvements in crash resistance. Structures using this type of adhesive absorb greater energy during impact, which reduces or eliminates the failure of the bond seam.

Structural adhesives deliver the additional benefit of allowing the reliable bonding of dissimilar materials such as steel and aluminum. This opens the door for more efficiently produced, lighter-weight vehicle structures. When designed properly, adhesive-bonded vehicle structures also deliver good durability.

Besides pumpable adhesives, structural adhesive tapes are another rapidly evolving bonding technology with great potential to simplify manufacturing and enhance quality. These tapes are well suited for robotic application, which increases manufacturing efficiency. A related technology out of Henkel's toolbox of patented solutions is the Orbseal Preform Automated Application System, which helps cut costs by producing fast, precise products through robotically applied, preformed seals. Removing variability leads to lower warranty costs, along with improved production.

When used separately or together, bonding technologies such as structural adhesives and tapes can deliver critical advantages. Adding structural foams to the equation delivers even more dramatic results. For example, modeling tests show that using Henkel's Terokal epoxy or acrylic-based structural adhesives in conjunction with its Terocore structural foam improves torsional stiffness of a typical body structure by about 40%.

Terocore, an expandable structural epoxy foam that provides lightweight strength, can be pumped into body sections for effective reinforcement. Furthermore, structural foam also can be molded into preformed support parts and inserts, tailor-made to strengthen key areas of the vehicle. Just a few uses for molded-in-place foam parts include bumper reinforcements, front frame rail, overhang inserts, roof pillar reinforcements, and a number of joint reinforcements throughout the vehicle. Reinforcing foams, structural adhesives, sound-damping foams, and noise-absorbing mastics also combine to improve NVH performance.

Overall, the automotive industry is facing a paradoxical challenge as OEMs and suppliers must provide more value to consumers, without raising costs or increasing vehicle weight. As is often the case, this major challenge also presents extraordinary opportunities. Recent innovations in structural adhesives and foams, preformed foam parts, and tapes from industry partners are driving advances in vehicle quality and strength.

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