

OVERVIEW OF NORTH AMERICAN STRUCTURAL ADHESIVES IN TRANSPORTATION

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Everywhere we turn – even if we take no notice – structural adhesives used in transportation are all around us. They are an integral and crucial part of the cars we drive, the airplanes on which we fly, the buses and trains on which we ride and the trucks and trailers that transport a myriad of everyday products. In many instances, structural adhesives have become a standard – and in some cases the only – method for manufacturing these products today.

In North America, structural adhesives used in transportation are a \$1.2 billion industry and projected to grow about 3-4% annually through 2013. As you can see in Figure 1, Auto OEM (31%) is by far the leading transportation end-use market. Other leading markets are Truck (20%) and Bus (16%).

There are a multitude of applications in today's cars, trucks and buses that generate the huge volumes of structural adhesives used in these industries: hem flanges for doors and enclosures, window/glass attachment, weld bonding, attachment of reinforcements and anti-flutters, brake and friction pads, SMC body panels, etc. More and more of these applications involve the assembly of dissimilar substrates, e.g. steel-to-plastics, steel-to-magnesium, etc., in major exterior and framing components. Structural adhesives are a well-established and accepted fastening method and the preferred method for bonding diverse substrates. The fact that the composition of today's cars has changed, and will continue to dramatically do so, bodes well for the continued use of structural adhesives:

- Mild steel is forecasted to decline from today's 55% of an average vehicle's weight to about 29% by 2015, while high-strength, low alloy steels are projected to grow from 11.9% to 68% in 2015
- By 2010, vehicles will average 318 lbs. of aluminum versus the current level of 274 lbs.
- Plastic content in vehicles grew from 11% in 1990 to 14% in 2000, and is forecasted to grow to 17% by 2011 or about 5.63 billion lbs. The biggest growth will be in body applications, which will grow from 1.2 billion lbs. in 2001 to 1.6 billion lbs. in 2011.
- In 2000, the average vehicle had 6.5 lbs of magnesium and 8.8 lbs. in 2003; this will increase to more than 12.0 lbs. in 2010.

Displacement of mechanical fasteners is becoming more prevalent, as they are labor intensive and both process and unit costs typically exceed that of adhesives. It is estimated that 68 lbs. of adhesive have replaced 201 lbs. of mechanical fasteners on the average vehicle in recent years for a variety of good reasons:



- The ability to spread a load across the entire bondline versus singular points of contact for mechanical fasteners;
- The ability to mitigate the adverse effect that welding has on today's thin-gage high-strength steels;
- The ability to mitigate differences in coefficients of thermal expansion between dissimilar substrates;
- The ability to increase styling latitude for design engineers and have more components assembled off-line with modular assembly and construction methods to reduce costs and improve quality;
- The ability to fill gaps and seal the bondline from moisture entry, as well as impart noise and vibration dampening properties.

In Aerospace (18%), weight versus performance is even more vital than it is for the automotive industry as it works to meet the new CAFE standards, as fuel is the single biggest expense for an airline. Thus, anything that can be done to decrease weight and improve fuel economy is highly valued and rewarded. As a result, composites have become the predominate material-of-construction for today's aircraft, with titanium also seeing increased used. For example, an Airbus A300 introduced in 1972 used about 1% composites and about 5% titanium in its construction. This is compared to the new Boeing 787 that uses about 50% composites and 15% titanium. These factors all definitely favor increased usage of structural adhesives.

While structural adhesives are well-accepted in many applications, they only capture about 10-12% of the overall industrial fastening market. So, how does the industry grow? Here are some key points that need to be addressed:

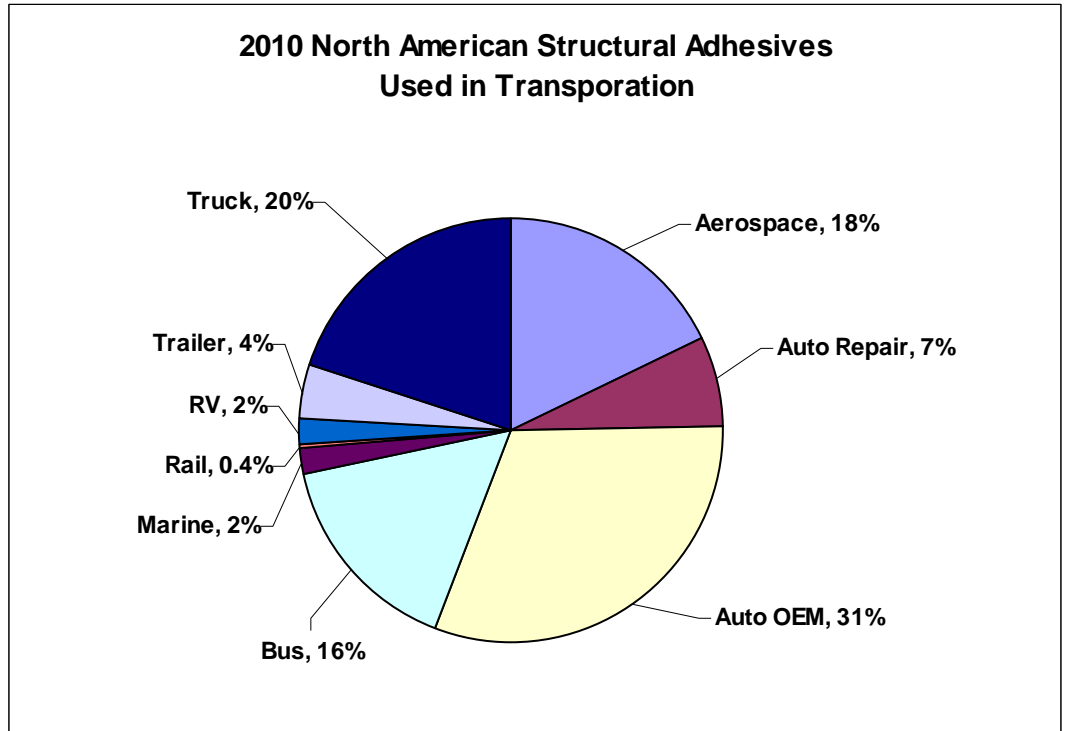
- Welding technology has been practiced for a long time and has an established track record for reliability and predictability. Adhesive bonding has a much shorter history, so more data (long-term durability and fatigue) needs to be developed to support the use of adhesives for such key structural applications like frame rails, floor pans, roofs, front modules (radiator & IP supports), etc.
- Because of this long history, workers are routinely trained and certified in proper welding techniques. The adhesive industry needs to focus more attention on seeing that their workforce gets proper instruction and certification on such crucial issues as proper surface prep, accurate bondline placement, correct manual or automated application, use of the appropriate adhesive for an application, etc. Without such attention, even the best structural adhesive will likely under-perform.
- The industry needs to develop new and improved structural adhesives that are more robust, cure faster and/or require less



energy, are lower density, disbond “on-command”, adhere through oily surfaces, bond non-polar substrates, use less material, etc.

As future end-use applications for structural adhesives become even more demanding and critical, the industry will need to rise up to meet these new challenges just like it has done to get structural adhesives where they are today.

Figure 1.



Source: ChemQuest database



About the Author



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an international strategic management consulting firm specializing in the adhesives, sealants and coatings industries, headquartered in Cincinnati, Ohio.

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Rick Jones joined The ChemQuest Group, Inc. as Vice President in 2006. He spent the previous twenty-nine years in the coatings and adhesives industry working for PPG Industries, Valspar Corporation, Lord Corporation and Sovereign Specialty Chemicals/Henkel Corporation. His entire career has focused on business management, marketing and technical sales within automotive, aerospace, industrial and wood markets. Rick has extensive knowledge and experience in creating successful business strategies, and successfully launching profitable sales and marketing programs for technical products into domestic and international OEM markets. Rick is a member of the Adhesives and Sealants Council, National Paint and Coatings Association, Society of Protective Coatings and RadTech. He holds a B.S. degree from Allegheny College (Meadville, PA).

The ChemQuest Group, Inc. is a strategic management consulting firm that has been a respected source of information pertaining to the coatings, adhesives and sealants markets since 1980. It has continually monitored the changes in market size, technology developments, raw material trends and the emergence of growth opportunities in these complex, fragmented industries. The firm is “top-line” focused, offering such services as strategy development, market analysis and mergers & acquisitions. ChemQuest is headquartered in Cincinnati, OH and has offices in Raleigh, NC; Columbus, OH; Boston, MA; London, England; Düsseldorf and Hamburg, Germany; Guangzhou, China; Buenos Aires, Argentina; and Cairo, Egypt.

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