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JUNE 2010  
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FMA The official publication of the Fabricators & Manufacturers Association, Intl.

## Bonding with adhesives

Welding and fastening have long been the go-to methods for metal bonding applications, but are they always the best, most cost-effective methods? Maybe, maybe not. Adhesives are gaining in popularity, particularly for joining dissimilar materials.

By Jeff Chapman

Many aspects are considered when designing a component. Among them are the part's shape, construction materials, and joining methods. Depending on the application, mechanical fasteners and welding are the usual bonding methods of choice. However, in certain applications, structural adhesive bonding can be used to build a high-quality product efficiently and cost-effectively.

Applications exist in almost every market for adhesive bonding as an alternative to mechanical fastening or welding. Along with the potential for time, process, and cost improvements, other benefits of adhesive bonding are stress reduction on parts, the ability to bond dissimilar substrates, and the need for less-skilled labor. Also, the inherent physical properties of adhesives, such as high shear strength and environmental resistance, are desirable characteristics.

### Adhesive Types

Epoxies, urethanes, and acrylics are adhesive alternatives to fasteners and welding. The type of adhesive needed depends on the application, as some adhesives work better on certain substrates or have certain chemical advantages.

These adhesives provide dimensional stability – the ability for a part to hold its design dimension – that improves product longevity.

### Stress Reduction

Because they are spread along the length of a bond, adhesives spread stresses over a wider area than a weld or mechanical fastener, which tends to localize a stress where the rivet or screw is placed.



### Dissimilar Substrates and Coated Materials

Adhesives can bond dissimilar metals, as well as plastic and metal.

Corrosion control coatings on some metallic substrates are ruined during the welding process. For example, welding two pieces of a zinc-coated metal destroys the corrosion coating. Adhesives take advantage of the corrosion protection and use it as a bonding substrate. The coating actually helps the adhesive develop a stronger bond.

In recent years, the auto industry has moved away from spot welding on exterior door panels and switched to adhesives because the corrosion protection was being negatively affected by the welding process.

### Adhesive Dispensing

For small operations and facilities that rely on manual processes, a pneumatic gun or manual adhesive dispensing gun can be more cost-effective than welding equipment.

In a larger, mass-production environment, robotic or automated dispensing equipment for adhesives is preferable. For a smaller operation, semiautomated dispensing equipment is sufficient, and various clamping or fixturing techniques can be developed to help with the bonding process.

### Application Examples

Applications in the trailer and container industries are particularly well-suited for structural adhesive bonding. Semitrailers, horse trailers, and utility trailers, as well as specialty vehicles such as firetrucks, tow trucks, and wreckers, all have components that can be bonded. Other applications include recreational vehicles, such as RVs and campers, and utility trucks outfitted for electricians or plumbers. Doors (cab entry doors and tool compartment doors), body panels, and shelving

on a utility or construction truck are ideal for adhesive bonding, as is anything above the trailer frame.

In the container industry, adhesives can bond the walls for mobile “pod” storage containers and fiber-reinforced plastic containers. In the green energy market, adhesives are used to build wind turbine blades, windmills, and composite and metal solar panels.

### Dispelling Adhesive Myths

Some manufacturers are reluctant to try out adhesives because of several misconceptions about them. The perception is that adhesives will not last as long as a fastener or weld and are not as strong as other methods, thereby rendering a component susceptible to failure. Safety hazards associated with adhesives might also be a concern.

The reluctance stems in part from the fact that an adhesive bond cannot be seen as it occurs, whereas with a weld or a screw or nut, you can actually see the fastening taking place. Without being able to see the bond, many people do not realize the longevity of adhesives versus other fastening methods.

The truth is that adhesives actually offer exceptional reliability and can improve a component's performance while reducing stress points and enhancing corrosion resistance.

Using adhesives requires no more safety precautions than other fastening methods do. In a typical plant setting, as with any chemical, adhesives must be used in a well-ventilated area and with personal protective equipment, such as face masks or eye protection.

### Factors to Take Into Account

Before deciding if adhesives are an option, consider several factors, such as product design and application, material substrates, and process techniques. Even if you currently are using adhesive bonding, there might be ways to make the process more efficient.

It's best to mine the expertise of an adhesive supplier to understand just what is involved in changing over a process line. Using an industrial adhesive is not simply putting glue down and sticking something together.

Some adhesives require equipment with a unique construction for proper application. For example, acrylic adhesives must be applied with stainless steel equipment, and epoxies may need different field designs because of the aggressiveness of the chemical composition of the epoxy.

The changeover to adhesive bonding involves more than just the adhesives and the equipment; there are also personnel issues to consider. Educating operators is of prime importance, especially for those,

such as welders, who have never worked with adhesives before. However, other employees – from inspectors in the quality department to manufacturing personnel – also need training. Quality department inspectors must learn to ascertain what constitutes a good or poor bond, and on the manufacturing floor, operators must be able to determine if the adhesive is in the right spot and if there is enough of it to produce a good-quality bond. Also, some adhesives are two-component formulations that must be mixed with certain ratios between Part A and Part B.

While operator training is important, the skill level needed for applying adhesives is much less than that required for welding. Skilled labor is not required for adhesive applications; personnel typically can be taught to use bonding equipment in 30 minutes or less.

Testing is a crucial part of the design process for an adhesive bonding operation. Adhesive suppliers should be willing to conduct on-site testing at your plant for large applications or test smaller pieces at their own facilities. Lab testing and periodic quality checks help ensure that the products bonded on the production line meet the lab test standards.

Like most technologies, adhesive technology is constantly evolving. If you currently are using adhesives as a bonding method, check with your provider to see if new developments can improve your operation.

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