The **adhesive** advantage: Strong joints, low costs

Pressure-sensitive adhesives minimize vibration, noise, and corrosion, making them a viable and cost-effective alternative to mechanical fasteners.

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Key points:

- Pressure-sensitive adhesives use less material and reduce assembly costs, compared to mechanical fasteners.
- PSAs resists flex and vibration, can bond dissimilar materials, and can adhere to low-surface energy plastics.

Resources:
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Manufacturers are always looking for faster and better ways to fabricate machines and subcomponents while reducing weight, noise, vibration, and costs. Pressure-sensitive adhesives (PSAs) can help do all of the above.

As the name implies, PSAs form a bond when pressure is applied to mate adjoining components. No solvent, water, or heat activation is necessary, and the amount of pressure used to apply the adhesive to the surface influences bond strength. Factors such as roughness, surface energy, and cleanliness of mating surfaces also affect bonding.

Vehicle manufacturers are one group increasingly turning to PSAs. They historically used mechanical fasteners and welding as a key part of the assembly process. But long before the Cash for Clunkers initiative to get gas guzzlers off the road, automakers were striving to produce lighter, more fuel-efficient cars. Manufacturers now use approximately 70 lb of adhesives to replace more than 200 lb of mechanical fasteners on the average car.

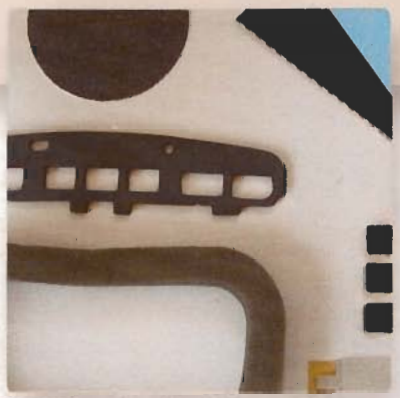
But automakers are not alone. PSAs are also used in appliances such as washers and dryers, cell phones and other electronics, power tools and lawn tractors, satellites, and a myriad of other products.

Adhesive advantages

PSAs are gaining favor with design engineers as an alternative to welds and mechanical fasteners such as screws, nuts, bolts, and rivets. The most-obvious benefits are that PSAs use less material and reduce labor and processing costs; they're simple to use; and can make it easier to disassemble parts when necessary.

PSAs evenly distribute loads over the entire bonding area, rather than concentrating it at the fastener, as with nuts and bolts. This reduces stress on the joint. They also resist flex and vibration and form both a seal and a bond to prevent corrosion. The materials can fill large gaps, join

Excellent shock and vibration-damping properties makes PSAs well suited for bonding disc brakes.



Gaskets and seals with an adhesive layer are quick and simple to install.

irregular-shaped surfaces, minimally increase the weight of an assembly, create virtually no change in part dimensions or geometry, and quickly bond dissimilar substrates (such as aluminum and steel) and heat-sensitive materials.

Manufacturers can integrate PSAs into automated assembly operations to speed manufacturing and reduce costs. And because adhesives don't extend beyond a part's exterior surface, as do mechanical fasteners, the end product can be both durable and more aesthetically pleasing.

Adhesives also remain viscous throughout their life. That viscosity imparts sound and vibration-damping properties in addition to fastening and joining. Acrylic and silicone double-faced PSA products sandwiched between substrates silence noise and eliminate vibration while withstanding extreme heat and harsh chemicals. And gaskets and seals with an adhesive layer affix quicker and easier, compared to installation with mechanical fasteners.

PSAs also provide gasketing. For instance, in mass-transit vehicles that require fire prevention and heat protection, tacky silicone adhesives bond protective padding between interior surfaces. This padding restricts the spread of heat and flame in the event of a fire and also damps noise and vibration. In addition, PSA-attached pads are less likely to be damaged by movement than those held with mechanical fasteners.

Material challenges

PSAs can also protect and join dissimilar or incompatible surfaces, such as two metals that would normally corrode when in contact. Such a barrier is important, for

example, in automotive-safety systems that require high-performance seals. These applications include bonding attachment clips for interior panels, air bags, and lamp assemblies, to name a few. With more vehicles being equipped with side-impact-protection air bags and curtains for rollover protection, high-performance substrates with film-to-fabric adhesive laminations are becoming more common.

Perhaps the biggest PSA contribution to the automotive and transportation industries is the ability to adhere to low-surface-energy (LSE) plastics without preapplication priming or flame treatment. It's also a major benefit on adhesion-challenging appliance surfaces like powder-coated paint and plastics such as thermoplastic polyolefin (TPO).

Along with TPO, low-surface-energy plastics such as polypropylene, polyethylene, and Teflon are cost-effective choices among OEM design and production engineers for a host of vehicle components. These substrates, however, have an inherent molecular structure that resists adhesion and printing processes. This can make product assembly more difficult and hurt long-term performance.

OEM engineers can rectify that with PSAs properly matched to the substrate. For instance, **Flexcon**'s V-778 is an aggressive, acrylic PSA suitable on a wide range of TPOs and polyolefin-alloys. The material helped **LyondellBasell Advanced Polyolefins**, Auburn Hills, Mich., a major producer of polymers, petrochemicals and fuels, overcome OEM aversion to TPO plastics because of adhesion problems they often pose on the assembly line. LyondellBasell found V-778 had excellent adhesion and durability, clearing a sales roadblock for customers who previously would not spec TPO plastics.

Outdoor power equipment, ATV, and recreational vehicle manufacturers, for example, now use permanent, pressure-sensitive acrylic adhesive to attach thermoformed TPO parts to equipment and to decorate or accessorize after assembly. V-778 is also an appropriate choice when applying gaskets and seals to adhesion-resistant surfaces.

PSAs are used by practically every industry and, whether it's an off-the-shelf or custom-made product, these polymers can meet aerospace, medical, and security requirements; form bonds in subzero cold and to low-surface energy (LSE) substrates; maintain adhesion at temperatures above 500°F; resist outgassing; resist dielectric breakdown; act as a thermal conductor or insulator; and survive the strict requirements for loss of coolant accidents in nuclear reactors.

But OEMs and design engineers can benefit greatly by consulting an adhesive and pressure-sensitive film supplier at the earliest stages of product design. Early collaboration can ensure the best bonding characteristics between adhesive and substrate, and optimize damping characteristics for specific frequency and temperature ranges to eliminate unwanted noise and vibration. Partnering with a knowledgeable supplier also minimizes potential time-to-market, durability, and aesthetic issues and makes cost-effective solutions more likely. **MD**

FlexMount acrylic PSAs can be used with metals, powder-coated painted surfaces, and thermoplastic-polyolefin (TPO) materials.