

BATTERY POWER PRODUCTS & TECHNOLOGY

Solutions for OEM Design Engineers, Integrators & Specifiers of Power Management Products

High Performance Adhesives for Battery Assembly

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High performance adhesives offer unique qualities that make them ideal for assembling battery products. Battery products are typically assembled using ultrasonic welding, snaps or in some cases mechanical fasteners. All of these methods are tried and proven methods for assembling battery products and each has its own benefits. The following will showcase how high performance adhesives show great promise for advancing battery assembly technology.

High performance adhesives are the fastest growing method for product assembly. The use of high performance adhesives for product assembly is accepted across most industries including, but not limited to: automotive, aerospace and the home products used to bond plastics, wood, glass and metals, high performance adhesives have also been adopted by almost every type of industry.

The battery industry has recognized high performance adhesives as attractive because of the following:

Material Bonding

High performance adhesives' ability to assemble similar or dissimilar materials is a major benefit. This allows significant design flexibility when choosing materials. For example, in a battery that is to be ultra-sonically welded, material choices are limited. Metals cannot be welded to plastics and plastic materials should be selected based on good weld properties. Materials that show good weld properties may not always be the best overall choice for a given product. Some designs actually require the use of dissimilar materials. By using high performance adhesives, material choices or combinations of materials are almost endless. Almost any battery product material can be bonded to any other battery product material if the correct adhesive material is chosen.

Impact Resistance

Virtually all battery products are attached to portable devices. This means they must withstand all types of environmental testing. One of the more challenging mechanical tests is impact resistance or drop testing. In order to pass stringent impact testing, the assembled product must have a very strong bond that is also flexible. The assembled joint needs to be able to remain strong as it flexes with the product during impact testing. High performance adhesives exhibit high bond strength (over 1,000 PSI shear) and have good flexibility down to -40°C. During testing, impact test results have shown that adhesives exceed other conventional means of assembling battery products. These results show that the housing typically fails before the joint fails. This is a significant shift in failure mode for impact testing.

Heat Resistance

Many battery products are expected to perform under high heat conditions. In extreme cases, operating temperatures can be as high as 85°C. In general, all adhesives lose bond strength as temperatures become excessive. Shear strength diminishes with high temperature. Older adhesives lost strength to the point that their performance was unacceptable for use at high temperature. Today's high performance adhesives retain high shear strength levels up to 130°C, depending on the adhesive. This improvement in high temperature performance is significant for battery applications. There is no longer a concern that the battery will come apart at high operating temperatures.

Watertight

Many of the other industries that use high performance adhesives require watertight final assemblies. Notable applications include exterior automotive components and assemblies as well as exterior home products. These applications are not only required to be watertight, but they must be watertight with the effects of high wind. There are battery product applications that require the battery to be watertight under these same extreme conditions. A similar scenario for a battery would be a two-way radio that is used by someone riding a motorcycle during a rainstorm. This is a very real possibility for a motorcycle police officer. High performance adhesives are known throughout the industry for their ability to withstand water intrusion. This makes them an ideal choice for battery applications that have tough watertight requirements.

Chemical Resistance

Battery products end up being used in all types of environments, both consumer and industrial. Batteries for consumer use may be exposed to chemicals used around the house. More significantly, many battery products end up being used in heavy industrial environments, especially for industrial applications there is the potential that a battery will be introduced to any number of stronger chemicals. In such applications it is important that the battery be able to withstand possible contact with many commonly used industrial chemicals. Much of a battery's chemical resistance comes from the exterior materials that are used but if the assembly method is not chemically resistant, neither is the battery. High performance adhesives have been tested to demonstrate that they can withstand exposure to migratory oils, plasticizers, water, lacquers and solvents making them desirable for both consumer and industrial applications.

Substrate Compatibility

One of the major concerns about using adhesives is the perception that adhesives will degrade or attack the substrate material - a legitimate concern if using some of the older adhesive technologies. Some adhesives are known to embrittle plastic or leave cosmetic defects. Adhesives have to be carefully selected for their intended substrate materials because an adhesive that bonds metals may not always bond plastics. High performance adhesives bond to the substrate by cross-linking with the substrate. That is, they chemically combine with the substrate based on the chemical composition of the substrate. Cross-linking results in a joint that ends up being generally stronger than the substrate material. Cross-linking is a main factor for outstanding impact resistance. Since there are countless adhesive material options, there is a high performance adhesive that will effectively assemble virtually any battery.

Manufacturing

High performance adhesives are dispensed in a number of ways. Dispense methods range from handheld dispensers all the way up to fully automated robotic dispense systems. Myths about dispensing adhesives are that they are uncontrolled, messy and lack repeatability. High performance adhesive dispense technology is continuously improving. Automated dispense systems are very controlled, precise and repeatable. Testing for dispensed weight has repeatability shown that automated dispense systems are repeatable to within fractions of a gram per part. Robotic systems typically demonstrate positional accuracy within +/-0.1mm (+/- .004"). Dispensing high performance adhesives has become a very robust manufacturing process.

Materials

Cost

All of the above mentioned qualities are important, but not a viable option if cost is too high. Cost is affected by adhesive type and quantity purchased. If purchased in bulk (5+ gallon containers) high performance adhesives can be very cost effective.

With the recognition of the properties of high performance adhesives, the next logical step is to understand how to effectively design a product that utilizes this technique. There are several resources available through adhesive suppliers, mechanical design websites and adhesive industry publications. These resources provide information on adhesive materials, joint design, and manufacturing related concerns. In general, designing a battery product that utilizes high performance adhesives is not significantly different than designing a battery that utilizes one of the customary battery assembly methods. Adhesive strength is a function of the bond area. Anything that can be done during the design phase to increase bond area will greatly enhance

the design. It is important to understand the materials to be bonded, the environmental performance requirements, and how the adhesive will be dispensed. Knowing the answer to each of these questions will significantly shorten the product design and launch process. It will also lead to a higher quality product once production begins.

As described, high performance adhesives have properties that make them desirable for battery products. With careful planning for joint design, adhesive selection, environmental conditions and dispense method, high performance adhesives can be utilized to produce battery packs that will be extremely robust in the field.

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