

Patent Pending Technology Thermal Management & Weight Reduction

Permabond has a comprehensive portfolio of adhesives and sealants for use throughout conventional, hybrid, and electric vehicles.

Our adhesives for battery assembly enhance the vehicle's performance by reducing weight, transferring heat, and reducing fire risks. Permabond specializes in custom formulations to meet battery manufacturers' requirements.

Title: Solution for Weight reduction in Thermal Management

Abstract: Permabond E1 is a thermally conductive resin based on a breakthrough patent pending technology. The two components of the adhesives are mixed and poured inside the battery pack. The resin contains an expanding agent that makes it increase its volume during cure. The pack itself is enclosed in the external case, and the free expansion of the mixed adhesive is higher than the available volume of the case. In this way, it gives rise to an internal pressure that generates a dual structure comprised of skin and foam. The compact, highly thermally conductive skin is in close contact with the batteries and the wall of the case, including the cooling plates. Inside the skin, the low-density foam also provides a level of thermal conductivity.

Background of the invention: Batteries are a significant part of a vehicle and are becoming more demanding in power consumption, in the performance of the vehicle. The thermal management is a key factor in the electric power.

Claims of the concept:

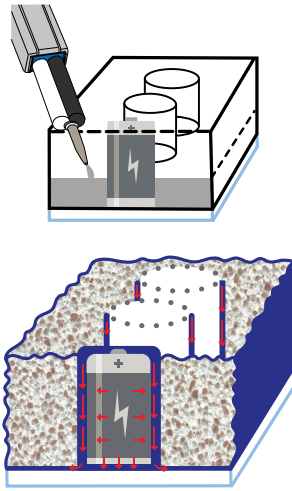
- 1) Internal pressure generates a dual structure comprised of skin and foam.
- 2) Compact, highly thermally conductive skin is in close contact with the batteries and the wall of the case, including the cooling plates.
- 3) The skin provides a thermal bridge for heat conduction and dissipation.
- 4) The foamed structure provides a better absorption of vibrations
- 5) [Redacted]





Examples:

Example 1: Permabond E1 density 1.2 g/cm³, thermoconductivity 0.8 W/mK

Example 2: Permabond E1 density 1.2 g/cm³, thermoconductivity on the skin 0.8 W/mK, on the foam 0.2 W/mK.

Fig.1



-  Cured foam
-  Thermally conductive skin
-  Heat path
-  Cooling plate

Featured Product - Permabond Expanding Thermally Conductive Filler

Permabond TC Filler expands during cure to form a lightweight foam surrounded by a highly thermally conductive skin.

Permabond TC Filler is a two component epoxy which is dispensed through a static mix nozzle to partially fill the battery pack. As it cures it forms a lightweight foam structure. The expansion causes the foam to compress at the edges to form a highly thermally conductive skin that efficiently transfers heat to the cooling plate.



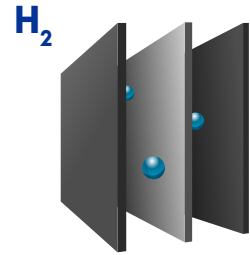
Adhesives for B

PERMABOND ES5520

Single Part - Heat Cure Epoxy

Bonds Graphite Plates for Hydrogen Fuel Cells

Permabond graphite bonder is a single part epoxy adhesive that cures with heat to form strong bonds to graphite and other substrates.



PERMABOND ET5441

Two Part - Epoxy

Thermally Conductive - High Temperature Resistance

Permabond ET5441 is a thixotropic, grey, 2:1 mix ratio 2 part epoxy that forms strong bonds to metals.

- ▶ Excellent chemical resistance
- ▶ Temperature resistance 200°C (390°F)
- ▶ Shear strength on steel (ISO4587) 20 N/mm² (2900 psi)
- ▶ Thermal conductivity (ISO 8302) 1.1 W/(m.K)
- ▶ Specific gravity 2.1

PERMABOND MT3836

Two-Part - Hybrid Epoxy

Flexible/Compressible - Thermally Conductive - Fire Retardant

Permabond MT3836 is a two-part, modified hybrid silane polymer adhesive designed for sealing and bonding applications. It bonds metals and many plastics as well as a variety of different metals. The cured adhesive has been designed to meet the fire retardancy requirements of UL94 V-0.

PERMABOND 825

Patented Cyanoacrylate Technology

High Temperature Resistant

Bonds Metals, Plastics, and more.

Permabond 825 is a clear, colorless, low viscosity (125 cP) adhesive. Permabond® 825 has excellent strength retention during thermal ageing and resists to 200°C (390°F). It forms strong bonds to most substrates. Shear strength on steel can exceed 2500 psi.

PERMABOND TA4611

Two-Part - Structural Acrylic

Battery Housing Bonder

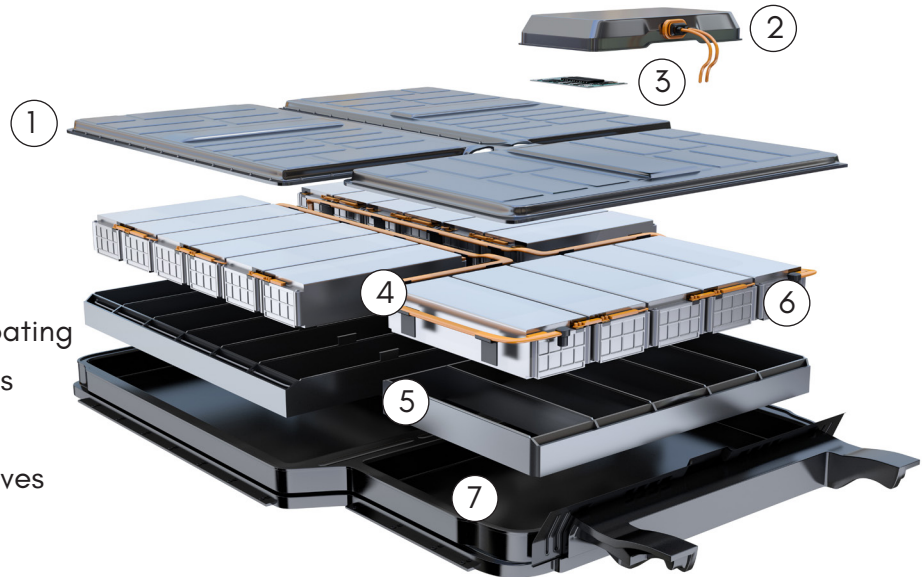
Bonds PTFE, PP, PE, UHMW, etc.

Permabond TA4611 is a transparent adhesive that achieves handling strength in under an hour, forming exceptionally strong bonds to low surface energy plastics with no need for primer or surface treatment.

Battery Assembly

APPLICATIONS

- 1 Sealing/Gasketing
- 2 Potting
- 3 Board protection - conformal coating
- 4 Electrically conductive adhesives
- 5 Structural adhesives
- 6 & 7 Thermally conductive adhesives



PERMABOND ET5442

Expanding Thermally Conductive Filler Lightweight Battery Filler

Permabond ET5442 expands during cure to form a lightweight foam surrounded by a highly thermally conductive skin. The fire-retardant, low-density foam filler encapsulates battery cells in EV battery modules providing a thermal bridge for heat transfer to the cooling plate.

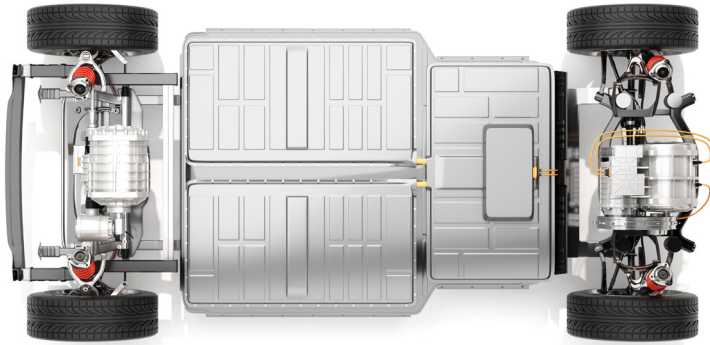


PERMABOND NH100

Non Reactive One Part Sealant Battery Housing Sealant Seals Metals and Plastics

Permabond NH100 instantly seals threaded and flanged metal and plastic joints that resist vibration and thermal shock. The non-hardening sealant is easily removed.

Permabond has been trusted for over 60 years in various industries, including the aerospace, automotive, transportation, and recreational vehicle industries. Adhesives are found in virtually every moving machine!



TYPICAL APPLICATIONS:

- ▶ Electric Motor Magnet Bonding
- ▶ Threadlocking
- ▶ Gasketing
- ▶ Retaining
- ▶ Bonding Interior Trim
- ▶ Camera Lens Bonding

The use of adhesives in electric vehicles is even more widespread than their use in conventional automobiles. Adhesives offer many advantages to both types of vehicles including; ease of use compared to welding, environmental resistance, sealing, distributing stress, and joining dissimilar materials. The advantages of adhesives specific to electric vehicles include bonding composites and low surface energy plastics, reducing weight, thermal conductivity, and electrical insulation.

WWW.ESSEXBROWNELL.COM

Permabond is a manufacturer, formulator, and innovator of adhesives and sealants.

Permabond manufactures many types of industrial adhesive products to suit the varied needs of a number of different industries. Contact us or our authorized distributor, Essex Brownell, with your application details and we will assist in finding the best solution.



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Our team is dedicated to providing high quality products that meet today's challenges for improvements in performance, efficiency, and cost effectiveness.



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The information given and the recommendations made herein are based on our experience and are believed to be accurate. No guarantee as to, or responsibility for, their accuracy can be given or accepted, however, and no statement herein is to be treated as a representation or warranty. In every case we urge and recommend that purchasers, before using any product, make their own tests to determine, to their own satisfaction, its suitability for their particular purposes under their own operating conditions. Always refer to current product technical datasheet for most recent and accurate technical information.

US ESSEX Electric Vehicle Batteries 032425