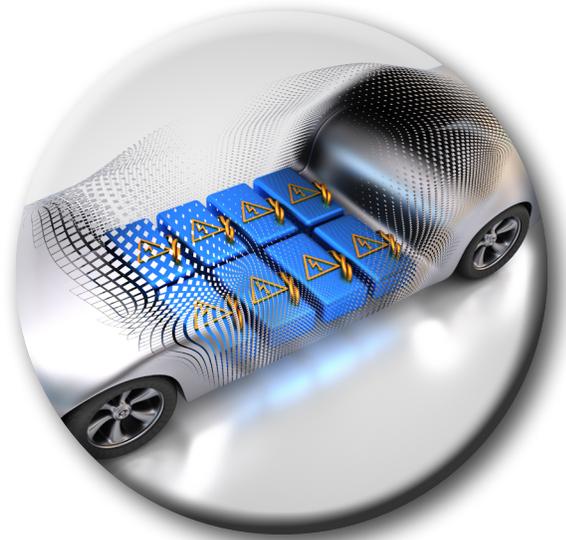


## Adhesives for Battery Assembly

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.

### FEATURES & BENEFITS

- Weight reduction
- High level of thermal conductivity
- Absorb stress and vibration
- Electrical insulation
- Fire retardancy to UL94-V0
- Flexible, compressible products available
- Excellent environmental resistance & 100% seal against humidity
- Ability to bond and seal hard to bond materials such as polyethylene, polypropylene, PEEK, PBT, and PTFE
- Ability to custom formulate to suit requirements



### Featured Product Permabond Expanding Thermally Conductive Filler

**Title:** Solution for Weight reduction in Thermal Management

**Abstract:** Permabond ET is a thermally conductive resin based on a breakthrough patent-pending technology. The two components of the adhesive 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. This skin provides a thermal bridge for heat conduction and dissipation. 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's energy storage system. The performance of the battery pack is directly related to the power consumption of the vehicle. The foam has its own conductivity due to its micro structure.

**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.

**Examples:**

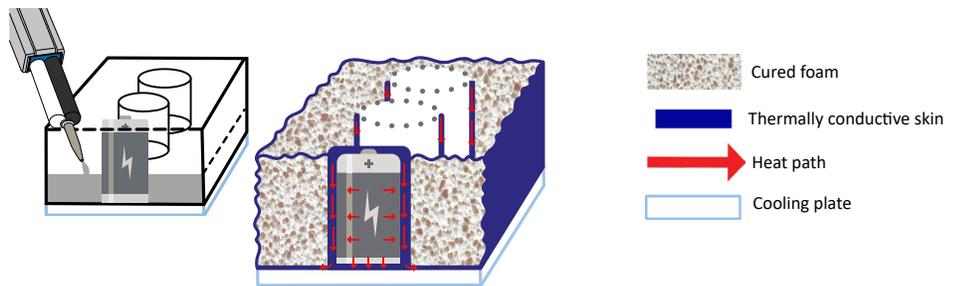
Example 1: Permabond ET density 1.2 g/cm<sup>3</sup>, thermal conductivity 0.8 W/mK

Example 2: Permabond ET density 1.5 g/cm<sup>3</sup>, thermal conductivity on the skin 1.5 W/mK on the foam 0.5 W/mK

**Fig.1**

### Patent Pending Technology

### Thermal Management & Weight Reduction



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.

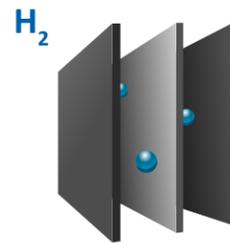
# Adhesives for Battery Assembly

## 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/mm<sup>2</sup> (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

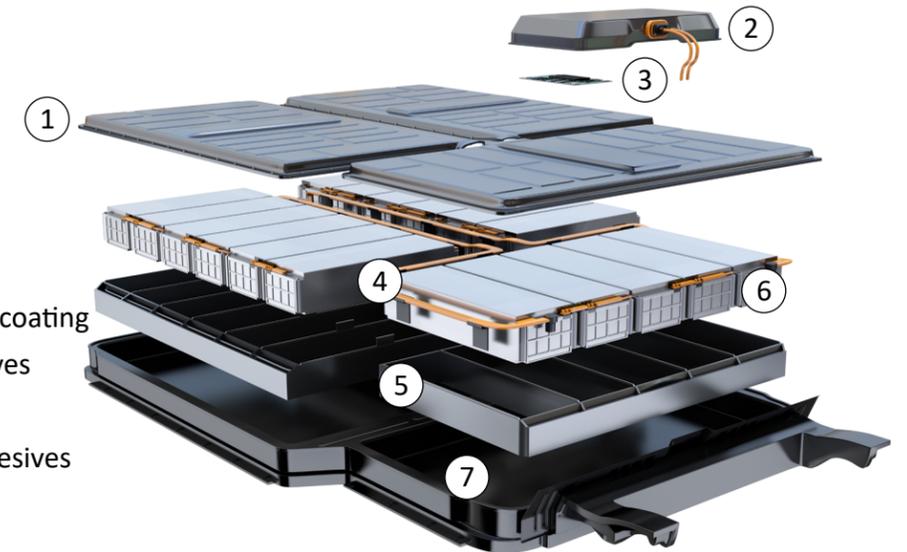
#### Battery Housing Bonder

#### 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.

## APPLICATIONS

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

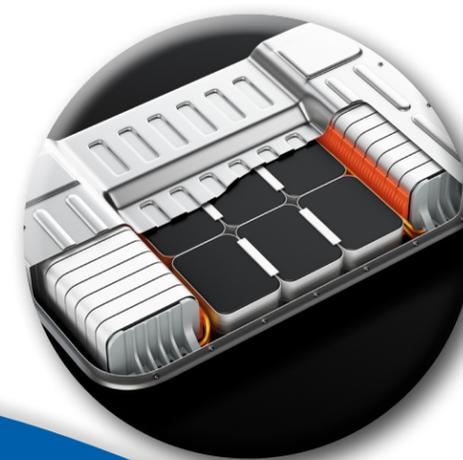


## PERMABOND ET5442

### 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

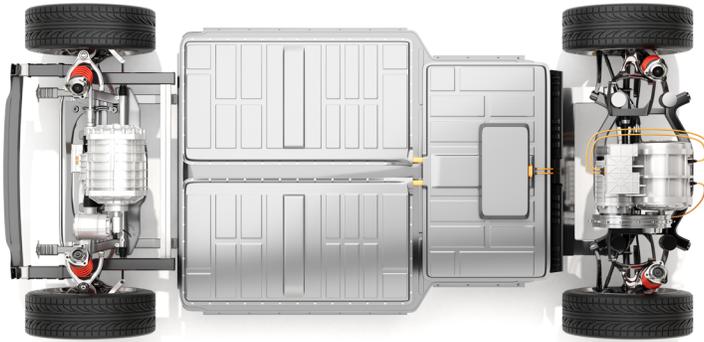
### Non Reactive One Part Sealant

#### 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 of Permabond adhesives include:

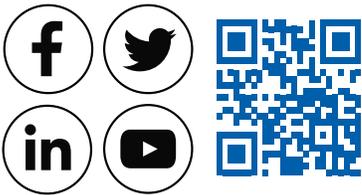
- Electric Motor Magnet Bonding
- Threadlocking
- Gasketing
- Retaining
- Bonding Interior Trim
- Camera Lens Bonding

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.

## Contact Us!

We look forward to assisting you in selecting the best stock or custom engineering grade adhesive for your application! Our team is dedicated to providing high quality products that meet today's challenges for improvements in performance, efficiency, and cost effectiveness.

[www.permabond.com](http://www.permabond.com)



Permabond® Engineering Adhesives  
223 Churchill Ave. Somerset, NJ 08873

- **The Americas** - 732-868-1372  
info.americas@permabond.com
- **Europe** - 0800 975 9800  
info.europe@permabond.com
- **Asia** - + 86 21 5773 4913  
info.asia@permabond.com

Non-Warranty: The information given and the recommendations made herein are based on our research and are believed to be accurate but no guarantee of their accuracy is made. In every case, we urge and recommend that purchasers, before using any product in full scale production, make their own tests to determine to their own satisfaction whether the product is of acceptable quality and is suitable for their particular purpose, under their own operating conditions. The products discussed herein are sold without any warranty, expressed or implied. No representative of ours has any authority to waive or change the foregoing provisions but, subject to such provisions, our engineers are available to assist purchasers in adapting our products to their needs and to circumstances prevailing in their business. Nothing contained herein shall be construed to imply the non-existence of any relevant patents or to constitute a permission inducement, or recommendations to practice any invention covered by any patent without authority from the owner of the patent. Purchasers of Permabond products are expected to follow the guiding principles of the Chemical Manufacturers Association's Responsible Care® program. Please refer to the technical data sheet for the most up to date information on each product. While every effort has been made to insure the accuracy of the information provided, Permabond cannot be held responsible for typographical errors.