



# Solving Electric Vehicle Battery Challenges with Pressure-Sensitive Tapes

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Automakers are investing heavily in electric vehicle (EV) technology and are setting long-term goals for phasing out internal combustion engines. This strategic shift is driven by government policy, long-term competitiveness, and lithium-ion technology and production innovations that have extended the EV driving range and reduced battery pack costs.

At the same time, more drivers are rethinking internal combustion engines in favor of electric motors powered by state-of-the-art battery packs. Lithium-ion batteries enabled the earliest EVs, and they remain the most common power supply for the latest models coming off today's assembly lines.

EV batteries provide a range of applications for converted, pressure-sensitive materials that enable those packs to be more efficient, safer and easier to assemble. The EV space is an area that will provide tremendous opportunities for converters and others working with high-performance, pressure-sensitive adhesive (PSA) tapes. Material suppliers, battery pack manufacturers and OEMs need assistance in various respects:

- Laminating a wide range of materials, including mica, ceramic papers, polyurethane foam, and dielectric films, to tape constructions
- Creating multilayer composites for various functional purposes, such as adding a dielectric barrier layer
- Die cutting to custom shapes
- Creating part presentations and providing consultation to facilitate automation through kiss cutting, dispensing and offering extended liners
- Providing quick prototypes and samples

## Challenges Faced

Pressure-sensitive materials are suited for solutions for some of the most frustrating challenges OEMs and battery pack manufacturers encounter as they look to improve their technologies. The major issues include:

## Reducing Flammability

Acrylic- and silicone-based adhesives with flame-retardant properties allow composites and other materials to meet UL® 94 V-0 and additional flame requirements. To address dielectric strength, single- and double-coated tapes incorporate dielectric films. To help protect pack materials, single- and double-coated tapes provide dimensional stability. In addition, easy-release liners can help protect delicate materials during assembly. OEMs and pack manufacturers should seek materials and adhesives tested for breakdown voltage and dielectric strength requirements using GB/T 1408.1-2016 and ASTM D3755 test methods.

## Boosting Dielectric Strength with Cell-to-Cell Bonding

PSAs offer a quick and robust way to provide structural integrity in an EV battery pack. The use of pressure-sensitive tapes to bond pouch and/or prismatic cells together in EV battery pack assemblies offers key benefits:

- PSAs require no cure time with immediate strength; they can act as an assembly aid and bonding solution, unlike liquid-applied products
- There is no need for mixing nozzles or pot life concerns, as PSAs feature single-component functionality
- Flame-retardant and dielectric tapes are available when there are flame or electrical requirements

## Thermal Runaway Protection Protects Battery Pack Materials

Various materials are dedicated to preventing thermal runaway events, in which a domino effect of fire spreads from cell to cell in the battery pack. EV and battery manufacturers have strict requirements to protect against thermal runaway events and rely on mica, ceramic fibers and other materials for protecting cells and passengers. Many solutions are available for bonding these materials to cells, modules and pack structures:

- Flame-retardant adhesives that enable composites and materials to meet UL® 94 V-0 and other flame requirements

- Single- and double-coated film tapes for fiber encapsulation and dielectric strength
- Easy-release liners for preventing the cohesive failure of delicate, fibrous-based materials

As the appeal for electrical vehicles increases and the need for solid and reliable batteries continues, the converting and tape industry is poised to expand along with it. Various pressure-sensitive tape technologies can help solve the industry's challenges with specific EV battery applications that converters can employ.

### Pack Seal and Gasketing

Creating a tight seal for components is critical in constructing EV battery assemblies. Heat-activated acrylic foam tapes help maintain a watertight seal between the casing and rubber gaskets. Acrylic foam tapes offer the following features:

- High durability and strength for demanding environments, shock absorption and dynamic resistance
- Acrylic foam core enables gap filling between rigid components
- A continuous bond line helps seal out unwanted intrusion and reduces the need for fasteners

### Compression Padding

Compression padding materials protect individual cells from damage caused by impact, movement or swelling. Pressure-sensitive tapes bond compression pad foam to protect EV battery cells.

Individual prismatic and pouch cells in EV battery packs need protection from impact and movement. Pouch cells can also swell during charging and discharging. To help prevent damage, EV battery manufacturers place foams backed with pressure-sensitive tape between each cell. The use of pressure-sensitive tapes for cell cushioning offers some key benefits:

- Requires no cure time and provides immediate strength; can act as an assembly aid and bonding solution, unlike liquid-applied products
- Full coverage adhesion between the metalized polyester pouch cell and cushion foam
- Flame-retardant and dielectric tapes are available when there are flame or electrical requirements

### Flexible Busbars

Busbars offer flexibility, safety and cost-effectiveness in EV battery applications. Flexible, printed circuits require electrical insulation and flame resistance. Adhesives protect these flexible, printed circuits and the bonds provide electrical insulation and flame retardancy.

### Thermal Interface Materials

Thermal interface materials (TIMs) facilitate heat transfer between components in EV battery assemblies. Multiple adhesive solutions for TIMs bonded to either heat sinks or chiller plate materials assist with battery cell and battery module cooling. These include:

- High, wet-out adhesives lower thermal impedance between TIMs and the heat source
- Silicone-based PSAs offer excellent adhesion to silicone TIMs
- Acrylic-based PSAs offer first-rate adhesion to non-silicone-based TIMs
- Flame-retardant adhesives, tested per UL® 94 V-0, are also available

### Electrical Insulation

Electrical insulation and cell wrapping are critical for protecting specific sensitive components in EV batteries. The best solution involves single- and double-coated tapes incorporating dielectric films for electrical insulation in EV batteries.

Double-coated tapes can be combined with other materials, such as compression pads to achieve electrical insulation. Single-coated tapes can be applied to rigid materials like aluminum chill plates and other metal structures.

### Collaborative Effort

Pressure-sensitive tapes are easy for converters, OEMs and pack manufacturers to apply/assemble, and they provide a slim profile and a continuous bond across a large surface area. They are also generally lighter than mechanical fastening systems, a critical property as the automotive industry looks for ways to reduce battery pack and overall vehicle weight.

As electric vehicles and EV batteries evolve, unknown needs and trials will develop. To build effective and reliable solutions, OEMs, tier suppliers and converters will need to work together closely to understand the engineering challenges and design requirements.

For more information, visit [tapes.averydennison.com/evbattery](https://tapes.averydennison.com/evbattery).

