

ENHANCING PRODUCTION EFFICIENCY:

THE IMPACT OF DIE-CUT ADHESIVE TAPES *on Cost-Effective Design and Scalability in the Electric Vehicle/BESS Markets*



Executive Summary:

As electric vehicle and battery manufacturers work to increase consumer confidence and improve widespread adoption of the technology they are faced with several hurdles, from reducing sticker prices to enabling faster charging, extending drive ranges and battery lifetimes, and decreasing the risk of thermal runaway.

With a large market share at stake, the race is on to find the most sustainable and cost-effective way to make a more efficient, lighter, smaller, cheaper, safer, and longer-lasting battery. Innovations are taking place at breakneck speed. Rapid developments in battery size and format are also taking place in the Energy Storage System (ESS) market.

What we've heard from our customers and suppliers is that the entire supply chain is dealing with a pattern of "constant innovation with a lot of stop and go." The challenge is how to cost-effectively support iterative prototypes and trials and be able to ramp production quickly once the design is locked.

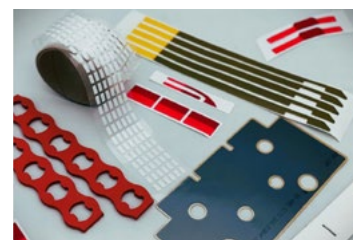
This paper will explore how Pressure-Sensitive Adhesives (PSAs) can play a pivotal role in helping manufacturers of Electric Vehicles, Batteries, and Energy Storage Systems address critical performance challenges. It will also highlight the production efficiency-enhancing benefits that an engineering driven flexible materials converter and die-cutter like JBC Technologies can offer.

Section 1 Design Advantages of PSAs vs. Liquid or Mechanical Fasteners

Section 2 Applications for Custom Die-Cut Adhesive Tapes

Section 3 The Role of the Converter

Section 4 Design for Manufacturability and Scalability



SECTION 1

DESIGN AND PRODUCTIVITY ADVANTAGES OF ADHESIVE TAPES VS. LIQUID ADHESIVES OR MECHANICAL FASTENERS

Because adhesives, by nature, are thinner and lighter than mechanical fasteners, incorporating them into a product design is one lever engineers can pull to take unnecessary weight and bulk out of a module, pack, or vehicle.

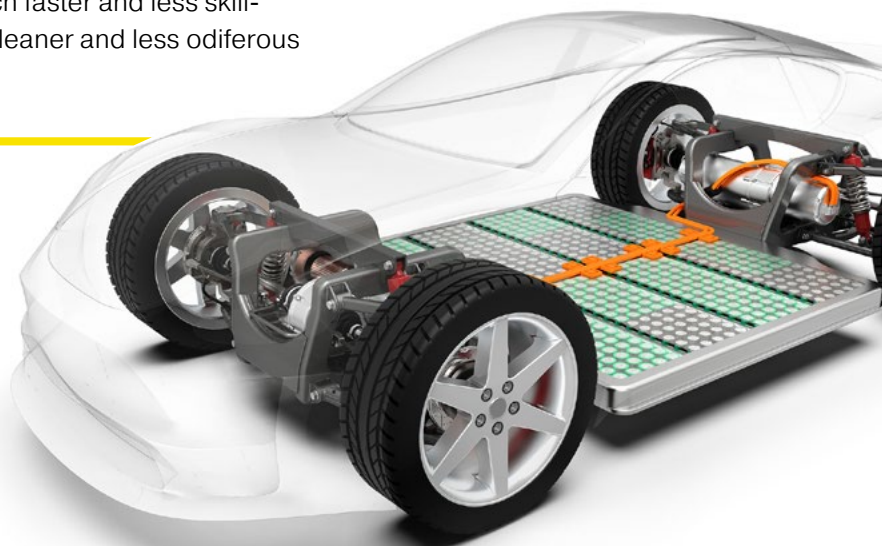
Liquid adhesives provide a strong bond yet require special equipment to apply. They also need time to cure and cannot guarantee a consistent coat weight. PSA tapes on the other hand, provide an instant bond and a guaranteed coat weight and are highly suitable for automatic assembly. PSA-backed parts can be applied quickly and easily by removing the release liner and then placing the part. There is very little set up and no cure time needed. Additionally, PSAs can be formulated to incorporate performance benefits that extend beyond simple bonding.

But the benefits do not stop with form, fit, and function. There are multiple stages in the supply chain where adhesive tapes can be used to optimize production efficiency.

- ➔ Using tapes to create multi-functional material stack-ups at the converting stage can take numerous steps out of your process.
- ➔ Applying adhesive-backed components is much faster and less skill-intensive than welding or riveting—and much cleaner and less odiferous than liquid adhesives.

KEY BENEFITS OF PRESSURE-SENSITIVE ADHESIVE TAPES

- *Provide Uniform Adhesive Coverage*
- *Form an Instant Bond*
- *Add Dimensional Stability*
- *Reduce Flammability*
- *Boost Dielectric Strength*
- *Prevent Arcing*
- *Enable a Slim Profile*



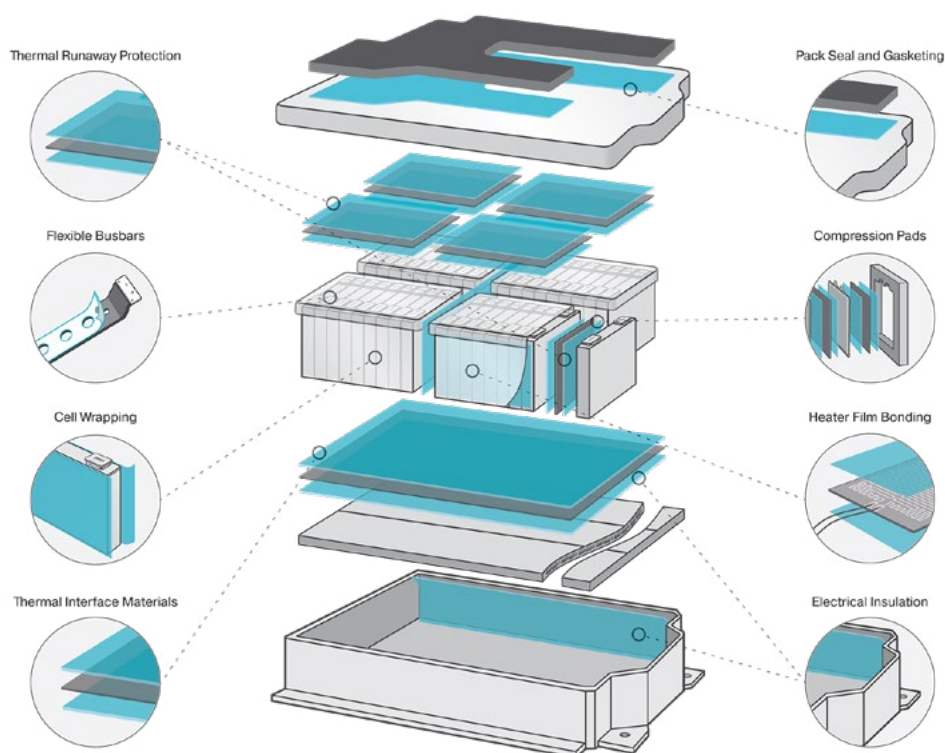
When you bring a strong converter into the mix and discuss your production environment during the design of your seal, gasket, compression pad, fastener or other adhesive backed component, the benefits are even greater. Organizations like JBC Technologies will work with you to make sure that your part is fabricated and presented in a way that will provide “lowest cost to deployment on your line.”

SECTION 2

APPLICATIONS FOR CUSTOM DIE-CUT ADHESIVE TAPES

There are many applications for specialty Pressure-Sensitive Adhesive Tapes in the electric vehicle, battery, and energy storage markets. Most of these applications can be summed up in four categories—all of which are critical to creating a holistic design that maximizes the effectiveness of the functional materials in the battery, driving down cost, and improving performance.

- **Component Fabrication** – *Taking various substrates and combining them using lamination to create multi-layer, multi-functional composites.* By combining dissimilar materials into a single part, you can achieve multiple performance benefits with a single SKU.
- **Bonding** – *Attaching something to something else.* By using a peel and stick PSA, it is possible to bond thermal interface materials, attach compression pads between cells, affix pack seals, gaskets, and much more.
- **Sealing** – *Using PSA tape to prevent the ingress of moisture.* By using a PSA with a gasket material in conjunction with removeable fasteners, it is possible to create a watertight seal with a serviceability factor.
- **Protecting** – *Adding an element of dielectric protection, reducing flammability, or providing a barrier to help maintain the integrity of fibrous or flaky materials and limit foreign object debris within the battery pack.* By adding dielectric strength and/or fire retardancy, PSA tapes can help prevent the spread of smaller electric fires into full thermal runaway.



“Adhesive tapes and die-cuts facilitate the production of highly precise and repeatable multi-functional composites. Together they enable space-saving, innovative designs in next generation battery packs, electric vehicles, energy storage, and high-voltage electronic applications.”

– Max Vanraaphorst,
Business Development Manager –
E-Mobility and Automotive,
Avery Dennison Performance Tapes



Image compliments
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SECTION 3

THE ROLE OF THE CONVERTER

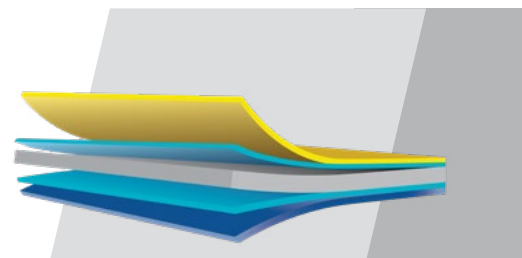
“Converter” is a term used to describe a manufacturer that specializes in modifying sheets or rolls of raw materials. This can be as simple as slitting master rolls of adhesives into custom widths, or as complex as creating multi-layer laminates cut to unique shapes.

The converter’s value lies in three core areas: creating laminated composites, transforming materials into functional parts, and optimizing assembly.

Creating Laminated Composites

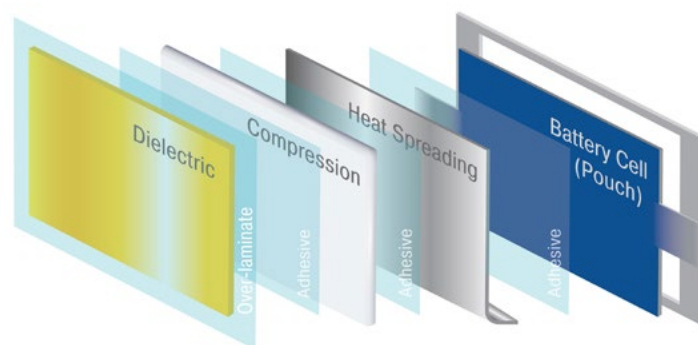
Using processes that include hot roll and cold pressure laminating, a flexible material converter can create multi-layer material stack-ups that combine the benefits of discreetly dissimilar materials into one functional composite. Depending on the use-case, this could be a foil laminated to ceramic paper or blanket, a foil laminated to a foam, a foam laminated to polycarbonate, all the above laminated together or whatever combination of materials it takes to solve the challenge at hand.

These multi-functional stacks can then be die cut to discrete shapes, slit to a custom width, or delivered in master sheets or rolls depending on the production needs of the end-user.



Q *How do I get the most functionality in the least amount of space?*

A *Custom die-cut multi-layer laminates offer high functionality in a small footprint*



- **Foams and elastomers** are used for mechanical compression, sound absorption, vibration dampening, sealing, gasketing, and even thermal insulation.
- **Aerogels and specialty ceramic papers, and blankets** are used for insulation, isolation, mechanical compression, and thermal flame barriers.
- **Flexible graphite** is often used to dissipate heat efficiently, maintain optimal operating temperatures, and prolong battery life.
- **Mica** is often used for its exceptional electrical insulation properties and ability to withstand high voltages.
- **Fire retardant polypropylene** is used between components within the battery pack, for electrical insulation, separation, and fire containment.
- **Dielectric film** is frequently used as a barrier between conductive elements to alleviate direct electrical contact and prevent arcing and short circuiting.

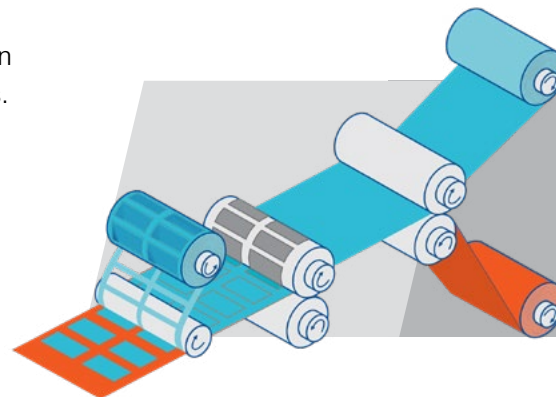
By combining different materials into a single part, not only does that part address multiple functional challenges, but it also speeds assembly and can take a layer or two out of the supply chain. Instead of working with 2-3 vendors and 2-3 SKUs, one supplier can manage the entire process.

Transforming Rolls or Sheets of Materials into Functional Parts

Using processes that include rotary and platen press die-cutting, a converter can produce parts with speed, precision, and consistency at extremely high volumes. For converters like JBC Technologies that have extensive converting options this holds true regardless of the size or complexity of the part. Our capabilities include:

- **Rotary Die-Cutting** for complex parts that require tight tolerances and multi-layer stack-ups.
- **Narrow Web Platen Die-Cutting** for simpler parts comprised of thicker, denser, and more rigid materials.
- **Wide Web Platen Die-Cutting** for large single and multi-layer parts up to 72" in width.
- **Waterjet Cutting** for materials that cannot be processed with traditional die-cutting.
- **Digital/Dieless Cutting** for quick turn prototypes and short runs.

Other available value-add functions include hot roll and cold pressure laminating printing, ultrasonic welding, surface treating, embossing, micro-perforating, kitting, and automated assembly.



Optimizing Assembly

At JBC, we've heard time and time again that our customers want to keep their production lines as efficient as possible. That requires parts that can be applied seamlessly, without significant investment in skilled labor. This is where part delivery systems and part presentation come into play. Some of the more common delivery systems we use:

- **Through cutting**
- **Kiss cutting**
- **Extended release liners**
- **Pull tabs**

The bottom line? If you have a specific requirement or are wondering whether something is possible the best thing to do is to ask. When we know in advance how you plan to incorporate the installation of that part into the next phase of your product assembly, we can work with you to make sure that the part presentation aligns with your assembly operations. This can be as simple as making sure that the parts are oriented the "right" way on the roll, or as complex as bringing some of your sub-assembly in house.



Kiss Cut to a Roll



Pull Tabs



Extended-Release Liners

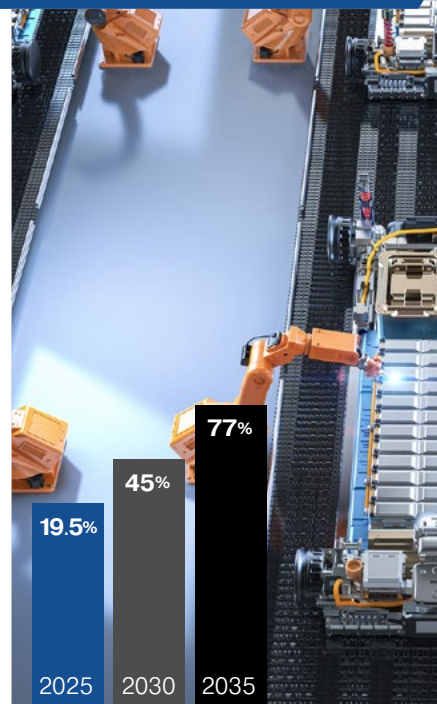
SECTION 4:

DESIGN FOR MANUFACTURABILITY AND SCALABILITY

Demand for EVs has grown markedly over the past decade and is forecasted to increase at a significant rate. According to [EV Volumes.com](https://www.evolumes.com), the EV share of light-vehicle sales in North America alone is forecast to reach 19.5% in 2025, 45% in 2030 and 77% in 2035.

Q How do I scale production?

A Find a converting partner that can support your growth with fast prototypes, low capital investment, and an appetite to work with you on design-for-automation solutions.



EV demand forecast

Turn to JBC Technologies for:

Fast, Reliable, Prototyping

JBC Technologies has numerous ways to fabricate low volume parts that can be used to test fit, form, and function without the need for expensive tooling or capital investment.

Low Tooling Costs

Die-cutting tools are typically much lower than those needed for alternative production methods.

Design for Automation

Tight tolerance die-cutting enables the precise repeatability required for automated placement. Features like easy to remove extended liners, pull tabs and adhesive zone coating enable pick and place operations that can speed installation and increase assembly accuracy.

SKU Reduction

Converted multi-layer composites and/or automated assembly can both reduce the number of discrete parts you need to purchase and integrate into your line.

Supply chain optimization

Providing just in time (JIT) delivery, on-site inventory management, and stock-keeping programs helps effectively manage our customer's carrying costs and improves manufacturing through-put.

Want to take a step out of your process? Ask JBC Technologies about automated assembly.



Convert Your Concepts into Reality with Die-Cut Solutions from JBC Technologies



As a cutting-edge flexible materials converter, JBC Technologies partners with many industry-leading material manufacturers to provide our customers with the highest quality die-cut solutions. Whether your goals are lightweighting, improved EV battery range, thermal management, bonding, sealing, or gasketing, we can help.

Contact us today at  sales@jbc-tech.com or  440.327.4522.



“JBC has been great to work with. They have a wealth of knowledge and a proven track record of collaboration and quality.

When we sit down at the table, it is all of us—the customer, JBC, and Avery Dennison,—attacking the engineering problem together.”

– Max Vanraaphorst, Business Development Manager,
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