The evolving landscape of EV battery technology and regulations: What this means for adhesive tapes?

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As the electric vehicle (EV) market accelerates, **battery technology is transforming** just as rapidly. Over the past decade, we have witnessed advances in high-performance lithium-ion batteries and new architectures, most notably cell-to-pack (CTP) and cell-to-chassis (CTC) designs. The next wave is already taking shape, with growing momentum behind sodium-ion systems and solid-state batteries. Across all these developments, the driving forces remain consistent: **safety, performance, and sustainability**.

This technological shift is unfolding alongside an equally **significant regulatory transformation** in Europe. As battery architectures evolve, policymakers are redefining expectations for sustainability, circularity, and responsible material use. The entire battery value chain is identified as one of the key product and material streams in the **EU Circular Economy Action Plan**. New rules directly influence how batteries, and the materials within them, must be designed, manufactured, labelled, and recovered.

These regulatory shifts are reshaping not only how batteries are manufactured but also how they are assembled, protected, and ultimately disassembled at end-of-life. This is where adhesive tapes come sharply into focus. Across every major EV battery architecture, **tapes are essential enablers** of safety, thermal management, mechanical stability, and increasingly, repairability and recyclability. Here, **debonding-on-demand** (DoD) adhesive technologies are revolutionising circular product design, closely intertwining with the principles of ‘right to repair’ and ‘design for recycling (DfR)’.

Innovations in battery pack designs and its consequences

At the inaugural edition of the European Tape Week held in Thessaloniki, Greece in September 2025, Afera invited **Dr. Keon Woo Lee**, Senior Manager Product Development and Innovation for Battery Systems at **Henkel**. He shared his insights on how innovations in this space impact sustainable mobility and the adhesive tape industry.

While providing an overview of the recent innovations in battery pack designs (detailed in the table below), Dr. Keon noted that "*minimalism is in,*" reflecting the industry's move toward fewer components and more integrated pack structures.

Battery pack design	Key feature / limitation
Module-to-pack (MTP) designs	Intermediate units that are assembled into a final battery pack Batteries are easily repaired by replacing modules
Cell-to-pack (CTP) / body / chassis designs (CTC)	Integrates cells directly into the battery pack (CTP) or into the vehicle's structural frame (CTC) Batteries are NOT easily repaired because of direct bonding Repairability is a fundamentally critical issue now

New EV models designed by most of the leading automotive OEMs have adopted CTP. Some older models, currently on the road, do feature MTP as well.

Tightened transition into regulations

In Europe, regulations have been evolving rapidly. The batteries value chain is one of the key segments in focus under the EU Circular Economy Action Plan. This includes rules on recycled

content, measures to **improve the recycling rates** and recovery of valuable materials. Similarly, under the **Critical Raw Materials Act**, many of the strategic raw materials are linked to the batteries supply chain. These include lithium, nickel, cobalt, copper and silicon metal amongst others.

EU New Battery Regulation (EU) 2023/1542, entered into force from August 17. 2023, lays down mandatory requirements for all batteries placed on the EU market. These cover sustainability and safety, labelling, marking and information, waste battery management, battery passport, etc. Under the **Ecodesign for Sustainable Products Regulation** (ESPR), **Digital Product Passport** (DPP) are to be introduced, which will include information on repair activities, recycling capabilities, lifecycle environmental impacts, etc.

Sustainable batteries: How debonding-on-demand can be a game-changer

Emerging architectures are placing structural adhesives and tapes at the centre of innovation. Advances in debonding-on-demand (DoD) technologies allow **safe, reversible, and precisely controlled disassembly**. At the heart of DoD technology is a mechanism that allows adhesives to switch between bonded and non-bonded states.

These adhesives incorporate smart materials or stimuli-responsive chemicals that react predictably to external triggers – typically **heat or electricity**. Selecting the optimal trigger depends on multiple factors including battery architecture and debonding objectives.

Read more about how DoD adhesives and tapes are unlocking circular product design across various downstream sectors including EV batteries.

Solid state batteries: The next big thing?

Solid state batteries (SSBs) replace the flammable liquid electrolyte in today's lithium-ion cells with a **solid electrolyte**. Common examples include ceramic, polymer, or sulphide. EV makers expect significantly longer driving range and faster charging. Also, solid electrolytes tolerate wider temperature ranges, improving performance in extreme climates.

In a recent conversation with Dr. Keon, following his visit to **Interbattery Korea 2026**, he remarked that excitement around solid-state batteries is now widespread across the entire supply chain. He also noted that dry-electrode technology is gaining significant traction, "*riding on the broader solid-state battery hype.*"

This prompts a key question for the industry: “is there a meaningful role for adhesive tapes in these emerging architectures?”

The answer is unequivocally yes.

All solid-state battery cells are said to contain high energy anode, which swells relatively more than the current lithium-ion battery cells. Therefore, to mitigate any side effects from this phenomenon, the system requires **cushioning materials** which are stiffer.

These cushioning materials, which look like **pad or sheet** are often made of **polymeric foam materials** with or without pressure-sensitive adhesives (PSA). With **PSA**, it can also be called a **foam tape**. New type of sealing solution is expected for all solid-state batteries.

These are examples where **tapes play an important role** for all solid-state battery technology.

Conclusion

The rapid evolution of EV battery technologies—spanning lithium-ion advances, emerging sodium-ion systems, and the accelerating push toward solid-state architectures—is reshaping not only how batteries are designed but how they must be assembled, protected, repaired, and ultimately recycled. As Europe tightens its regulatory framework through the EU Battery Regulation and the ESPR-driven Digital Product Passport, the industry is moving toward a future where safety, sustainability, and circularity are non-negotiable.

Adhesive tapes support next-generation EV battery pack architectures, enable controlled disassembly through debonding-on-demand, and help manufacturers meet stringent repairability and end-of-life requirements. As innovations in cell and pack design continue to accelerate, the adhesive tape industry stands at a pivotal intersection—empowering safer, lighter, more repairable, and more sustainable batteries that will define the next era of electric mobility.

References:

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