

## Adhesive tapes for EV batteries and energy storage

Customized solutions for smart bonding in lithium-ion batteries



## High-tech adhesive tapes for e-mobility and energy storage systems

### Reliable and cost-efficient Li-Ion battery assembly

Lohmann offers multifunctional adhesive tape solutions and high-precision die-cuts for thermal and electrical management of Li-Ion batteries. Safety, reliability and efficiency over the whole lifetime of the lithium-ion battery and hence the bonded joints are paramount. Lohmann adhesive tape solutions offer a more flexible and weight-saving alternative to mechanical fastening methods, featuring an easy and clean assembly compared to liquid bonding. Using multifunctional tape solutions in the battery manufacturing process combines multiple benefits: They offer immediate and strong adhesion and thus fast handling and add functionality in just one product.

For example, in an EV battery our tapes do not only efficiently connect the cells to the cooling system, but also prevent sensitive components from short circuits by realizing excellent grounding or, as part of a laminate, help protect against fire. Furthermore, Lohmann's range of single- and double-sided adhesives tapes takes over functions like thermal runaway protection, sealing, cushioning, electrical and thermal insulation, electrical conductivity or EMI shielding. The portfolio offers flame-retardant solutions that fulfill the requirements of UL 94.

Additionally, to support the heat management of the EV battery, the tapes of the DuploCOLL® TC range realize state-of-the-art thermal conductivity. The multifunctional tape portfolio meets automotive requirements, has low-outgassing and is free of solvents, silicones and halogens.

With many years of experience in numerous automotive applications as well as specification work in close cooperation with OEMs and tiers, Lohmann is the development partner for individual bonding solutions in serial production and is certified according to IATF 16949. Customers benefit from local supply chains and a network of international experts and project teams that support on-site.

Lohmann offers long-time experience in creating sustainable connections. As drivers for future technologies, we developed the first bonding solutions for PV-modules more than 30 years ago. Also, our solutions used in wind turbines prove: the more reliable and efficient components are connected, the longer-lived and more economical the overall system is – irrespective of whether energy is obtained from renewable energy systems or energy is being stored using modern battery technologies.

## From high-tech tapes to process integration



From the initial idea to the implementation into the final process – from prototyping to series production – Lohmann produces customer-specific adhesive tapes and converts them into die-cuts. Directly from one source, independently from intercontinental supply chains, in various high-precision manufacturing processes (e.g., laser plotter, rotary die-cutting, etc.) and in low  $\mu\text{m}$ -tolerances. This is Lohmann's "Smart Bonding Approach": Together, we develop the best adhesive solution for the individual application, offering support throughout the entire project up to process integration.

The whole product portfolio of single- and double-sided adhesive tape solutions is available on rolls, spools, as die-cuts or sheets. Lohmann provides customized laminates in a wide variety of materials that combine the individually required properties: For example, insulating PET films in various colors and thicknesses combined with pressure-sensitive adhesives on one or both sides of the tape. Various foam materials (e.g. PE, PU, EPDM or acrylic foam) can be combined with PSAs as well. Moreover, apart from intumescent and thermally insulating materials, electrically conductive fabrics or foam materials in combination with

electrically conductive adhesives are also part of the extensive high-tech portfolio.

To support you in the project phase, Lohmann offers a wide range of tests used in the automotive industry and by OEMs, which are carried out in-house in modern high-tech laboratories as well as in cooperation with external institutes. Beside traditional static and dynamic test methods for peel, tack and shear strength, our adhesive specialists conduct various environmental testings for temperature, UV, humidity or chemical resistance. Furthermore, Lohmann has in-house test equipment for analyzing the conductivity, resistance and impedance of thermal interface materials (TIM) according to ASTM D5470.

Apart from process aids such as mounting films or handling aids and simple applicators, Lohmann adhesive technology experts provide additional support for complex manufacturing concepts. To make your fully automated processes even more efficient, our solutions can be integrated reliably and seamlessly, thus enabling high quantity and cost-conscious manufacturing.

### The entire value chain of PSAs and die-cuts – from a single source



R&D of adhesive

We tailor the properties of our adhesive to the requirements of the respective application. For example, we can adjust the adhesive strength by adding additives or meet requirements such as flame retardancy or electrical and thermal conductivity.



Die-cutting

With precise die-cutting machines, that are used to create high-quality, dimensionally accurate products, we meet the increasing demands of the market.



Coating

Acrylics and rubber-based adhesives are coated onto web materials using solvent, dispersion or hotmelt systems. Reactively crosslinking adhesive systems additionally offer you increased mechanical or physical strength in your application.



Testing

With elaborate inspection and testing procedures in our laboratories, we ensure that our products meet and maintain the quality requirements.



Converting

We convert coated materials into rolls, spools and sheets in many dimensions according to your requirements.



Applying

We support our customers with application tools and help with the detailed engineering: from manual, semi or fully automatic application aids to cutting equipment.



Laminating

We laminate a variety of materials, creating individual product designs for specific applications.

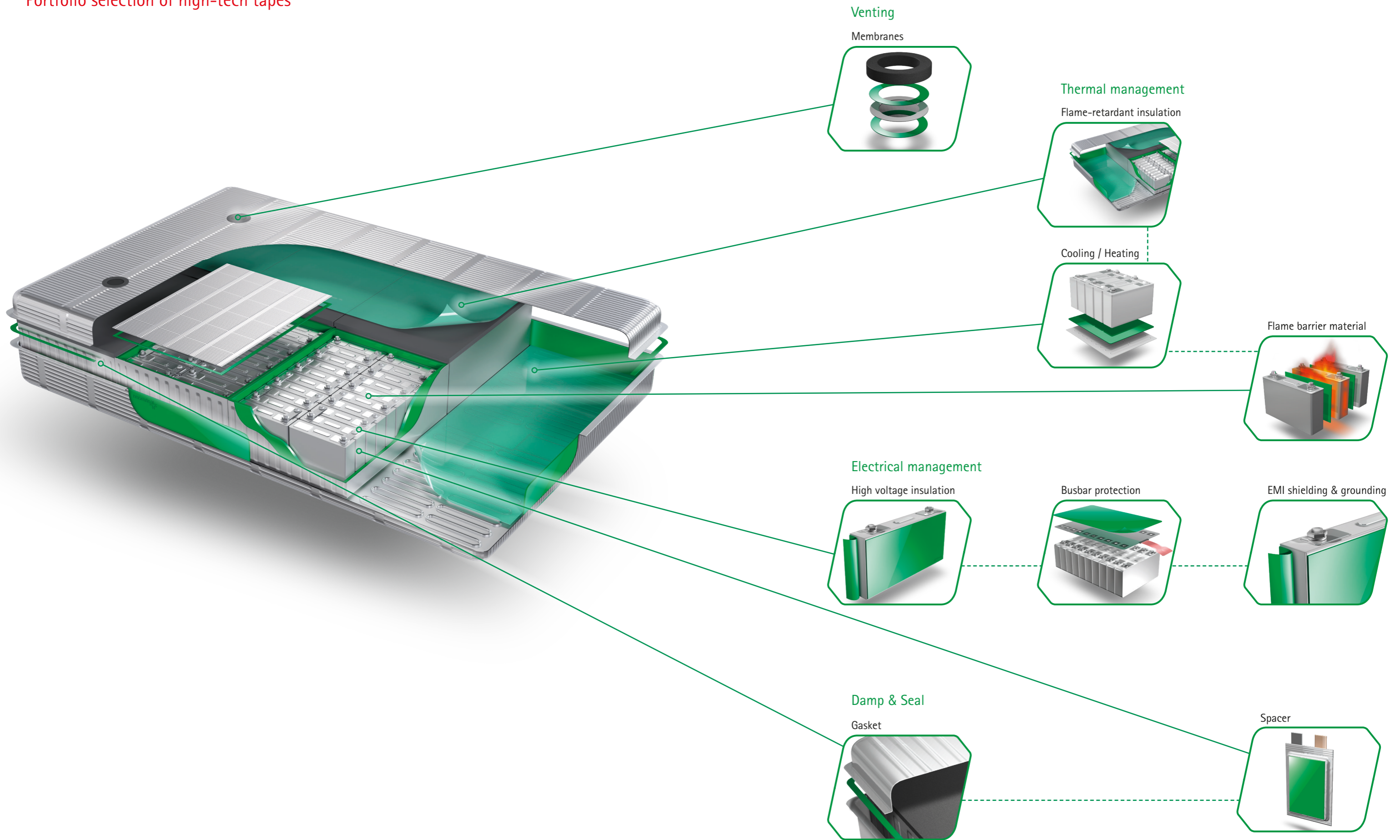


Pick & Place

Application technology specialists support you in integrating our adhesive systems into the production process by fully automated pick & place solutions.

# Li-Ion battery applications

Portfolio selection of high-tech tapes



# Applications

## Electrical management

### High voltage insulation

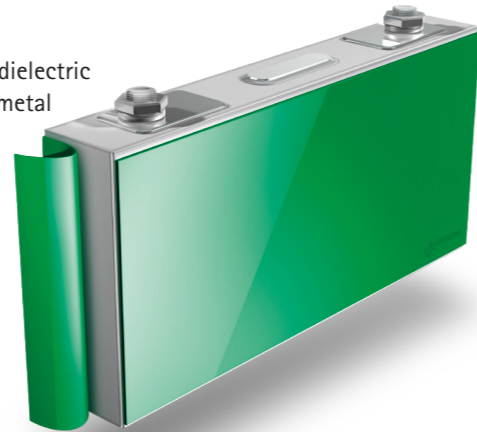
For the electrical insulation of sensitive battery components and effective protection against dielectric breakdown, Lohmann offers various single- or double-sided PET films. They can be applied to metal parts of the battery, e.g., on side panels, cell housing or battery case components. Due to their flexible adaptation to various shapes, they can optimally be used for cell wrapping. For better camera recognition in fully automated production processes, different colors of PET are available to support safe and reliable mounting.

### Your benefits

- Optimal electrical and thermal insulation
- Tapes are tested for dielectrical strength
- Long-term heat resistance
- Single- or double-sided adhesive tapes, equipped with a PET carrier
- PET carrier available in various colors for reliable detection by vision systems

### Products

- PET films in different thicknesses and colors combined with adhesive on one or on both sides



### Busbar protection

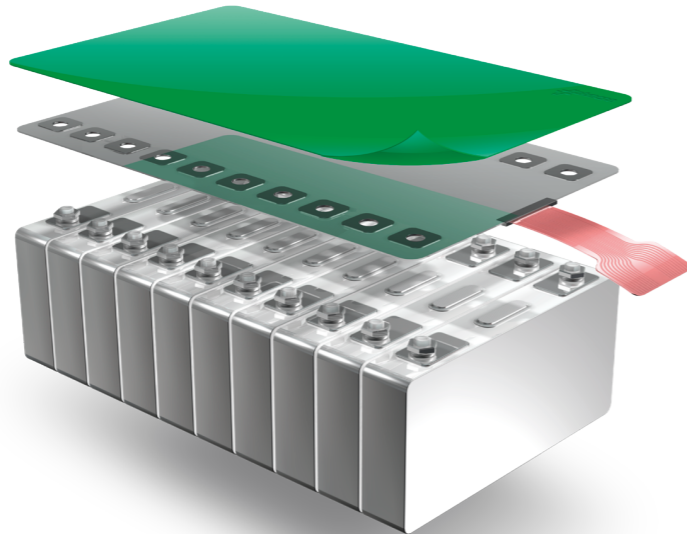
Lohmann provides single-sided adhesive PET or PI films for the electrical insulation of the busbar which protects the adjacent components of the battery system from sparkover. These self-adhesive films can be laminated to cushioning foams in various thicknesses for further protection against mechanical impact or for compensating tolerances. If flame-retardant insulation is required as well, we provide additional lamination of technical papers or other flame barrier materials. Thus, Lohmann offers individual lamination of various materials and different thicknesses according to your needs for an undisturbed battery function over lifetime.

### Your benefits

- Improved electrical insulation of the connection to the battery management system
- Tapes are tested for dielectrical strength
- Flame-retardant tapes fulfill requirements of UL 94
- Cushioning foams for mechanical protection of the electrical connection
- Tapes available as rolls or as customized high-precision die-cuts

### Products

- Customized laminates of a wide range of materials available e.g., PET film + special paper + foam (optionally)

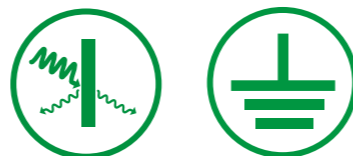


### EMI shielding and grounding

Electrically conductive foams offer a smart solution for grounding without using springs or wires. The single-sided foam helps to enable safe grounding over lifetime by bridging gaps caused by part tolerances and thus offers reliable protection of sensitive battery components. At the same time the pressure-sensitive adhesive tape also fulfills a shielding function and helps to prevent malfunction or failure of the battery system.

### Your benefits

- Isotropic and anisotropic electrically conductive
- Excellent shielding properties against electromagnetic waves according to ASTM D 4935
- Tapes available on rolls or as customized high-precision die-cuts
- Easy assembly thanks to reliable and seamless integration into highly automated production processes



### Products

- DuploCOLL® EC Range

## Damp & Seal

### Gasket

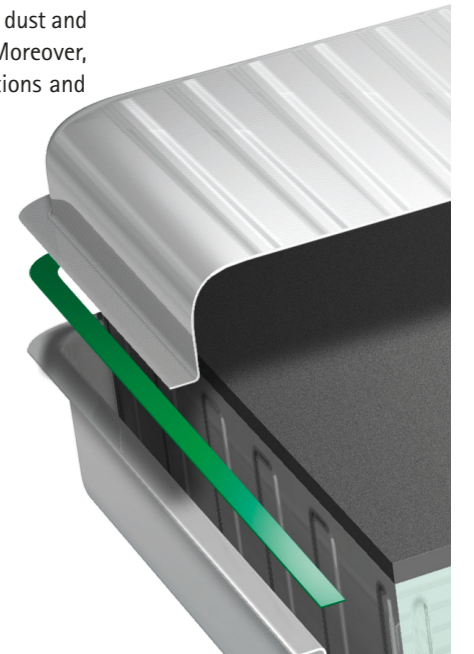
Lohmann's closed-cell PE, PU and EPDM foam tapes provide optimal sealing and dampening against dust and humidity and help to make the battery case tamper-proof over the lifetime of the components. Moreover, the self-adhesive foam tapes act as NVH (noise, vibration, harshness) materials to absorb vibrations and support the minimization of noise.

### Your benefits

- Excellent adhesion to variety of surfaces
- Absorption of vibrations and protection of sensitive components
- Effective noise-reduction and damping properties
- Reliable protection from unwanted irruption – no opening without destruction of the foam

### Products

- PE, PU, EPDM or acrylic foams in a variety of thicknesses combined with a wide selection of pressure-sensitive adhesives



### Spacer

The use of foams between individual pouch or prismatic cells as spacer and electrical insulation support the performance of the EV battery. The "breathing" movement of the cell during charging and discharging will be compensated by the foam and generates the ideal backpressure. Foams are also used as spacers between battery packs and support noise reduction management.

### Your benefits

- Reliable backpressure for optimal performance of the cells
- Compensation of expansion of cell during use
- Absorption of vibration and shock and thus effective noise-reduction
- Effective cell cushioning due to full-surface bonding of the foam tape
- Compensation of different component tolerances
- Long-term heat resistance
- Electrical insulation properties for protection against dielectric breakdown or flashovers

### Products

- Different foam chemistries in a wide thickness range according to individual requirements



## Thermal management

### Flame-retardant insulation

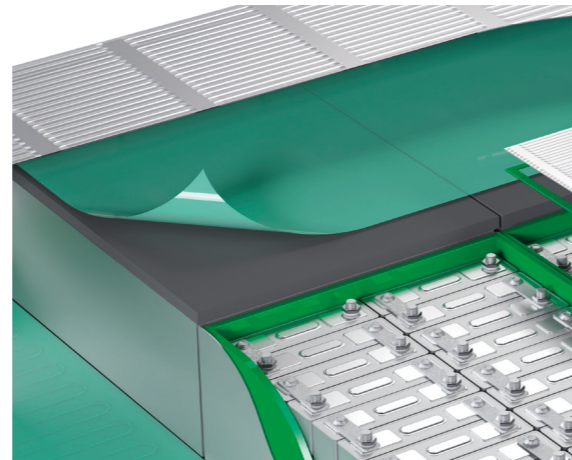
Lohmann pressure-sensitive tapes can be laminated to various materials, such as aramide paper or inorganic materials like mica, to realize self-adhesive flame-retardant insulation of the battery housing. All products can be adapted to your individual requirements to optimally support passenger safety in the vehicle.

### Your benefits

- Heat-resistant acrylic adhesives
- Thermal insulation
- Flame-retardant tapes fulfill requirements of UL 94
- Pressure-sensitive adhesive foam tapes offer good cushioning properties

### Products

- Customized laminates of a wide variety of materials that combine the required properties



### Cooling / Heating

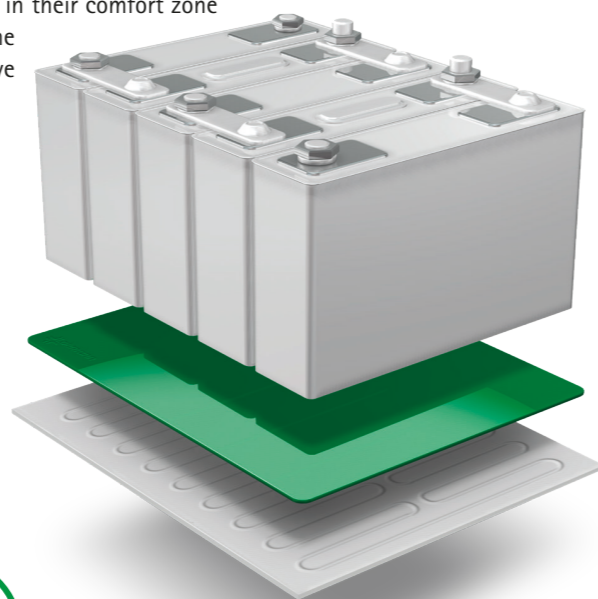
Lohmann's pressure-sensitive adhesive tapes allow an efficient and reliable connection to the cooling or heating element and provide a thermal conductivity of up to 2 W/mK. Tapes from our TC-portfolio support the heat management inside the EV battery and help keeping the lithium-ion cells in their comfort zone between 20 and 35 °C in order to enable the longest possible lifetime of the cells. The double-sided tapes are free of solvents, halogens and silicones and provide effective protection of electrical components as no silicone oil can migrate.

### Your benefits

- Thermal conductivity up to 2 W/mK tested according to ASTM D 5470
- Good adhesion and excellent surface wetting for good heat transfer
- Homogeneous heat transfer
- Flame-retardant tapes fulfill requirements according to UL 94 V-0
- Protection against corrosion and abrasive dust
- Free of solvents, silicones and halogens
- Different colors available for better detection by vision systems
- Tapes available on rolls or as customized high-precision die-cuts
- Easy assembly thanks to reliable and seamless integration into highly automated production processes

### Products

- DuploCOLL® TC Range (Thickness range: 140 µm – 2 mm)



## Thermal management

### Flame barrier material

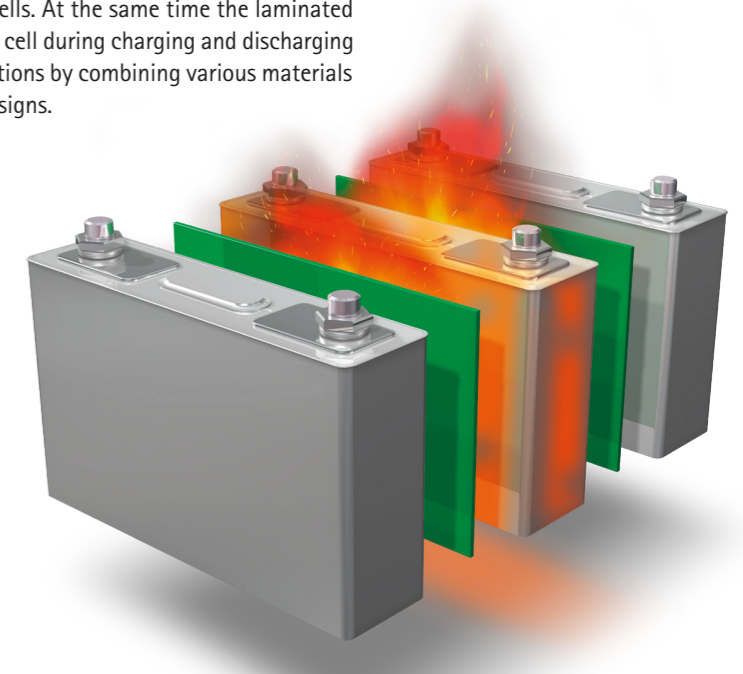
If a cell is overheating the flame barrier material prevents thermal propagation to neighboring cells and therefore helps to keep vehicle passengers safe. Lohmann offers various flame-retardant tape laminations with low thermal conductivity to be used as a flame barrier between cells. At the same time the laminated materials are compressible to compensate the breathing behavior of the cell during charging and discharging and the swelling over the cell lifetime. Lohmann offers customized solutions by combining various materials to match the requirements of different cell chemistries and battery designs.

### Your benefits

- Very low thermal conductivity
- Compressible for optimum compensation of cell expansion
- Flame-retardant tapes fulfill requirements according to UL 94
- Heat resistant up to several hundred degrees

### Products

- Customized solutions according to individual customer needs



## Venting

### Membranes

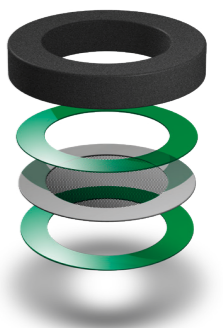
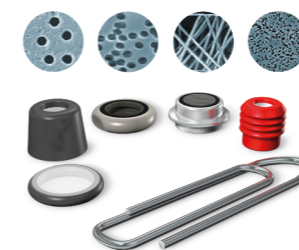
Membranes can be combined with self-adhesive foam die-cuts in lowest µm-tolerances to seal the EV battery against humidity and thus help to enable an incident-free usage over lifetime. Lohmann's high-tech die-cutting technologies offer endless varieties of membrane constructions – choose your suitable membrane and we combine it with cushioning foam and adhesive for your application.

### Your benefits

- Effective humidity protection for undisturbed battery function over lifetime
- Time- and cost-saving, as no additional fixing materials are necessary
- Excellent adhesion and surface wetting for good humidity transfer
- Cushioning foams for mechanical protection
- High-precision die-cuts in lowest µm-tolerances available in customized shapes

### Products

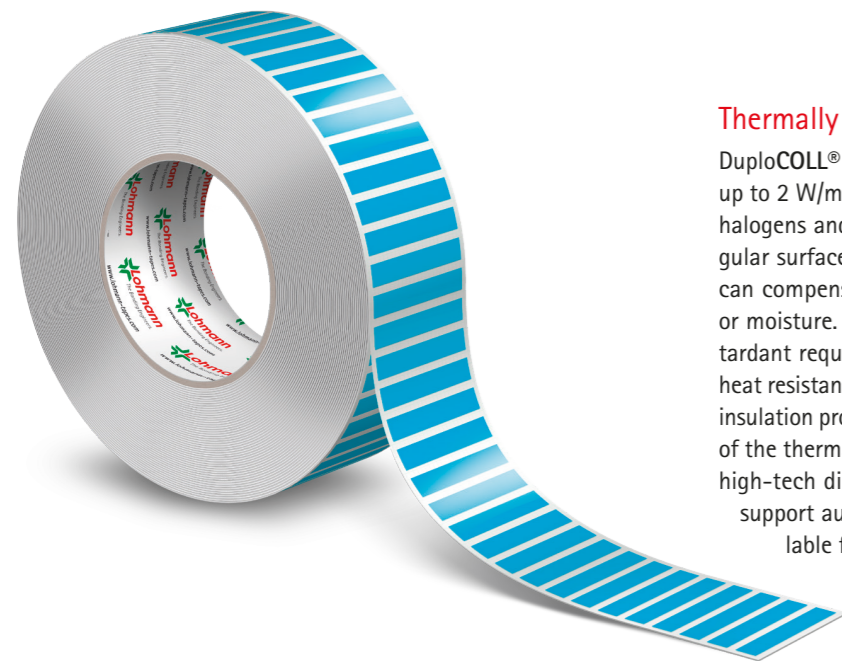
- Customized combinations of membranes, adhesives and cushioning foams



# Multifunctional adhesive tape portfolio

Developments in the electronics sector are driven mainly by digitalization, miniaturization and increased power density. EV batteries become more compact to save weight and combine more cells with a higher energy density to provide higher performance. This leads potentially to more heat generated in the module or pack and more sophisticated battery surveillance and management. Additionally, batteries and further high-voltage components in electric and hybrid vehicles need a reliable electrical engineering including effective protection against electromagnetic waves to prevent interferences as well as smart grounding solutions to avoid short circuits.

These technical challenges continually require new bonding solutions that offer more than just joining components. Our products offer smooth thermal or electrical management or serve other functions, such as sealing, damping, vibration and shock absorption, protection or cushioning. Lohmann's multifunctional adhesive tapes are optimized to be customized as die-cut solutions to fit perfectly into your highly automated manufacturing process.



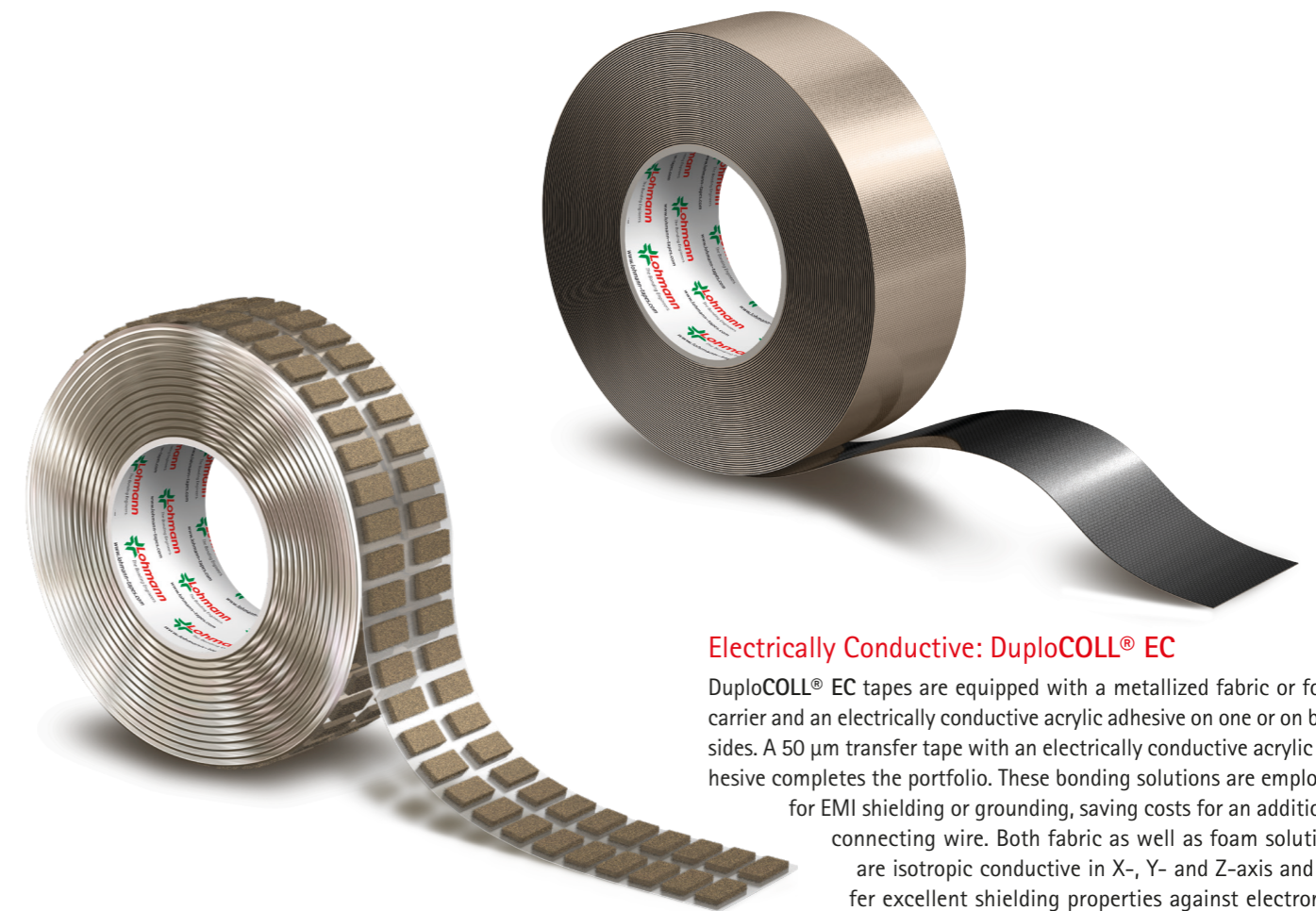
## Thermally Conductive: DuploCOLL® TC

DuploCOLL® TC acrylic transfer tapes offer a thermal conductivity of up to 2 W/mK for an efficient heat transfer. They are free of silicones, halogens and solvents and provide immediate adhesion even to irregular surfaces, realizing excellent surface wetting. Additionally, they can compensate component tolerances as well as seal against dust or moisture. The thermally conductive portfolio fulfills the flame-retardant requirements according to UL 94. In short-term use they are heat resistant up to 180 °C. What's more, they offer also high electrical insulation properties with breakdown voltage up to 26 kV/mm. All tapes of the thermally conductive range are available as rolls or customized high-tech die-cuts in various thicknesses from 140 µm to 2 mm. To support automated production processes, different colors are available for better detection by camera or optical sensor systems.

## Electrically Insulating: DuploCOLL® IS

DuploCOLL® IS adhesive tapes are a broad portfolio of electrically insulating filmic tapes. Combined with a foam the laminates provide damping properties and therefore offer protection for sensitive components such as printed circuits or flexible busbars during the lifetime of the battery. Thanks to their isotropic insulating properties, the bonding solutions protect against dielectric breakdown and enable safe battery operation. The easy to apply tapes feature excellent temperature resistance so they can serve as heat barrier either in the lithium-ion battery or also in the production process.

The range is designed for applications where a high heat resistance in combination with electrical insulation is required. All adhesive tapes of this portfolio are available as rolls or individual die-cuts.



## Electrically Conductive: DuploCOLL® EC

DuploCOLL® EC tapes are equipped with a metallized fabric or foam carrier and an electrically conductive acrylic adhesive on one or on both sides. A 50 µm transfer tape with an electrically conductive acrylic adhesive completes the portfolio. These bonding solutions are employed for EMI shielding or grounding, saving costs for an additional connecting wire. Both fabric as well as foam solutions are isotropic conductive in X-, Y- and Z-axis and offer excellent shielding properties against electromagnetic waves. The electrically conductive foam tapes are easily compressible and thus compensate tolerances between components optimally and at the same time, with constant contact, provide a permanent grounding function. All tapes in the EC portfolio are available as rolls or customized die-cuts in any shape.

## We make it green: Sustainability at Lohmann

As pioneers of adhesive bonding technology, our history has been characterized by progress and innovative ideas since our founding over 170 years ago. Our various high-tech adhesive solutions are the result of years of research and development. In the continuous further development of our technologies and products, our goal is to become even more sustainable while at the same time meeting the individual requirements of our customers. Our focus along this path is on reducing emissions, the use of renewable energies, biobased and ethically sound raw materials, circular economy, optimized recycling concepts, waste avoidance, more sustainable packaging and targeted investments in technical innovations.

We have been awarded the EcoVadis Silver Seal for our global sustainability activities in the areas of ecology, social responsibility and economy. The certificate applies to all Lohmann sites worldwide and underscores our sustainability efforts.



The best bonding solution is the one that meets the precise needs of your application. And how do we find it? By advising and supporting you from the initial idea right through to its intergration in your process.

Our philosophy in three words:  
**smart bonding approach.**

Interested in finding out more on bonding solutions for the automotive and electronics industry?

Please visit our website or get in contact with us:

[www.lohmann-tapes.com](http://www.lohmann-tapes.com)

[electronics@lohmann-tapes.com](mailto:electronics@lohmann-tapes.com)

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