

Increase EV Motor Performance with Electrical Insulating Tapes



Saint-Gobain Tape Solutions

North America | South America | Europe | Asia

For a full list of locations, please visit tapesolutions.saint-gobain.com/contact-us

The electric traction motor in an electric vehicle (EV) is the equivalent of an internal combustion engine (ICE) in a traditional vehicle. While the power to run the electric motor comes from the battery pack, the transmission transfers the power from the electric motor to drive the wheels. At the heart of the vehicle, electric motors are playing a big role in the shift to more environmentally friendly transportation. While electric motors are not new, their use in an electric vehicle is rapidly gaining momentum. Compared to the industrial motors that have been in use for several decades, motors for EVs are demanding a new set of requirements for their components.

Electric motors have strict requirements with respect to the availability of space, shock resistance and chemical resistance. They must meet the power requirements of an EV, while also occupying a smaller footprint. This requires these motors to be very compact while still providing the power and energy found in high capacity, larger motors used elsewhere. Compared to industrial electric motors, the designs and demands for electric motors can require a unique combination of electrically insulating materials. The mechanical, chemical

and electrical resistance of a tape used in an electric motor must be considered when sourcing the right materials for increased performance.

How Tape Can Affect Electric Motor Performance

From the moment when tapes are wound, mechanical performance is critical due to the tension brought on by that process. Performance consistency continues to be necessary for the lifespan of the electric motor as it endures temperature fluctuations, vibrations on the road and much more. Any failure (like a tear) during the installation can be a costly affair, and any failure during service can lead to an unsafe and expensive electrical short situation.

Electric motors are directly connected to the transmission gears and there is potential for tapes to come in contact with grease/oil that help them. These grease/oils can attack the tape and cause damage to its structural integrity which can negatively impact mechanical performance. Choosing the right material combination (backing(s) and adhesive as shown pictorially in Figure 2) that can stand the specific oil/grease is an important decision.

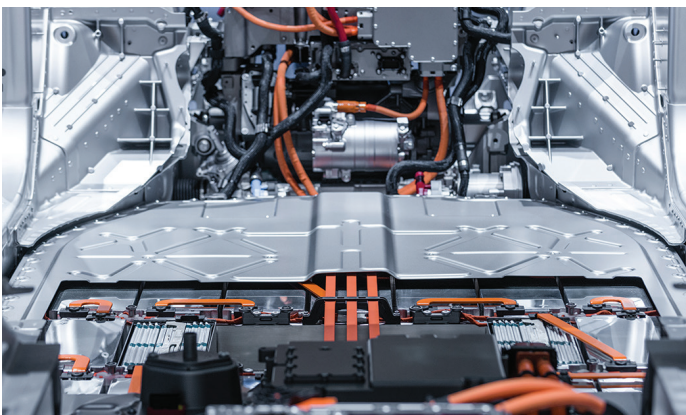


Figure 1.

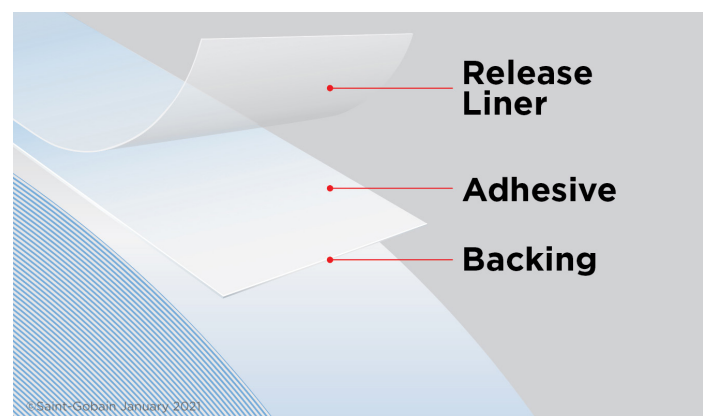


Figure 2.

Source: Saint-Gobain

Mechanical Resistance

Motors used in electric vehicles experience more starts and stops compared to industrial motors which run continuously. Different tape backings, or a combination of backings, can be used to improve the mechanical integrity of the tape to account for this increased activity. For instance, while taken individually, the mechanical strengths of PET, PI or PEN may not be sufficient for the specific application, but with our expertise in combining these substrates with glass filaments, glass cloth or other filmic materials, exceptional tensile strength can be achieved in this composite structure. **CHR**® PS.25 is an example of how a [PET tape reinforced with glass filaments](#) can reach outstanding mechanical properties.

Mechanical integrity is also necessary when considering how these insulating solutions are used in electric motors. In many cases, these tapes are required to be converted into die-cut pieces of varying lengths and widths to meet the size constraints of the application. Making a tape able to endure the die-cutting process should also be considered when constructing a solution. Sometimes this means developing a custom product that addresses the specific needs of the application, ensuring the lasting performance of the electric motor.

Chemical Resistance

When choosing an [electrically insulating tape for electric motors](#), it is critical to understand the chemicals that the tape will come into contact with in the transmission box, and to tailor a solution that it is compatible. While the transmission in an EV is quite different from an ICE vehicle, the necessity for chemical compatibility is still important. For scenarios where the drive shaft from an electric motor is directly linked to the gear box, the tape used will come into contact with the lubricating material; having a solution with proven chemical compatibility will contribute to the longevity of the electric motor performance.

Compared to the more inert backing component, the adhesive component of insulating tapes has the most impact on chemical compatibility. Pressure sensitive adhesives include rubber, acrylic and silicone. Relative comparison for chemical resistance of pressure sensitive adhesives can be shown as Silicone > Acrylic > Rubber, indicating that acrylic based adhesives provide better resistance than rubber, and silicone-based

adhesives provide better resistance than both acrylic and rubber. An excellent example of a product where the backing material improves chemical resistance is **CHR** K.30, which combines silicone adhesive with a PEN film, resulting in an exceptional material when compared to other films like PET or PI.

Electrical Resistance

As an electric motor accelerates and decelerates, the resulting voltage fluctuations create an operation pattern that is different than the typical steady operation of an industrial motor. The typical industrial motor is rated for 20,000 hours, whereas the life of an electric motor is still being defined and could demand a much longer useful life. The voltage spikes experienced in EV motors may require a range of breakdown voltage capabilities and corona resistance. Rather than over- or under-engineering, optimal performance can be expected when the tape material is chosen to meet the motor design and requirements. The choice of which backing material when taking electrical resistance into account can be shown in a good, better, best scenario where glass cloth is good, Aramid Paper (eg., **Nomex**®) / PET (Polyethylene Terephthalate) is better, and Polyimide (PI, **Kapton**®) / Polyethylene naphthalate (PEN) is best.

CHR PX.50 and 6601 are examples where different backings are combined to create high-performing products resulting in great flexibility and conformability with outstanding dielectrical and mechanical properties.

Customized Solutions for Electric Motors

A tailored product that addresses the mechanical, chemical and electrical stresses placed on an electric motor is often required for optimum performance. Custom tape development is not a complicated task, but it does require technical knowledge of material relationships and the specific application conditions that come with an electric motor. It also takes a strong understanding of available manufacturing methods. Our dedicated global engineering team has extensive experience in [specialized product development](#), making us a reliable partner to deliver a custom-made tape with optimal adhesive, the perfect backing materials, seamless process integration and superb performance for your electric motor.

A PI film with a glass cloth to enhance mechanical strength while maintaining very high dielectric

properties and an aramid paper with a PI film for an upgraded version of PX.50 are examples of successful co-developed solutions for this market. We can choose the best adhesive system from rubber, acrylic and silicone to design the product to fit the specific application needs, and a broad selection of release papers and films is available to provide optimal die-cut processing.

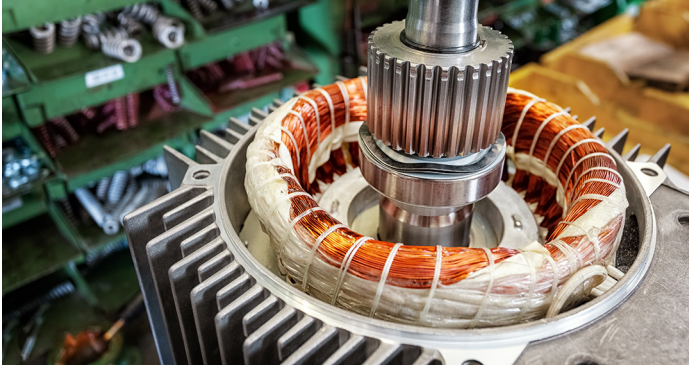


Figure 3.

The electrical insulation requirements within the electric motor can vary from one motor to another depending on the vehicle category and OEMs. These new solutions can be custom developed with different constructions to reflect the unique needs of a particular application.

Saint-Gobain Tape Solutions is committed to developing specialized [electrical insulation products](#) to meet the unique requirements of the electric vehicle industry. Learn how we can help to address the stresses in an electric motor and improve performance with electrical insulating tapes. [Contact us](#) today to discuss your specific needs. Also, discover our complete [EV battery pack protection](#) offering.