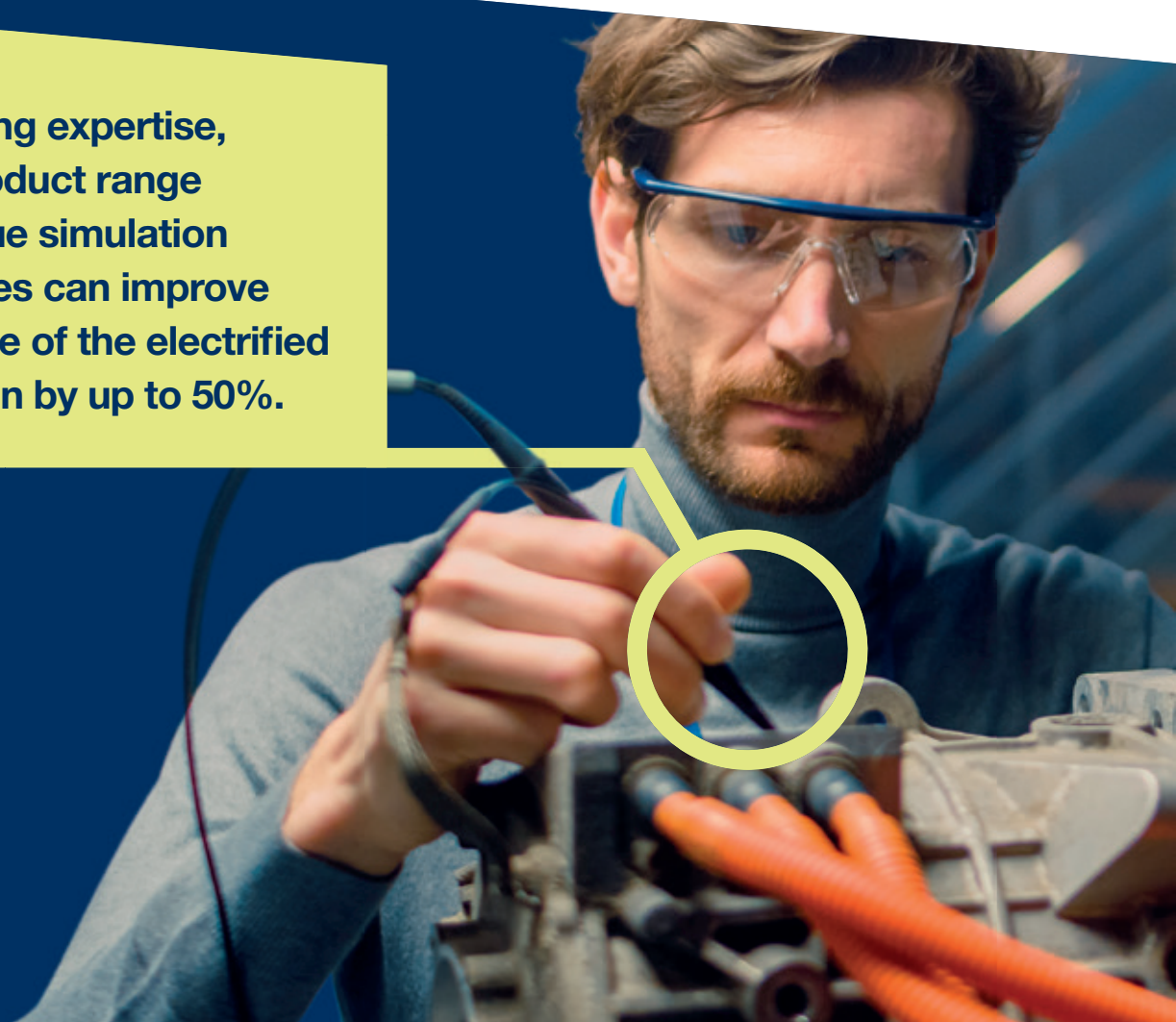


BUILD PERFORMANCE WITH GREAT CONFIDENCE

Insulating Resin Systems for Electric Vehicles

Our leading expertise, broad product range and unique simulation capabilities can improve endurance of the electrified powertrain by up to 50%.



MADE POSSIBLE



**DEVELOP NEXT
GENERATION
VEHICLES
FOR GENERATIONS
TO COME**

New mobility concepts and innovations are emerging at a rapid pace, bringing with it a number of new challenges for the automotive industry, such as motor and battery reliability and longevity.

At the heart of an electric vehicle, flawless electrical insulation and physical protection of the electrical and electronic components are vital for achieving long-term performance.

At Huntsman Advanced Materials, we make this possible.

BRING IDEAS TO MARKET WITH CONFIDENCE

For over 60 years, Huntsman Advanced Materials has supported many of the world's leading businesses in the automotive sector. This means that with us, you benefit from decades of know-how and expertise in developing and providing thermal management solutions that answer the most stringent requirements for electronic applications, specifically within the electrified powertrain.

With countless successful projects completed for customers worldwide, we understand the value of dedicated support. Our specialist teams know exactly how to help you create outstanding results by providing technical expertise at every stage of your manufacturing process.

NEXT GENERATION PERFORMANCE

Together, we can create new possibilities in design and application. Our extensive portfolio provides you with a unique range of high-performance resin systems engineered to protect devices against chemical, mechanical and electrical loads. Furthermore, cleaning, stripping, and etching throughout the semiconductor manufacturing process is simplified.

Utilizing cutting-edge technologies that streamline your development route, our experts will ensure optimal compatibility and efficiency between resin systems selection and your process requirements.

You can be confident that your products will have the properties you require, the results will be more predictable, which will give you more flexibility to innovate in your product development.

4x The electric car market is expected to quadruple by 2030.

30% Automotive electronics are predicted to constitute nearly a third of the total cost of the entire car.



BUILD CERTAINTY INTO YOUR PROCESS

Ideas
MADE POSSIBLE

Our goal is to bring your ideas to life. No matter how complex or challenging, our experts are ready to help realize your development ambitions.

However, creating new and holistic solutions is not a simple process, which is why we deliver a proven approach that takes the guesswork out of trials and ensures a faster and more cost-effective route to market.

90% Over 90% project success rate in simulation predictions

Minimize trial and error with our unique simulation capabilities

Applications of our resin systems on manufacturing lines are supported by sophisticated computer simulation capabilities that help customers develop new products and processes quickly and cost-effectively.

Accurate cure-kinetics data of the resin systems are used to generate material models. This enables the prediction of the material behavior during the cure process at each point on the final part.

↓50%

REDUCE TRIALS BY UP TO 50%

Supported by strong processing and material selection expertise, our simulation and applications know-how contribute to a significant reduction in the number of trials needed for product qualification. They make possible the preselection of resin system, to evaluate various process scenarios for cost optimization.

This enables you to save valuable time and cost when designing and determining key process parameters such as mold temperature, cure time and more.

Simulation exercises can quickly demonstrate the limitations or the achievable characteristics for various sets of resins and processing parameters, thus reducing the number of real-world trials that must be conducted. Computer simulation of production processes is a valuable tool that can greatly shorten the development phase of a product and accelerate time to market.

↑80%

UP TO 80% CONVERSION FROM IDEA TO MARKET

Huntsman's expertise can simulate all the processes used for production of the electrical and electronic components. We maintain an extensive database that supports the development of a number of internal simulations. Additionally we can leverage these data to drive, design and optimize external customer set up processes.

We can help you to significantly improve conversion from ideas to marketable products. Our dedicated technical service teams and experts in electronics chemistry, processing and testing will collaborate with you to deliver the right results, while taking responsibility for a successful outcome.

To date, our onsite and offsite availability ensures that more than 80% of requests are solved before deadline.

01 STEP

**Material
Characterization**

02 STEP

**Data Analysis &
Material Modelling**

03 STEP

**Finite Element
Simulation**

QUALITY ISN'T JUST A DRIVER IT'S A PROCESS

Performance MADE POSSIBLE

YOUR PROCESS IS COVERED

The main components of electric vehicles, including stators and rotors, will operate in harsh environments. Longer product lifetime and better performance are possible with proper thermal management, electrical insulation and protection. An appropriate application process can be decisive for meeting these requirements.

Our unique process expertise not only gives you greater confidence when developing new products with specific performance characteristics, it also means we can support you in other key areas. These include lowering production waste and processing time, and improving your production line stability. Huntsman technical experts are available to guide you through the setup phase of all processing parameters.

We can produce prototypes using industrial vacuum casting or automatic pressure gelation machines available within our application laboratories or in collaboration with equipment manufacturers.

© Watch video



We continuously study and improve our resin systems to deliver fast curing cycles that meet the most challenging productivity targets in serial production.

VACUUM CASTING

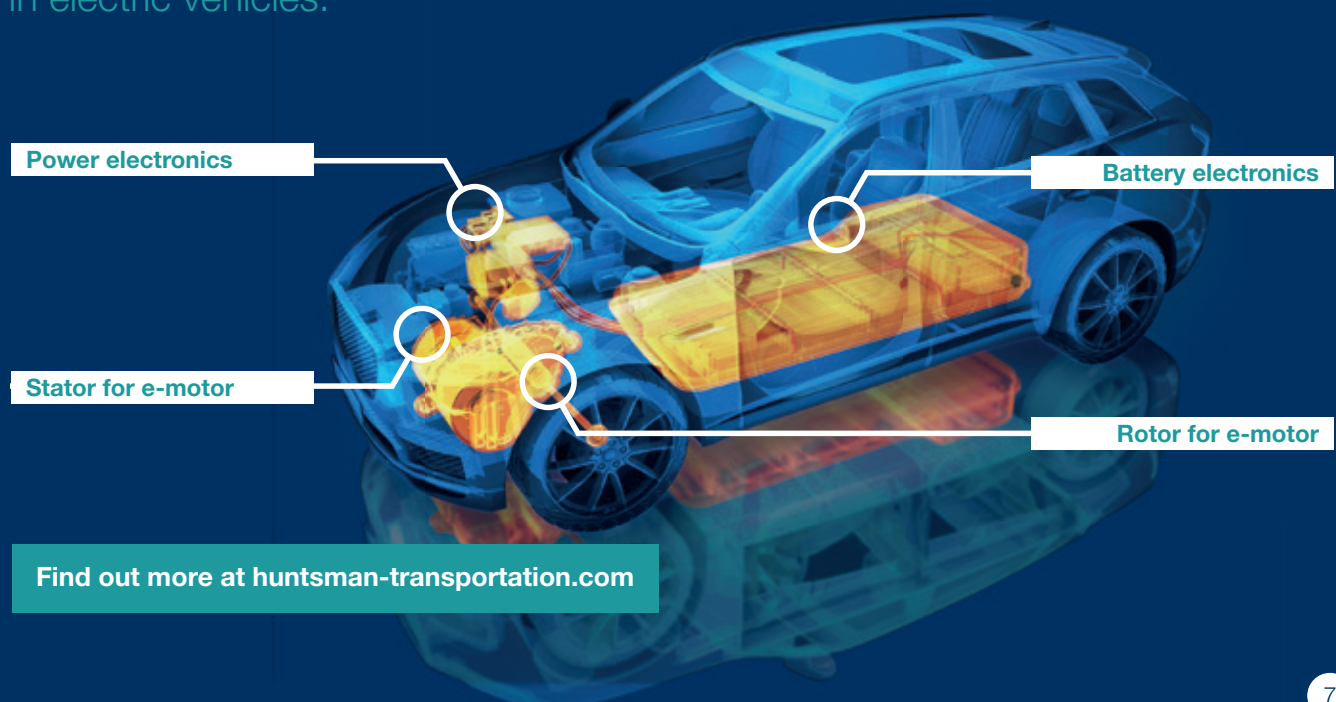
Our resin systems exhibit optimal viscosities at processing temperatures, which translates to excellent impregnation and gap filling capability. They are formulated to meet customers' needs in terms of materials management and processing: even when supplied in containers, they exhibit minimal filler sedimentation during transport and storage.

AUTOMATIC PRESSURE GELATION (APG)

The APG process features short cycle times and is well-suited to fully automated production. It delivers uniform product quality thanks to constant reactivity, temperature and viscosity of the material. Huntsman resin systems display low viscosity, sedimentation stability, ideal for fast demolding and curing.

Chemistry and process to increase productivity

Huntsman is a pioneer in electrical insulation and has developed an unsurpassed processing expertise for electronics applications in electric vehicles.



IMPACT YOUR MARKET NOT YOUR ENVIRONMENT

Tomorrow
MADE POSSIBLE

↑ **50%** Increase the motor lifetime by up to 50%

160x Achieve up to 160x return on invested carbon

Latest life cycle analysis indicates that electrical vehicles will save between 20% and 80% of CO₂ emissions compared to combustion counterparts, depending on the reliability and lifetime of the electrical motor.

Huntsman's advanced insulating materials solutions are regarded as an enabler for a more sustainable and reliable, high performance e-motor. Preventing partial-discharge and reducing the peak temperature will double engine lifetime and reduce CO₂ emissions leading to 160x return on invested carbon.



CASE

ENCAPSULATING ROTOR FOR A MAGNET-LESS MOTOR CONCEPT

Ensure long-term protection of coils with advanced epoxy based polymers

Currently manufactured high power density motors are based on the use of a permanent magnet that requires up to 2 kg of rare earth metals as a raw material. The severe environmental impact of rare earth metal mining is a global concern because of the significant ratio of waste to output that includes radioactive waste.

In addition, the supply of rare earth metals is largely from regions that are facing increased supply pressure. Consequently, the magnet-less motor concept may prove to be a viable alternative to secure supply and cost, and avoid the mining conditions that continue to undermine sustainability commitment and targets.

Huntsman's rotor potting insulation technology demonstrates the possibilities for a "magnet-less motor". Replacing permanent magnets with coils that are fixed and protected by advanced epoxy-based polymers, may just be the right solution that provides sustainable protection for the electric motor and potentially the environment moving forward.



STATORS AND ROTORS FOR ELECTRIC MOTORS

<p>Encapsulant for rotor ARALDITE® CW 30386 / ARADUR® HW 30387</p> <p>Glass transition temperature (Tg) 200°C</p> <p>Thermal conductivity 0.6 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Developed for rotor potting. Very low CTE, highest modulus and strength between -40°C and + 180°C. Very good intra-coil impregnation, high Tg. Outstanding resistance at elevated temperatures and high rotation speed.</p>	<p>Encapsulant for rotor ARALDITE® CW 30388 / ARADUR® HW 30389</p> <p>Glass transition temperature (Tg) 200°C</p> <p>Thermal conductivity 0.95 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Highest modulus and strength between -40°C and + 180°C. Very good intra-coil impregnation. Developed for rotor potting with improved heat dissipation.</p>	<p>Impregnation resin for rotor composites / sleeve armoring ARALDITE® CY 179 / ARADUR® 917-1 / ACCELERATOR DY 070</p> <p>Glass transition temperature (Tg) 200°C</p> <p>Thermal conductivity 0.2 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Filament winding <p>High strength and modulus supporting the rotor structure during operation within the entire operation range. Low CTE, outstanding dimensional stability at high loads. Low viscosity and long pot life for versatile processing, e.g. filament winding.</p>
<p>Encapsulant for rotor ARALDITE® CW 30590 / ARADUR® HW 30327</p> <p>Glass transition temperature (Tg) 170°C</p> <p>Thermal conductivity 0.6 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Very good impregnation. Developed for rotor potting. Toughened with reinforcing fillers for superior crack and thermal shock resistance</p>	<p>Encapsulant for stator end-turn ARALDITE® CW 2731</p> <p>Glass transition temperature (Tg) 165°C</p> <p>Thermal conductivity 3.0 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>1-c epoxy system with deep viscosity drop above 60°C for fast processing. Very high thermal conductivity and endurance. Excellent resistance to atmospheric and chemical degradation.</p>	<p>Encapsulant for stator ARALDITE® CW 30326 / ARADUR® HW 30327</p> <p>Glass transition temperature (Tg) 115°C</p> <p>Thermal conductivity 0.7 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Excellent gap filling capability and heat conductivity. Toughened resin with reinforcing fillers for superior crack and thermoshock resistance. Very high thermal and chemical endurance.</p>
<p>Encapsulant for stator ARALDITE® CW 30334 / ARADUR® HW 30335</p> <p>Glass transition temperature (Tg) 100°C</p> <p>Thermal conductivity 1.2 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Well balanced properties: good heat conductivity, very good crack resistance, media and thermal resistance. Excellent flow properties allow for fast filling times and good impregnation.</p>	<p>Encapsulant for stator ARALDITE® CW 30334 / ARADUR® HW 30327</p> <p>Glass transition temperature (Tg) 85°C</p> <p>Thermal conductivity 1.0 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Excellent crack and thermal shock resistance with good filling factor and thermal conductivity. Superior mechanical and electrical properties. Thermal Class H, recommended for stators encapsulation.</p>	<p>Encapsulant for stator ARALDITE® CW 30407 / ARADUR® HW 30408 / ARADUR® HY 30409</p> <p>Glass transition temperature (Tg) 60-65°C</p> <p>Thermal conductivity 0.8-1.1 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum / Atmospheric Pressure Casting • Vacuum Automated Pressure Gelation <p>Fast processing and curing comparable to impregnation processes. Excellent flow and gap filling with adaptable viscosity and thermal conductivity. High temperature and crack resistance. Recommended for hairpin windings.</p>

BATTERY AND POWER ELECTRONICS

<p>Encapsulant for power electronics ARALDITE® CW 5742 / ARADUR® HY 5726</p> <p>Glass transition temperature (Tg) 210°C</p> <p>Thermal conductivity 0.7 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum Casting • Vacuum Automated Pressure Gelation <p>Superior flow and gap filling capabilities enabling fast processing times. High Tg enabling low thermal expansion within the complete operation range. Very high thermal and chemical endurance (Class N).</p>	<p>Encapsulant for power electronics ARALDITE® CW 30386 / ARADUR® HW 30387</p> <p>Glass transition temperature (Tg) 200°C</p> <p>Thermal conductivity 0.6 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum Casting • Vacuum Automated Pressure Gelation <p>High Tg and lowest thermal expansion within the complete operation range. Very high thermal and chemical endurance. Fast gel and cure times.</p>	<p>Encapsulant for power electronics ARALDITE® CW 1195 / ARADUR® HW 1196</p> <p>Glass transition temperature (Tg) 140°C</p> <p>Thermal conductivity 0.7 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum Casting • Vacuum Automated Pressure Gelation <p>Fast fill and cure times enabling fast processing. Low coefficient of thermal expansion (28·10⁻⁶ 1/K). Flammability certification UL 94 V-0 (6.0 mm) and thermal endurance (Class H).</p>
<p>Encapsulant for battery and power electronics ARALDITE® CW 1302 / ARADUR® HY 1300</p> <p>Glass transition temperature (Tg) 75°C</p> <p>Thermal conductivity 0.9 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum Casting <p>Good heat conductivity and thermal endurance (Class H). Flammability certification UL 94 V-0 (3.0 mm) and HB (1.5 mm).</p>	<p>Encapsulant for battery electronics ARALDITE® CW 1312 / ARADUR® HY 1300</p> <p>Glass transition temperature (Tg) 20°C</p> <p>Thermal conductivity 1.1 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Vacuum Casting <p>Increased heat conductivity. Flammability certification UL 94 V-0 (3.2 mm). Low curing temperature and Tg enabling low thermally induced stress.</p>	<p>Adhesives and encapsulants for battery packs assembly ARATHANE® 2K POLYURETHANE THERMALLY CONDUCTIVE ADHESIVES</p> <p>Glass transition temperature (Tg) -50°C</p> <p>Thermal conductivity 1.8 W/(m.K)</p> <p>Suitable for:</p> <ul style="list-style-type: none"> • Dispensing <p>Polyurethane, flame retardant and halogen free systems for processing and curing at room temperature. High flexibility and low modulus, improving battery crash-safety within the entire operation range. Good adhesion to new substrates, enabling battery cells fixation and thermal management.</p>

MADE POSSIBLE

HUNTSMAN

Enriching lives through innovation

Huntsman Advanced Materials

At Huntsman Advanced Materials, we make things possible. Serving many of the world's leading businesses across virtually every industry, we enable greater innovation, performance and sustainability to address global engineering challenges and contribute towards a better quality of life.

Our capabilities in high-performance adhesives and composites, delivered by more than 1600 associates, support over 2000 global customers with innovative, tailor-made solutions and more than 1500 pioneering epoxy, acrylic, phenolic and polyurethane-based polymer products.

We operate synthesis, formulating and production facilities around the world



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