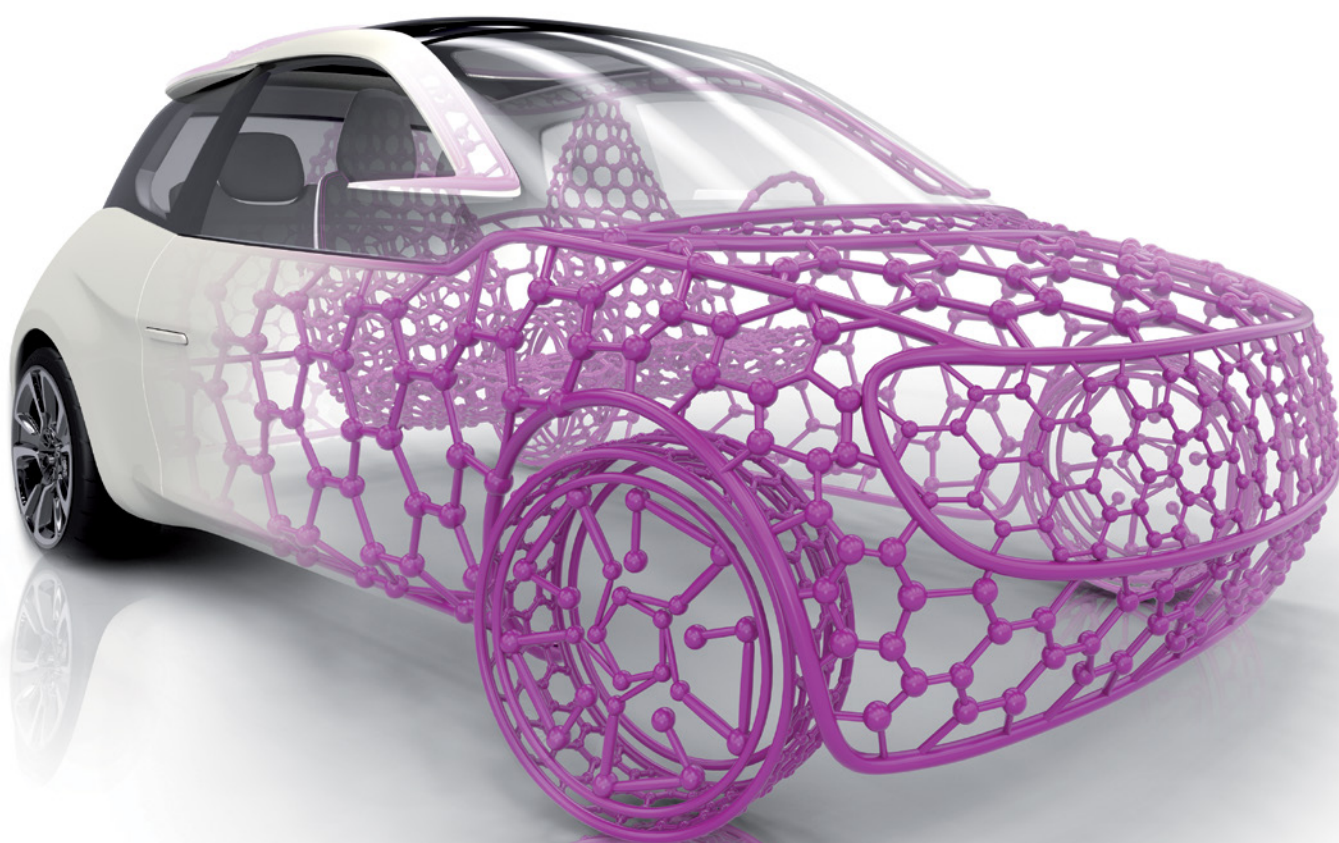


EVONIK FOR AUTOMOTIVE

**INNOVATE MOBILITY –
WE PROVIDE THE CHEMISTRY.**



MEETING THE CHALLENGES OF TODAY AND TOMORROW

Evonik is working on innovative materials and processes, providing solutions for better cost efficiency and more environmentally friendly systems as well as materials that are more resistant to chemical or mechanical stresses.

Our developments focus on four key drivers of innovation: We save weight, we boost efficiency, we create surfaces and we drive New Mobility.

The competencies that have fueled success for Evonik and its customers for decades are as varied as the many different applications in the automotive industry.



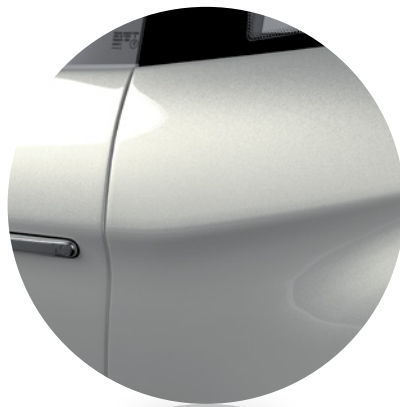
We save weight.

Evonik develops high-performance lightweight materials to replace metal or rubber parts. By combining different polymer materials weight is reduced and efficiency soars. Our solutions give customers the power to design commercially optimized vehicles with a perfect blend of multi-material systems.



We boost efficiency.

Evonik provides innovative technologies to reduce energy consumption and CO₂ emissions while boosting efficiency with advanced lubrication of engines and drive trains, low friction parts, and reduced rolling resistance of tires.



We create surfaces.

Evonik provides innovative raw materials and additives to reach excellent surface effects of cars, both interior and exterior. These materials and additives are needed when it comes to high gloss or matte coating or scratch resistant modifications of plastics.



We drive New Mobility.

Evonik enables new solution for batteries, thermal management, electronics and many more with its specialized products as New Mobility is one of the major challenges for the automotive industry.

INNOVATIVE SOLUTIONS THROUGHOUT THE ENTIRE VEHICLE

Our strong competitive position is based on advanced technology expertise, an innovative spirit and close cooperation with our customers. By focusing on dynamic trends and developments, resource efficiency and sustainable transportation we stand behind OEMs in their quest to meet the key demands of the automotive industry.

Evonik provides a wide product portfolio for applications: like lightweight composite body or chassis parts, class A surfaces, low-rolling-resistance tyres or safe and high power batteries – we have solutions to benefit virtually any vehicle component.

Innovate mobility – we provide the chemistry.

Exterior and body applications



1 Hybrid structures metal/plastics

The reactive adhesive VESTAMELT® increases the bonding of plastic resins on metal inserts. Therefore, it saves weight and space in over-molded hybrid structures e.g. in front end carriers or floor panels.

2 Structural parts

Placing reinforcing fibers where needed and overmold it to the final shape: this is the idea of VESTAPE®, unidirectional fiber reinforced tapes with a thermo-plastic matrix like PA or PEEK.

For autoclave, RTM or wet pressing, the high temperature and creep resistance of the rigid foam ROHACELL® is the trouble-shooter for high-end fiber reinforced plastics (FRP) sandwich structures like roofs, engine hoods or battery housings.

In-mold foamed with homogeneous particle distribution, ROHACELL® Triple F offers ready to use complex 3D shaped sandwich cores. With a couple of additives, the performance of resins for FRP can be optimized for the individual requirements of the processes.

DICYANEX® micronized dicyandiamide, in combination with the accelerators IMICURE®, CUREZOL® or ANCAMINE® combines easy handling with high performance and long formulation latency for epoxy prepreg applications.

VESTAMIN® enhance the mechanical properties of the composite and offers a high surface quality.

The nano structured silica in the NANOPOX® product family improves the toughness and fatigue behavior e.g. for FRP springs. NANOPOX® is a transparent and low viscosity additive for in-mold coatings and helps to realize class-A surfaces.

The rubber particles in ALBIPOX® are homogenously distributed in epoxy composites to improve the toughness.

For structural parts made of epoxy sheet molding compounds (SMC) the curing agent VESTALITE® S improves the processing and thermal performance but enables a significant reduction of volatile organic compounds (VOC).

3 Exterior Coating and Corrosion Protection

Clear coats based on VESTANAT® EP-M-family combine the flexibility and ease-of-use of a PU coating with a glasslike hardness. This results in unprecedented scratch- and chemical resistance.

AEROSIL® hydrophobic fumed silica is used as an additive in a variety of coatings to optimize rheology during processing, as reinforcement of silicone elastomers and leads to excellent water-repelling properties and improved corrosion protection.

The Dynasylan® family offers a large variety of silanes, used for high performance coatings, metal treatment and resin systems. Usually known as adhesion promoters they act as a binding agent between organic resins and inorganic substrates.

To optimize the properties in various dimensions, the SURFYNOL®, ACEMATT®, AEROSIL®, and TEGO® additive lines offer solutions for adhesion promotion, corrosion resistance, foam control, pigment dispersion, substrate wetting or surface control.

As binder the unsaturated polyester resin DYNAPOL® for coil coating top coats assures high gloss and resistance against color fade out or dirt pick up.

4 Adhesives & Sealants

Outstanding low VOC and FOG values of PU hot melts can be achieved with DYNACOLL® polyesters. They are ideal for interior lamination and bonding of headlamps or windshields.

A low VOC content, high thermal stability and easy handling makes VESTOPLAST® the perfect raw material for hot melts used in interior bonding such as headliners, door panels, dashboards or for insulation felts and car carpets.

For superior adhesion properties on oily or degreased metals the POLYVEST® range contributes to a large variety of Body-in-White adhesives and sealants to be easily applied by robot or manually along car assembly.

High quality two-part PU adhesives for headlamps can be reached by the flexible and hydrophobic polymeric binder POLYVEST® HT.

Depending on the target substrates, the VISIOMER® product range offers the right monomers for acrylic based adhesives. Usually those kind of structural adhesives need no further surface preparation.

Under the hood and underbody applications



1 Powertrain

Under the hood, you find high temperatures, chemical aggressive fluids and gases, but the high performance polymers VESTAMID® or VESTAKEEP® PEEK can stand it: As a silent running gear wheel, clutch lines with laser welded connectors or lubricant free swivel-joints.

2 Lubricants

Engine oils and transmission fluids formulated with DRIVON™ technology reduce fuel consumption and CO₂ emissions while ensuring wear protection and durability for critical powertrain components. The versatile Viscosity Index Improvers (VIIs) bring advanced fluid technology to formulation of high-performance shock absorber and power steering fluids. They provide excellent low temperature properties and provide optimal viscosity across a wide range of temperatures.

3 Plastic tubing systems

In fuel lines, cooling lines for EVs or for transmission oil, monolayer or multilayer tubing with VESTAMID® are significantly lighter than metal, but still guarantee high mechanical, thermal and chemical performance. They are low extractable to avoid blockages in modern fuel injection systems.

Highly precise and leakage-free quick connectors in fuel handling systems can be easily injected molded with the PA12 from the VESTAMID® portfolio.

Hydraulic and brake hoses can benefit from VESTENAMER® as a non-migrating plasticizer, as well as compatibilizer of different rubber compounds.

4 Chassis

Weight saving in the chassis, are a new field for composites, especially in the unsprung masses like rims or strut wheel mount modules. The BMI based resins COMPIMIDE® provide excellent mechanical properties, even at temperatures up to 250°C.

In-mold foamed structural PMI based ROHACELL® Triple F, with accurately placed metal inserts, makes it simple to create complex, ready-to-use 3D shaped cores that can be processed in RTM and wet pressing at elevated temperatures and pressures.

A very cost-efficient method to produce FRP-profiles is the PulPress technology. This Evonik-developed continuous process technology combines pultrusion and press processes with a ROHACELL® foam core to create lightweight and complex 3D components.

Lightweight FRP driveshafts get a higher fatigue with NANOPOX® nano structured silica added into the epoxy resin.

Anyway if it is for sealing rings or shut-off needles in the antilock braking system (ABS) or for self-lubricating pumps for the parking brake system, VESTAKEEP® PEEK offers with its outstanding thermal, mechanical and chemical properties high performance solutions.

5 Battery and electrics

AEROXIDE® can improve safety, lifetime or capacity when used for separator, anode or cathode of LIB in EV's.

Electronic components like ignition systems are encapsulated in epoxy resin with the toughener ALBIDUR® to improve the thermomechanical performance and to meet the high demands of harsh environments.

Electronic connectors reach higher temperature resistance if the basic thermoplastic material is equipped with the crosslinking agent TAICROS®.

Insulative materials in high-voltage batteries must feature high fire protection and outstanding dielectric properties. This applies particularly to power busbars, which is why these are preferably insulated with VESTAMID®.

800 Volt fast charging of LIB in EVs save time but produces a lot of heat in the cables. No problem for cable insulations made out of ultrapure extruded VESTAKEEP® PEEK.

6 Tires

ULTRASIL® silica and silanes like Si 69° and Si 363° are making today's tires safe and environmentally friendly. So called Green Tires with Silica/Silane-technology have proven to have significantly lower rolling resistance, resulting in a reduction in fuel consumption up to 8 % and thus lower CO₂ emissions. Additionally, they also have better grip – particularly in wet conditions – which significantly shortens the braking distance.

POLYVEST® and VESTENAMER® further boost those properties and help to ease the processing.

VESTENAMER® also turns end-of-life tires into a valuable resource in sustainable road construction with rubber-modified asphalt.

7 Underbody

PVC plastisols based on NOURYBOND® adhesion promoters are essential in automotive sealant, underbody and anti-chip primer formulations, providing unique rheological properties and improved adhesion to electro-deposition primers. Plasticizers like VESTINOL® are able to further enhance adhesion.

Interior



1 Surfaces

To warrant a high durability of the car, lavishly decorated panels, consoles, and operational controls have to retain their appearance over the life of the vehicle. Sweat, skin oil, and cosmetics or sunlight, temperature swings or even cleaning agents can cause damage. Surfaces made of micro-crystalline thermoplastic TROGAMID® are built tough for these requirements. They stand up to sunlight, heat, shock, not to mention cosmetics and other chemicals.

Spray skins include coatings for the dashboard and other plastic parts. In addition to high resistance, such components need to look and feel good, properties that VESTANAT® IPDI can noticeably improve.

Hybridur® polymer dispersions provide excellent wetting and adhesion to a variety of substrates including wood and plastic to provide highly aesthetic, durable coatings.

2 Foam Parts

On average, passenger cars contain up to 30 kg of polyurethane foam, found in seats, headrests, armrests, carpet backings, sound deadening mats, steering wheels, roof linings and instrument panels. Evonik offers the broadest product portfolio of catalysts, surfactants, release agents and performance additives for all types of foamed and non-foamed polyurethane materials by combining market leading brands, including TEGOSTAB®, TEGOAMIN®, DABCO®, POLYCAT®, ORTEGOL® and GORAPUR®, to offer the most comprehensive package for product differentiation.

3 Structure

UD-tapes with a thermoplastic matrix called VESTAPE® can be over molded to reinforce thermoplastic structures e.g. in seats.

The bonding of injection molded resins on metal inserts e.g. in cross car beams can be significantly increased with the VESTAMELT® adhesive.

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