

Full speed ahead

Innovative products from Evonik Industries make the car of the future lighter, more economical, and eco-friendly



1 Weight reduction through lightweight construction materials

2 Power train of the future: safety, performance, and a long service life, thanks to lithium-ion batteries with the SEPARION® ceramic separator

3 Reduced rolling resistance: fuel savings of 3 to 8 percent through the right combination of carbon black, silica, and silanes

The reinvention of the automobile is well under way, but there is as yet no single technology that is clearly superior to its competitors; it is, rather, a large number of individual innovations that will make the car of the future a reality. According to Car Innovation 2015, a recent study from the strategy consulting firm Oliver Wyman, the major tasks to be tackled by the industry are to reduce fuel consumption, emissions, raw materials consumption, and costs. The expertise of Evonik Industries in the mobility sector is embodied in a large number of innovative products. In this way Evonik plays a key role in the reinvention of the car.

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It takes power to move a large mass, and a considerable amount of fuel is needed to get a big car going. Light structural foams and innovative plastics applications and adhesives from Evonik make cars significantly lighter and so help save fuel. The Oliver Wyman study notes that the industry's innovations remain focused on emissions, fuel consumption, and weight. In combination with fiber composite materials, high-performance ROHACELL® foam makes it possible to produce sandwich elements. Used in body parts such as the roof, rear hatch, hood, and doors, these reduce weight by 60 to 70 percent compared with the conventional steel parts; as an example, Evonik is joining forces with sports car maker Lotus Engineering to develop a very special, roadworthy Lotus Exige. The result: the Evonik Light Weight Design (LWD) Lotus, which weighs a whopping 75 kilograms less than the already very light Exige S series. The plastics VESTAKEEP® PEEK and VESTAMID® are also used for lightweight construction. The high-performance plastic VESTAKEEP® PEEK serves for production of components designed for continuous operation under the toughest conditions, as in drives and engines. Plastics can be used as alternatives to metal, thanks to such properties as high thermal resistance, hardness, and flame retardancy. And the big advantage of VESTAKEEP® PEEK is that it allows significant weight savings. Car Innovation



ROHACELL® sandwich elements and fiber materials lower the weight of a car body by 60 to 70 percent compared to the steel parts used until recently.

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2015 predicts that revolutionary materials, lightweight components and plastic windows and reduced metal content will radically reduce costs thanks to weight savings.

Reduced weight

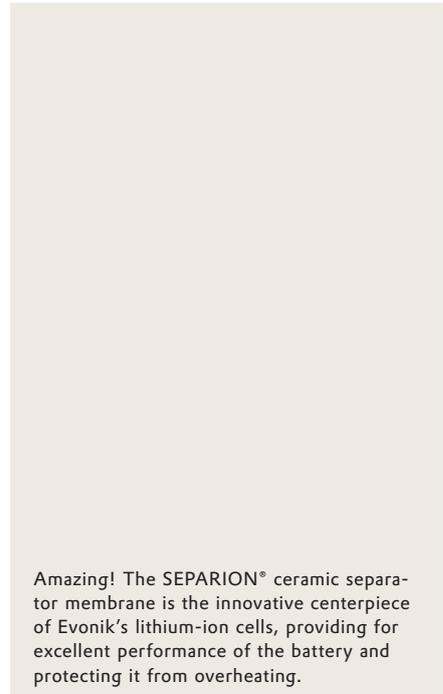
High-performance adhesives containing materials from Evonik also reduce weight because, for instance, they allow the use of light plastics that cannot be bonded by welding or soldering.

VESTAMELT® adhesion promoter even allows steel and plastic parts to be bonded to form hybrid materials. Such high-performance adhesives are used in fuel filters, car doors, and seat heaters, among many other applications.

PLEXIGLAS® composite windshields also make cars lighter. And PLEXIGLAS® and PLEXALLOY® molding compounds have other advantages as well: They are used instead of coatings for the surfaces of body parts. Thanks to its specific properties, PLEXIGLAS® ensures a particularly sophisticated look and feel as well as outstanding quality and performance for the high-gloss, abrasion-resistant, and durable surface of the part. So Evonik products provide aesthetic appeal in addition to protecting the environment. Automotive coatings are in the champions league of coatings, setting new standards in resistance to weathering, chemicals, corrosion, and abrasion. A new AERODISP® dispersion now allows production of coating systems even more abrasion resistant and brilliant than before, thanks to a customized additive that optimizes the flow behavior of the coating and promotes the desired visual properties in the finished coating film.

The power train technology of the future

Great hopes are currently invested in electric cars. Their Achilles heel so far has been the battery; lithium-ion batteries are powerful and compact energy storage devices, but for safety reasons it has not so far been possible to use them in the size required for automotive applications. Thanks to a novel ceramic separator membrane from Evonik in the interior of the lithium-ion battery, their use has now become possible. Called SEPARION®, the separator membrane is the key component of the high-performance batteries, which are produced in Kamenz, Saxony, by Li-Tec, a joint venture of Evonik and Daimler. Safety, performance, and du-



Amazing! The SEPARION® ceramic separator membrane is the innovative centerpiece of Evonik's lithium-ion cells, providing for excellent performance of the battery and protecting it from overheating.

rability are optimally combined in these cells, and the batteries will soon be in large-scale use in automotive production. This makes Li-Tec the first commercial-scale producer in Europe of lithium-ion batteries with ceramic storage technology for automotive applications, marketed under the brand name CERIO®. Car Innovation 2015 identifies power train systems as one of the most successful technologies, with an annual growth rate of 8 percent or higher. And the study mentions another plus for the electric power train: By 2015, 40 percent of the world's population will live in cities with more than a million inhabitants, in most cases with severe lack of parking space, traffic congestion, and restrictions on emissions. City cars—formerly of no more than marginal interest to the automotive industry—will therefore be a development goal to be taken seriously in the future, according to the study. What's more, the automotive industry is on the threshold of one of its most important technological changes since the introduction of the internal combustion engine. According to a study by automotive expert Prof. Ferdinand Dudenhöffer at the University of Duisburg-Essen, the future belongs to electric cars with a high-tech battery power train. Evonik occupies a special position here because of its extensive involvement in battery technology. In as few as 15 years, by 2025, about two-thirds of the 87 million cars then sold will

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operate partly or entirely on electricity from batteries. Dudenhöfer estimates that this will create a €130 billion market for high-tech energy storage devices for the automotive industry. He believes that the international competitiveness of the German automotive industry will depend decisively on access to innovative battery technology. As a supplier of high-tech solutions, the chemical industry plays a key role here. Energy storage technology from the chemical industry will be a pivotal driver of development in the new era of the automobile.

Reduced rolling resistance

Tires are high-tech products that must perform, whatever the demands may be, whether in hot weather, rain, or snow. The rolling resistance of the tires is particularly important in transmission of energy to the road: The lower the rolling resistance, the lower is the fuel consumption, and carbon dioxide emissions are reduced accordingly. The use of the silane additive Si 363® allows rolling resistance to be reduced by about 10 percent compared with conventional tires, with resulting fuel savings of 3 to 8 percent.

Evonik products are also used under the hood. Under the name VISCOPLEX® Evonik develops high-performance components added to lubricants to make them more efficient and reliable and to prolong the service life of engines and gears (transmission systems). All in all, Evonik products offer a large number of application possibilities that pave the way for the car of the future.