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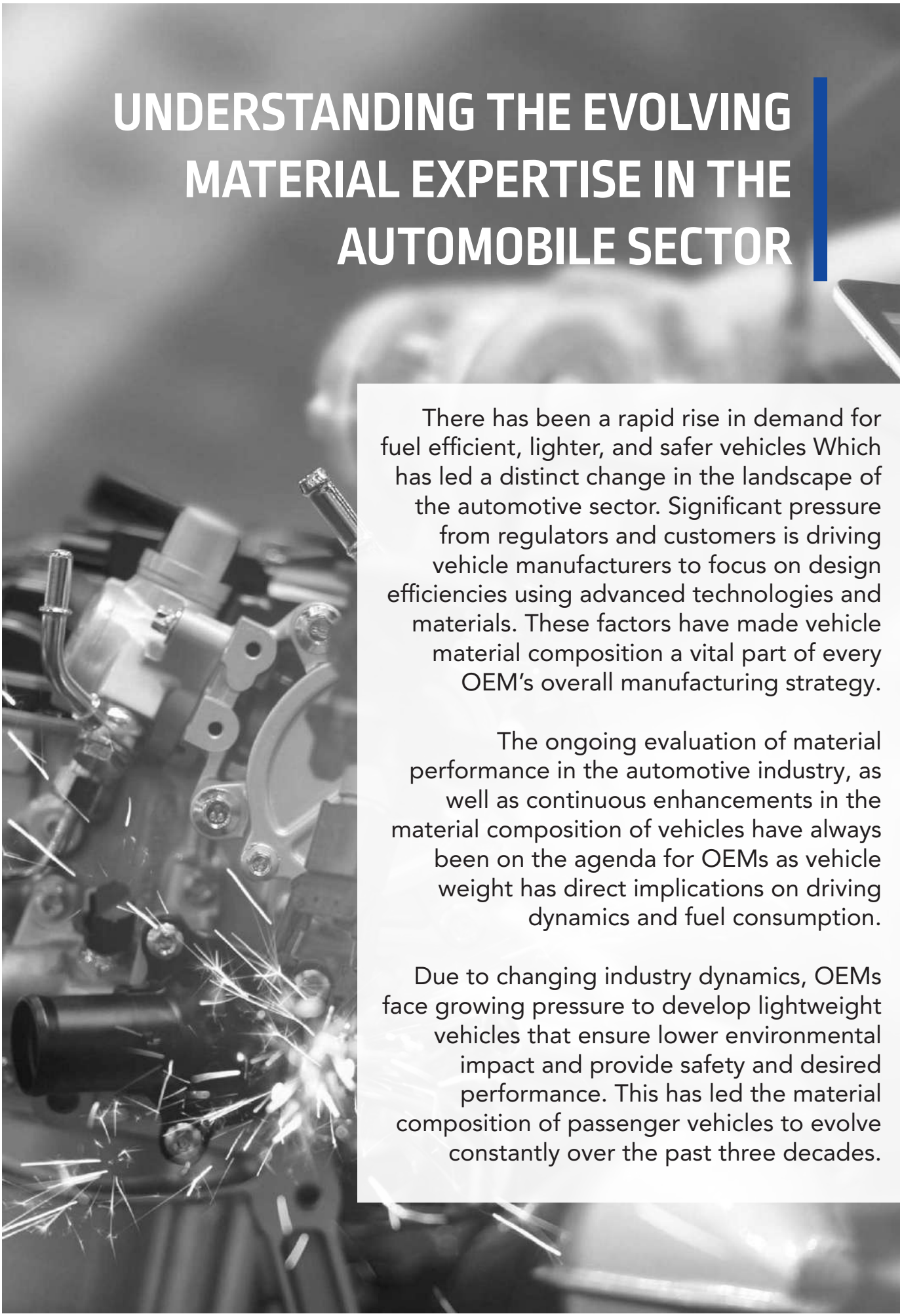
UNDERSTANDING THE EVOLVING MATERIAL EXPERTISE IN THE AUTOMOBILE SECTOR



UNDERSTANDING THE EVOLVING MATERIAL EXPERTISE IN THE AUTOMOBILE SECTOR

There has been a rapid rise in demand for fuel efficient, lighter, and safer vehicles Which has led a distinct change in the landscape of the automotive sector. Significant pressure from regulators and customers is driving vehicle manufacturers to focus on design efficiencies using advanced technologies and materials. These factors have made vehicle material composition a vital part of every OEM's overall manufacturing strategy.

The ongoing evaluation of material performance in the automotive industry, as well as continuous enhancements in the material composition of vehicles have always been on the agenda for OEMs as vehicle weight has direct implications on driving dynamics and fuel consumption.

Due to changing industry dynamics, OEMs face growing pressure to develop lightweight vehicles that ensure lower environmental impact and provide safety and desired performance. This has led the material composition of passenger vehicles to evolve constantly over the past three decades.

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UNDERSTANDING SHEET METAL TANKS

Auto manufacturers are currently working primarily with tanks that comprise a steel substrate coated with either terne or zinc-nickel.

Stainless steel tanks have been tested, and although effective in flexible fuels, they are difficult to form without severe breakage occurring during stamping. Also, stainless steel is expensive, with an estimated cost ratio to terne steel exceeding 5:1.

The electrocoated zinc-nickel product is painted on both sides with an aluminum-rich epoxy. Industry accelerated tests on the corrosion of painted zinc-nickel confirm that it will meet a ten-year life in current fuels and flex-fuels and resist external corrosion.

Testing the characteristics of painted galvanneal (zinc-iron alloy coated steel) have found it effective for resisting corrosion on both the inside and outside surfaces of the tank. General Motors has a product undergoing testing.

Hot-dipped tin has also been found to be effective for resisting all fuels, but it does require a paint coating for exterior protection from road-induced corrosion. This product welds faster than painted terne and has a better potential for good solderability than painted galvanneal and zinc-nickel coated steel substrates, permitting the attachment of fuel filler tubes and other lines.

EVOLUTION OF PLASTIC TECHNOLOGY

Plastic has come a long way since ts inception to become an important part of the automobile sector. High-density polyethylene (HDPE) has become the resin of choice for plastic gas tanks for a large number of OEMs. This has led to an increase in ramping up the production capacity for the plastic fuel tanks. In Europe about 90% of all fuel tanks are plastic and in the US that number is 75%.

The emergence of new technologies has enabled the increase of the production of plastic gas tanks. These new technologies can be grouped into either multilayer or barrier types.

MULTILAYER TECHNOLOGY

Some manufacturers see multilayer tank technology as the answer to stricter emission standards. To minimize fuel permeation, the formation of a harrier layer of polyamide resin by multilayer (three-resin five-layer) blow molding is considered more promising than sulphonation or fluorination treatment of the polyethylene resin.

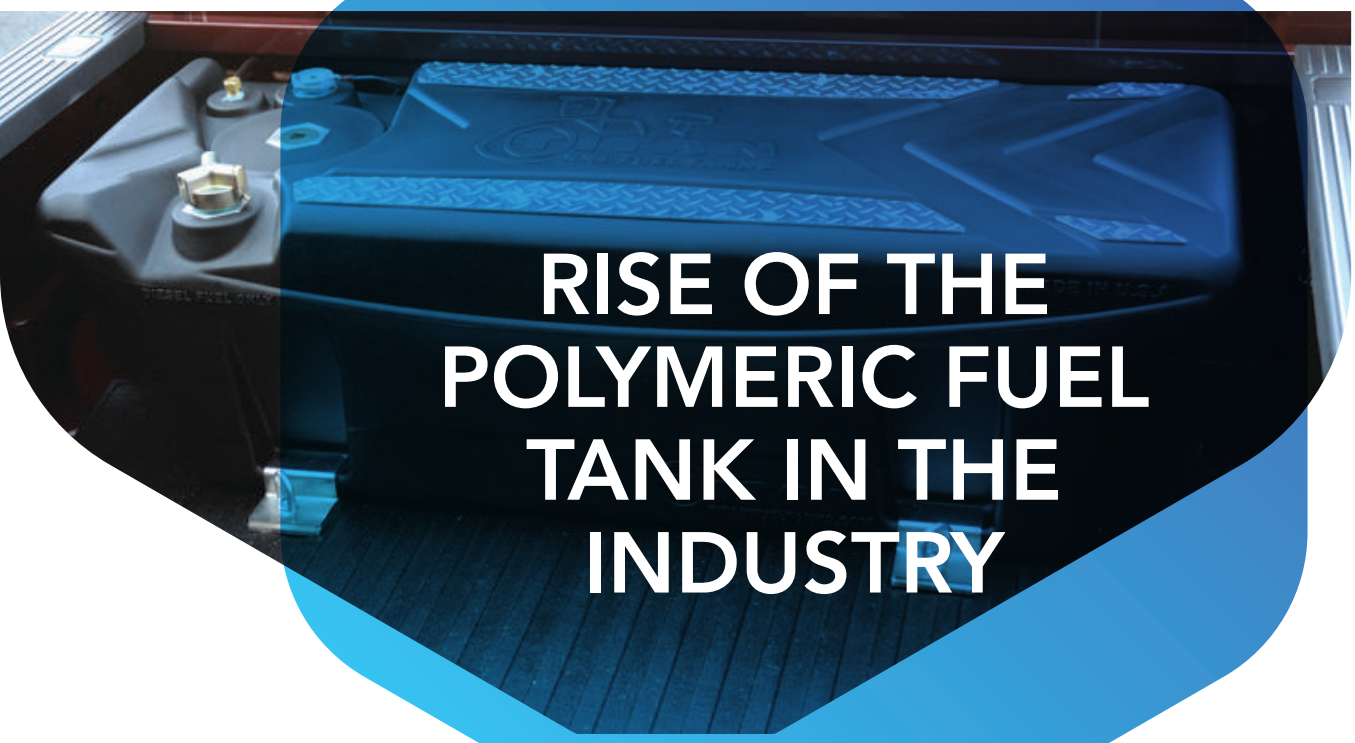
This technology was one of the first ones to help create a fuel tank that had a weathering resistance and a chemical resistance. Apart from fuel tanks, they are also used as various other kinds of containers.

BARRIER TECHNOLOGY

This commercialized fluorine-based barrier technology that enables plastic fuel tank manufacturers to meet more stringent emissions standards. With Hydrocarbon permeation rates as low as 0.1 g/24 this multilayer tanks while maintains the long-term structural integrity of monolayer tanks while allowing them to meet much stricter emission standards.
This tank can is used for race cars and military vehicles as well as by automotive OEM . Thanks to their low density, to their excellent processability and recyclability, and to their outstanding chemical resistance and specific mechanical strength, polymers are now the best materials to be applied in fuel tank systems. In that field, High Density Polyethylene ("HDPE") is regarded as the best compromise between economical and technical requirements. But, basically, because of its chemical nature and structure, HDPE offers a poor barrier to hydrocarbons, especially light ones composing gasoline. Additionally, in order to meet more and more demanding regulations on air quality and emissions, professionals from the Fuel Tank System area have developed several technologies in order to cope with the property of HDPE.

INTRO TO PLASTIC FUEL TANKS

Since the mid-1980s, automakers have been displacing coated-steel fuel tanks with the plastic one. Although plastic-tank applications have experienced some reversals as a result of the stricter permeation standards, some experts believe their usage will gain momentum by the end of the decade as new plastics technology is converted to commercially feasible operations. A report by the University of Michigan indicated that experts predict plastic tanks will capture 28% of the North American market by the end of 1996 and up to 50% of the market by 2000. However, these projections were more than surpassed in the larger scope of things. With over 75% of the Market in US today, plastic fuel tanks, thanks to the constantly evolving technology are only poised to grow.



RISE OF THE POLYMERIC FUEL TANK IN THE INDUSTRY

A fuel tank in the vehicle is an important component of the fuel system in an internal combustion engine. A tank is used to store motor fuel such as petrol, diesel fuel and gas. The present-day fuel tanks can be made of different advanced materials: ferroalloys, aluminum alloys, plastics.

Steel fuel tanks are manufactured by stamping of sheet metal and welding of upper and lower parts. Steel fuel tanks use steel with high viscosity grade and ultimate strength. When subjected to external influences a fuel tank is deformed due to its viscosity but remains leak-proof. The main disadvantage of steel fuel tanks is high corrodibility. The probability of water ingress into a fuel tank is great as it can find its way inside as a condensate or together with fuel and settle down at the bottom.

Aluminum fuel tanks are manufactured by stamping and welding. They are not corrodible and have lower weight than steel fuel tanks. In comparison with steel tanks aluminum fuel tanks have the following disadvantages: possible fuel leaks due to weld failure during the operation; low deformation capacity (impact resistance); presence of stress risers in a material after short-term strain higher than its strength; high cost.

Today the leading world manufacturers are in process of transition to plastic fuel tanks. Polyethylene and polypropylene fuel tanks are manufactured by rotational molding or extrusion. In comparison with steel and aluminum fuel tanks plastic tanks are not corrodible, resistant to scratches, chipping, have lower weight, require no welding, have lower cost. The existing methods of plastic fuel tank production make it possible to manufacture components with complex geometry; use the tank mounting space efficiently; provide the maximum tank volume.

Plastic fuel tanks are made of medium and high density polyethylene. It is established that the main disadvantage of polyethylene as a material for a tank is high permeability with respect to hydrocarbons, due to the low degree the polarization of polymers macromolecules and weak bonds between the chains of macromolecules. This disadvantage is eliminated by methods of improving the barrier properties of the walls of the fuel tanks

PREMIER SEALS SOLUTION : CONVERSION AND DEVELOPMENT OF SHEET METAL TANK TO PLASTIC TANK

The performance attributes of the plastic and steel alternatives are reviewed from an original equipment manufacturer (OEM) perspective in the critical areas of manufacturability, cost, design, weight, safety, corrosion, and recyclability.

MANUFACTURABILITY

In Sheet Metal tank- unforeseen corrosion can easily contaminate the fuel delivery system and cause costly repairs, whereas it eliminates issues in Plastic blow moulded tank.

SAFETY

Generally, plastic tanks are considered safer in crashes because they are seamless and, thus, not prone to failures in thevulnerable seam areas. When steel tanks absorb energy and deform,the pressure within the tank increases as the volume decreases. This makes them vulnerable at welded or clamped areas where failure can potentially occur.

CORROSION

Corrosion is a well-known concern on both the inside and outside surfaces of tanks. The outside surfaces and supporting structure are exposed to road chemicals, salt, mud, and gravel. The corrosion issue is critical with zinc-coated products that replace terne plate because of their sacrificial nature, which puts an even higher demand on the quality of the barrier film for both inside and outside surfaces. In contrast, the HDPE gas tanks are inert to the corrosive environments inside and outside the tank.