Automotive Trends
Drive Broader, More Diverse Plastics Use

Automotive designers and manufacturers continue to focus on weight reduction, cost control, improved performance, and innovative styling, and the materials and applications targeted to achieve these goals are constantly expanding. A major reason is the growing array of specialty and commodity plastics developed for new application areas in automotive interiors, lighting, glazing, structural components, and more. The creative use of plastics is accelerating as OEMs and tiers find new opportunities to replace traditional materials across their existing product lines, not only to achieve the benefits mentioned above but also to create sustainable solutions and decrease their carbon footprint. This trend also encompasses the latest electric and hybrid electric vehicles (EVs and HEVs) currently being developed.

Interiors
There is high demand for molded-in color polypropylene (PP) for use in instrument panels (IP), door panels, and interior trim. Long glass-fiber PP is increasingly being used in retainers of soft, skin-and-foam instrument panels. Although historically reserved for high-end luxury vehicles, these soft IPs are being developed at the small and mid-size levels, indicating that demand for long glass-fiber PP will continue to grow.

Although IP retainers are trending away from polycarbonate/acrylonitrile-butadiene-styrene (PC/ABS) and toward PP, PC/ABS remains popular for painted hard trim due to its high flow, high impact strength, and good heat resistance. Particularly as designers look for new cost-out and weight-out alternatives, it is important to design trim components having thinner-wall sections while ensuring compliance with interior crash-safety standards. The balance of properties delivered by a PC/ABS grade such as Sabic Innovative Plastics’ Cycoloy XCY620 resin can help engineers design for these requirements.

Steering wheels are a new focus area for plastics. Typical steering wheels consisting of a die-cast magnesium or aluminum armature overmolded with flexible urethane foam have remained basically unchanged for years. Drawbacks of this design include lack of package space for integration of electronic components, inability to attach components, and restrictions on new styling such as advanced shapes and innovative aesthetics. Using injection molding to process an advanced material such as Lexan EXL PC copolymer is a fresh approach to steering wheel design. Designs featuring a hollow rim reduce weight and mass and provide space for electronics. Compared to die casting and finishing, injection molding offers greater design flexibility, avoids secondary operations, and streamlines production while reducing greenhouse gas emissions from the manufacturing process.

Resins offering molded-in custom color offer improved aesthetics for auto interiors and avoid the cost of secondary painting and coating operations. Special effects, such as metallic looks, textures, and patterns, can be molded into components for a distinctive appearance at a cost-effective price point. An example can
be found in the 2010 Ford Mustang IP trim panels made of Geloy PC/acrylic styrene acrylonitrile (ASA) resin. This molded-in-color solution is a unique styling enabler while reducing costs and emissions associated with the painting process.

**Exteriors**

Lightweight, tough plastics are becoming the material of choice in auto fenders, as well as an ever-broadening range of auto body components. Not only do plastics cut weight by up to 50% versus steel, but they also provide greater freedom to create complex designs and to improve overall safety and performance. Further, conductive resins such as Noryl GTX allow body panels to be electrostatically painted online without the need for a conductive primer, and they deliver high-quality painted aesthetics.

Chery Automobile’s A3CC sleek sports coupe delivers high-end style and practical performance with the first Noryl GTX resin front fenders used by a Chinese automotive OEM. Replacing steel body panels with Noryl GTX resin enabled Chery to cut fender weight by more than 50% vs. steel (1.37 kg vs. 2.80 kg) while delivering better low-speed impact durability than steel.

Mitsubishi Motors selected Noryl GTX resin for its 2010 RVR compact crossover. By replacing steel with this high-performance resin, Mitsubishi slashed weight by almost 50% and achieved a unique geometry to differentiate the vehicle’s styling and improved pedestrian safety compliance. In developing the RVR, Mitsubishi engineers made every effort to reduce part weight to achieve best-in-class fuel efficiency. Noryl GTX resin made a major contribution by reducing vehicle body weight by 3 kg (6.6 lb). By injection molding Noryl GTX resin, Mitsubishi designers were able to create a fender geometry featuring a sharp front edge and a side slot for an indicator lamp. Such a design would have been difficult to fabricate in steel as it would require multiple steps, tools, and operations.

Pedestrian safety is a key application area where plastics can make a major difference. By increasing the flexibility of auto fenders compared to steel, plastics help provide excellent head impact energy absorption in pedestrian incidents, as well as recovery of the fender from minor collisions. Another Sabic Innovative Plastics’ material, high-impact Xenoy PC/polybutylene terephthalate (PC/PBT) alloy, is increasingly being used in energy management systems such as bumper energy absorbers. In particular, North American OEMs are evaluating the Global Technical Requirements (GTRs) for pedestrian safety bumper systems—historically a European requirement—and are considering designing to meet them. For example, Ford introduced its first production energy absorber (EA) for pedestrian protection molded of tough, lightweight, Xenoy resin on its 2009 Kuga crossover.

Hyundai Motor India Ltd. (HMIL) selected Xenoy resin for the EA of its Hyundai i10 city car—targeted for export—to meet stringent European safety regulations for pedestrian lower-leg impact. HMIL faced space constraints for the EA, which required an alternative to bulky expanded polypropylene (EPP) foam. With the revised EA design featuring Xenoy resin, the Hyundai i10 qualified for export to the European Union (EU). It also won the 2008 Indian Car of the Year award and a host of other honors.

Sabic STAMAX long glass-fiber PP resins are used extensively by European automakers to replace steel in key components such as front-end modules, door modules, underbody shields, and other structural and energy management systems. STAMAX resins are sold world-
wide, and they currently are manufactured in Europe and U.S., with production slated to expand soon into the Asia Pacific region.

Sabic STAMAX long glass-fiber polypropylene (LGFPP) resin helped Hyundai-Kia Motors win a coveted Society of Plastics Engineers (SPE) 2010 Innovation Award. The Chassis Hardware category award honored the 2011 Hyundai Sonata’s plastic door module featuring an integrated window guide rail. This major application, which used STAMAX 30% glass-reinforced resin to replace steel in all four door panels, cut total vehicle weight by approximately 4 lb (2 kg), enabled 21 components to be integrated into a single injection-molded part, and cut overall system costs by streamlining five assembly processes into one.

Wire and cable

As consumers demand increasingly more sophisticated and feature-loaded vehicles, the global automotive industry must balance these expectations with space constraints and weight concerns. Halogen-free, flame-retardant Flexible Noryl resin from Sabic Innovative Plastics enables thin-wall and ultrathin-wall insulation that reduces the size and mass of wire and cable, freeing up space for additional functionality. Using this material to replace traditional cable insulation also helps reduce weight by an average of 25%.

Flexible Noryl resin provides superior properties compared to polyvinyl chloride (PVC) and cross-linked polyethylene (XLPE), including better abrasion resistance than XLPE, excellent chemical resistance, and lower specific gravity (1.03) than PVC. The material also supports sustainability efforts by meeting halogen-, chlorine-, and lead-free part requirements.

Lighting

Materials such as Sabic Innovative Plastics’ high-temperature Lexan XHT PC copolymer resins offer thermal and color stability in the high-temperature headlamp environment, and can be metallized for a highly reflective appearance or used in clear, tinted bezels and lenses, which have become a fashion statement. Direct metallization without the need for a coating or the alternative of molded-in color both help reduce production costs.

For example, Hella, a leading Tier 1 auto lighting supplier, selected Lexan XHT resins to create a metallized headlamp bezel and a clear, ice blue-tinted bezel for two major European car manufacturers. The material enabled Hella to create distinctive lighting that can stand up to the exceptional performance demands of today’s high-intensity halogen, xenon, and light emitting diode (LED) bulbs, as well as ultraviolet (UV) light and humidity.

An accelerating trend in automotive lighting is its migration into the vehicle interior in areas such as illuminated sill plates, center consoles, and door trim panels. Specialty resins, already used extensively in headlamps and other exterior lighting, are finding new applications as lighting becomes an important interior design element.

Glazing

An important application area for weight reduction is automotive glazing. Replacing glass with lightweight polycarbonate glazing contributes to better fuel economy and lower emissions, and increases design options. However, the PC must be coated for abrasion resistance. Sabic Innovative Plastics’ Exatec business is making this technology more practical and accessible in two important ways. Exatec recently partnered with ULVAC, a vacuum technology company, to make turnkey, mass-production systems for plasma-coated Lexan PC glazing available. Exatec also is scientifically evaluating the effects of surface wear on PC glazing using either wet coat or both wet coat and plasma coating technologies, including conducting long-term road evaluations.

Hybrid and hybrid electric vehicles

Although hybrid, plug-in hybrid, and battery electric vehicles can reduce fuel consumption and emissions, the additional weight of battery packs—up to 300 kg (660 lb) on a mid-sized car—can undermine environmental benefits. To reduce weight, plastics can replace steel in different applications such as battery housings, an approach that is already being taken by leading global auto manufacturers.

Sabic Innovative Plastics’ Noryl and Noryl GTX resins offer lower initial mold shrink and warp; lower moisture uptake that minimizes dimensional and mechanical property changes; and a lower, more stable coefficient of thermal expansion (CTE). These high-end properties help keep the performance of the battery pack system stable regardless of potential changes in environment such as temperature, humidity, and load.

In HEVs, the higher the voltage, the more important electromagnetic interference/radio frequency interference (EMI/RFI) shielding becomes to control potential interfer-
ence from electronic components such as inverters, electronic control units, and battery management systems. Sabic’s LNP Faradex compounds provide exceptional EMI/RFI shielding properties without the heavy weight of metal layers or the environmental risks of metallization.

Use of flame-retardant materials in EVs, especially plug-ins, is increasing as these vehicles are plugged into electrical outlets in homes. SABIC has numerous materials that are tested and approved to UL standards and are used in a wide variety of applications such as bus-bars, battery enclosures, and charger connectors.

Conclusion
Automotive manufacturers continue to face unrelenting pressure in the areas of regulatory compliance, global competition, and cost control while striving to please demanding consumers. Converting from glass, metal, and other traditional materials to plastics or creating entirely new components from plastics, can help OEMs and tiers find answers to all of these challenges. Ongoing innovations in materials and technologies offer new solutions for virtually any auto component, from large body panels to the smallest connectors, and from the headlights to the rear window.

In hybrid electric vehicles such as this HEV Shadow car, plastics can replace steel in different applications such as battery housings to reduce weight.

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