



BASF Enlightens the Auto Industry

Continuous fiber-reinforced thermoplastic composite and virtual simulation technology enables BASF to develop an innovative and cost neutral seat pan that is 45% lighter than its predecessor.

By Beverly A. Beckett

In the automotive industry, new regulations governing fuel economy and CO₂ emissions are driving manufacturers and suppliers to investigate “lightweighting” – design practices that reduce the mass of a vehicle either through removal of unnecessary material and/or complete substitution with lighter materials. Lightweighting is also seen as a key initiative to reduce product development time and cost.

One company on the forefront of lightweighting is BASF. The chemical company supplies a range of products to the automotive industry including engineering plastics, polyurethane and specialty foams, coatings, synthetic lubricants, coolants, and chemicals for leather and textiles. The company is also a leader in leveraging virtual simulation technology and optimization in its design process

BASF
The Chemical Company

BASF collaborated with GM Opel to develop a thermoplastic composite seat pan for the 2012 Opel Astra OPC sport coupe. Its efforts earned the chemical company the inaugural Altair Enlighten Award. The award, presented at the 2013 Center for Automotive Research (CAR) Management Briefing Seminars (www.cargroup.org), was created specifically to honor the greatest achievements in vehicle weight savings each year.

A New Plan for the Seat Pan

The majority of seat pans are made from multiple stamped steel components that are welded together and must meet strict crash performance targets. Instead, the Opel Astra OPC features an innovative seat pan made from a thermoplastic laminate with continuous fiber reinforcement (organo sheet). This is the world’s first automotive seat pan based on this technology manufactured for a production vehicle. The plastics used are polyamide specialties from the BASF Ultramid product range.

Thermoplastic laminates with continuous fiber reinforcement, also called composites, are plastic-impregnated fabrics that are processed into laminates. They serve as the reinforcement in plastic parts that must be especially lightweight yet still exhibit exceptional performance.

BASF developed two special Ultramid grades for the Opel Astra OPC seat pan. The first is an unreinforced grade acting as the material in which the glass fiber fabric is embedded. The second is an impact-modified, short glass fiber-reinforced Ultramid used as over-molding material to achieve the necessary ribs and edges of the part by means of injection molding.

Dr. Martin Jung, senior vice president of Global Research for Structural Materials, BASF, explains that in order to get the maximum benefit from the new composite material, BASF engineers leveraged virtual simulation and optimization techniques to lay out the material in the most efficient structure. Very important input for these techniques to be valid is accurate mechanical properties for these new materials, of which BASF has proven proprietary methods. Given the high strength of the composite laminate, engineers were able to optimize wall thicknesses and rib heights and thicknesses of the seat pan while still meeting all crash and durability targets.

As such, the weight of the component was lowered by 45% (1.5 kg to 0.8 kg) compared to the original design; 1.6 kg represents the total savings per vehicle. The new manufacturing process and materials along with the efficient design yielded a cost-neutral component with a reduced packaging space.

In addition, the seat back, the transverse support and the handle on the back were also made from Ultramid. The seat has 18 adjustment options, allowing optimal adaptation to the body of the driver or passenger.

With regard to production, BASF employed a new manufacturing process — injection molding with the addition of thermoplastic infrared (IR) heating and robotic handling. The composite pan was produced by means of in-mold forming, which involves placing the heated and formable thermoplastic laminate in the injection mold, turning it into the necessary shape, fixing it and immediately over-molding it. BASF was able to support its customer with its own expertise in this innovative manufacturing process

“Metal-to-plastic material substitution with the glass fiber composite laminate was a significant factor in achieving the weight savings, but the overall 45% reduction could only have been achieved by removing excess material where it was not needed. BASF’s leadership in new materials, manufacturing methods and virtual simulation were all leveraged in this successful project. We collaborate with customers on creating new design processes and material solutions that deliver measurable, cost-effective and sustainable benefits,” says Dr. Jung.

An Award-Winning Solution

BASF’s efforts were recognized in August when the company was named as the first recipient of the Altair Enlighten Award. The Altair award was presented in collaboration with CAR, based in Ann Arbor, MI. It aligns with the goals of CAR’s Coalition for Automotive Lightweighting Materials initiative to support the cost-effective integration of mixed materials to achieve significant reduction in vehicle mass through the collaborative efforts of the material sectors and auto manufacturers.

The Altair Enlighten Award is intended to honor the greatest achievements in weight savings each year; to inspire interest from industry, engineering, policymakers, educators, students and the public; and to create further competition for new ideas in the industry. In addition, it strives to provide an incentive as well as a platform for sharing important technological advances in the lightweighting domain.

David Mason, vice president, Global Automotive, Altair, notes, “The great response to the inaugural Enlighten Award demonstrates the importance of lightweighting in the automotive industry today. We had entries representing every major system in the vehicle. Some of the entries did not change materials but utilized lightweight material removal (LMR) via optimization software to achieve great weight savings. Others relied on direct lightweight material substitution (LMS) to reduce weight. BASF’s winning design used a blended approach of material substitution and material removal. Ultimately, it will be a combination of lightweight material removal leveraging optimization software and substitution with advanced materials that will be the successful formula to achieve the industry’s fuel economy goals at the right price.”



Dr. Jay Baron of the Center for Automotive Research (left) and Dave Mason of Altair look on as Dr. Jung accepts the Altair Enlighten Award on behalf of BASF.



The Altair Enlighten Award

The Altair Enlighten Award aims to recognize achievements in weight reduction across the automotive industry, from motorcycles to passenger cars, light trucks, commercial vehicles and buses.

Altair, in collaboration with the Center for Automotive Research (CAR), Ann Arbor, MI, presented its first award to international chemical company BASF Corporation for the development of its thermoplastic composite front seat pan. Joint runners-up included ArcelorMittal and Plasan Carbon Composites.

ArcelorMittal, in collaboration with Honda and MAGNA-Cosma International, designed the industry’s first single-piece, hot-stamped door ring, which contributed to significant weight reduction (3.9 kg), improved safety and fuel economy performance for the 2014 Honda Acura MDX. Plasan Carbon Components developed a carbon fiber composite roof for the 2013 Viper GTS that weighed 51% less than the previous roof assembly while capturing structural and Class-A Surface requirements.

Judging chair Dr. Jay Baron, president and CEO of CAR and director of CAR’s Coalition for Automotive Lightweighting Materials, said that his committee had the opportunity to review 10 very strong nominations for the award, all demonstrating a variety of solutions with great potential for lightweighting vehicles. “New fuel economy regulations remain a significant concern for vehicle manufacturers,” he says, “and the Enlighten Award has highlighted a range of innovative strategies being implemented by the industry.” **Applications for the 2014 Altair Enlighten Award will be accepted through Jan. 2014. Learn more at altairenlighten.com/enlighten-award.**