Automotive Highlights of K 2022

Suitable Materials for Smart Vehicle Design

Currently, the plastics and automotive industries are undergoing a large transformation. Both are faced with demands for more sustainability. How these can be achieved was illustrated by various exhibits at this year's K trade fair. Hereby, it was clearly shown that with suitable materials not only can CO_2 emissions be reduced, but also advantages in component design achieved.

The Japanese chemical company Asahi Kasei showed its concept vehicle at K 2022. The domed roof in particular could lead to a few changes in future automobiles. © Hanser/F. Streifinger

Currently, the plastics and automotive industries are undergoing a large transformation. They are faced with demands from society for more sustainability. How both industries are jointly dealing with these changes was clearly shown at the K 2022. Hereby it became clear: with suitable materials not only can CO_2 emissions be reduced, but also advantages in component design achieved.

Two days before the K opened, the Society of Plastics Engineers (SPE) had presented their traditional SPE Automotive Awards. Many of the award-winning components could be appraised at the exhibition. Hereby it became clear how important the suitable material is for successful implementation in many cases.

For example, the control module of a truck brake system was shown at the booth of **EMS-Chemie** (**Fig. 1**). It combines a total of seven individual modules in one component. The module controls e.g. the braking and emergency braking system, the antilock brake system, and the undercarriage. Thanks to the combination of different functions in one component, the number of individual parts and the weight are reduced. The latter is also achieved by the replacement of metal components with plastic parts. Both solutions are intended to reduce CO_2 footprint, and also ensure better recyclability.

The module was developed by Haldex Brake Products together with KB Components and EMS. The combination of different functions in a single module, and its application in the automotive sector means that the material used must exhibit adequate resistance against e.g. road salt, diesel fuel, alkaline detergents, brake fluid, as well as coolants and solvents. Therefore, a high-temperature stabilized polyphthalamide (PPA) of the Grivory HTV series from EMS is used.

Another award-winning component was shown at the **Akro-Plastic** booth. It involves a hybrid brake disk protection for motorcycles (**Fig. 2**). Exciting features of the component are the process used for its production, and the material. It was manufactured using the Conexus technology – a jointing procedure that creates a molecular bond between thermoplastics and thermosets. For this, a coupling film is connected with the thermoset by means of isothermal hot press molding, and subsequently back-molded with polyamide (PA). The material used is a PA510 from Akro-Plastic – a bio-based PA reinforced with long glass fibers. The prepreg used was reinforced with natural fibers. Both ensure that the component has the necessary mechanical properties with a simultaneously reduced CO_2 footprint. Participators in the development were KTM Technologies, Altendorfer Kunststofftechnik, Alba Tooling & Engineering, Bcomp, Akro-Plastic, the engineering company Zahler, and the Fraunhofer ICT.

Another award winner was showcased at the Lanxess booth: a battery pack for electric vehicles (**Fig. 3**). Developed together with Kautex, the demonstrator is based on the battery housing of the ID.3, Volkswagen's e-auto flagship. According to the plastics manufacturer, it is the first battery pack for electric vehicles that is made entirely of thermoplastics. The component was produced in a single-stage impact extrusion process. Because of the component's size, a specially adapted material was required – the glass fiber-reinforced PA6 Durethan B24CMH2.0 from Lanxess. Its flowability has been improved, and therefore meets the requirements of the production process. Moreover, to protect the battery pack from damage, the crash-relevant places were strengthened with the PA6 composite Tepex dynalite 102-RGUD600 reinforced with continuous fibers. In case of a collision, the fabric's structure ensures that the energy is deflected accordingly, thereby protecting the battery.

The demonstrator is intended to show the improvements offered by replacing metal with plastics for battery packs. And these are really notable. Compared with an aluminum model, the plastic version saves about 15 % in weight. Also the component's CO_2 footprint is significantly lower. It is claimed to be up to 40 % lower. This is partially due to the far lower energy consumption for producing the PA6 compared with aluminum. Also the usual finishing steps for metal, such as e.g. cathodic dip coating for corrosion prevention, are eliminated by the single-stage productions process. Furthermore, items such as fixing elements and stiffening ribs can be integrated directly. This ensures less installation work, thereby reducing manufacturing costs. Interest from the automotive industry has definitely been aroused. Currently, says Lanxess, road tests are being conducted with the demonstrator in a series vehicle.

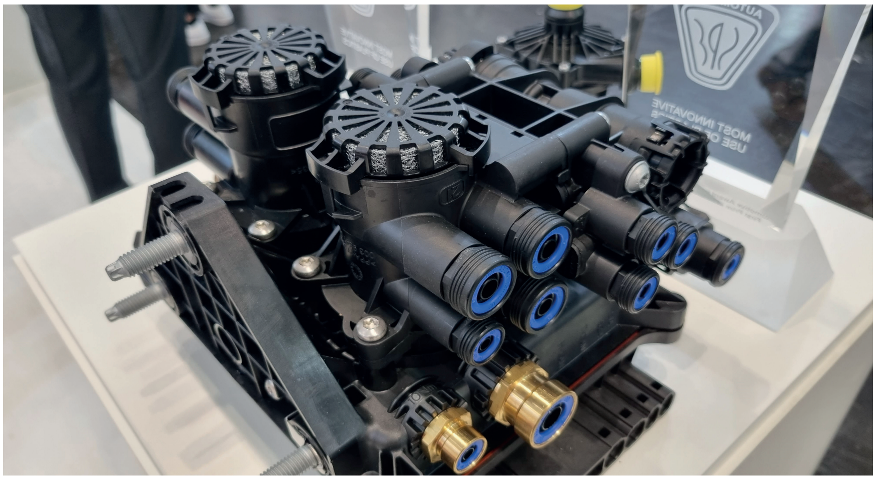

Fig. 1. Seven at a blow – the control module from Haldex Brake Products combines a total of seven modules in a single component. © Hanser/F. Streifinger

Fig. 2. Exciting features of the brake disk protection are both the production process as well as the material used: the applied jointing method creates a molecular bond between thermosets and thermoplastics. The thermoplastic used is a bio-based PA from Akro-Plastic. © Hanser/F. Streifinger

Good Protection for Batteries

In general, batteries for electric vehicles are an important focal point of development for plastics producers at present. Hereby, protection against thermal runaway of individual cells or the entire battery plays a major role. If this is not ensured, there is a risk of fire. In order to give passengers enough time to exit from the vehicle and move away from it in such a case, materials are required that withstand very high temperatures for a long time, and prevent heat from being released to the surroundings.

For this, **Wacker** presented a silicone-elastomer mix that is applied to the battery housing's interior. In case of corresponding temperature effects, the mix ceramifies and forms a protective layer against the heat. Although just a few »

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Fig. 3. The battery demonstrator is based on the battery of the ID.3. The housing was manufactured entirely of plastic in a single-stage process. For protection, it was reinforced with a continuous fiber composite at specific points. © Hanser/F. Streifinger

millimeters thick, the layer is said to withstand temperatures of more than 1000 °C.

A technology shown by **Asahi Kasei** could lead to another major change in vehicle production. The Japanese chemical company introduced a hard coating method for polycarbonate (PC). It ensures adequate scratch resistance so that the polymer can be used for vehicle windscreens. Thanks to the coating, the PC meets the abrasion resistance and weatherability requirements for safety glass in vehicles, as specified in Regulation UN ECE R43, according to the company. Consequently, it might be possible in future to replace the glass windows in vehicles. Asahi Kasei has installed the new technology in its concept car that was presented at the K 2022. The vehicle's large transparent dome is made of correspondingly coated PC (**Fig. 4**).

Hereby, the dome addresses another focal issue of the automotive industry: sustainable materials –because the raw material for the PC is CO_2. The corresponding production method also originates from the Japanese company, and meanwhile has been marketable for 20 years. According to the Japanese, they were the first company to offer such a technology. Instead of using it themselves, Asahi Kasei licenses it to other companies. The chemical company says that meanwhile 15 % of global PC is produced in this way.

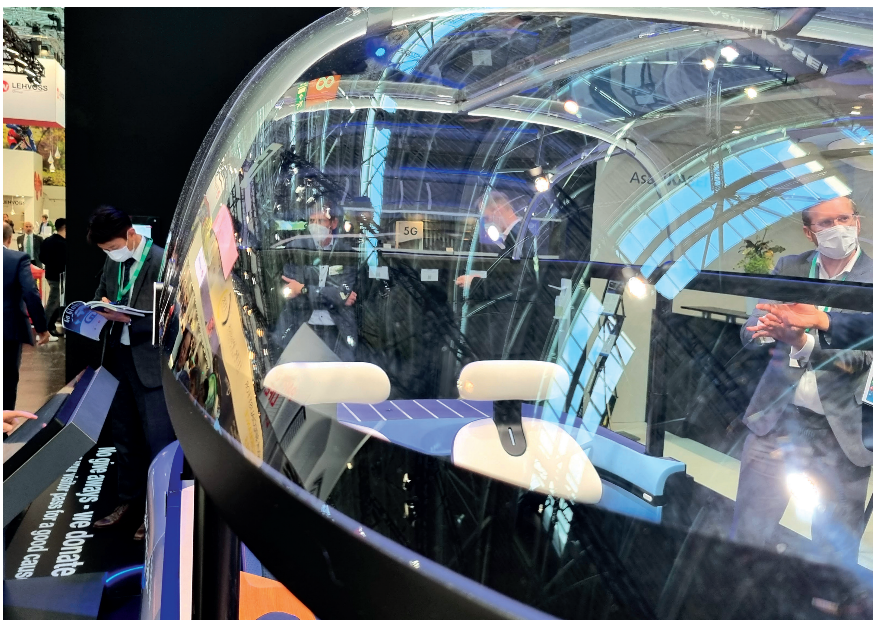

Fig. 4. The dome of Asahi Kasei's concept car is made of PC. A specially developed coating increases scratch resistance and weatherability, thereby meeting the requirements for windscreens. © Hanser/F. Streifinger

Concept Vehicle from Citroën and BASF

Just before the exhibition started, the French automaker Citroën and **BASF** had introduced another concept car. With the design study named "Oli", the two companies want to give impulses for a more sustainable and simultaneously affordable mobility. Therefore, a central issue of the vehicle is the reduction of non-essential parts and functions. This is intended to save weight and resources. This is nicely illustrated by the absence of an entertainment and navigation system. Instead, the idea is to provide both functions via the passenger's smartphones and mobile speakers. An exciting and simultaneously controversial approach is also the top speed limit of 110 km/h, which is intended to extend the electric vehicle's range.

Unfortunately, visitors to the K were not able to experience the overall concept car live. At the time of the trade fair, it was being shown at the Paris Autosalon. But the basic idea was well explained by the car seat on show at the BASF booth (**Fig. 5**). The seat was completely printed in 3D, and its open grid structure is intended to provide ventilation, thereby eliminating the need for ventilating fans. It is made completely of a thermoplastic polyurethane (TPU). This mono-material approach simplifies recycling, and was also used for other parts of the vehicle.

Functional Integration Using Layered Construction

A nice summary of current trends in automobile interiors was provided by a component in the booth of **Covestro**. The surface of the trim part consists of real wood. Particularly in this field, natural materials are very popular, says the plastics producer. Also in high demand are appealing lighting designs that are directly integrated in the components and serve as ambient illumination. Important hereby is that light sources such as LEDs are only visible when switched on, and are not noticeable otherwise, similar to the black panel effect of displays. There is also an increasing demand for integrated lighting effect controls and other functions such as touch operation.

For the exhibited component, this was implemented by means of a layer structure. For the back lighting, a layer of Makroblend OM – a glass fiber-reinforced PC blend – is mounted under the real wood surface. The material is transparent and therefore translucent, and exhibits the necessary stiffness and stretchability. Touch and other operating functions are implemented via a rear film with integral electronics. The top layer consists of a glass fiber-reinforced PC/ABS blend. In spite of the numerous integrated functions, the component's thickness is just 7 mm.

However, black panel effects are of interest not only for displays and interior lighting. For example, exterior tail lamps can be produced, which merge completely with the vehicle body when switched off, and only become visible when switched on. To make this possible, "neutral gray" colored materials are required. For this, plastics producer **Röhm** showcased a polymethyl methacrylate (PMMA) molding compound at the exhibition, which is designed specifically for such tail lamps. The compound's special feature is its higher transmission of red light (**Fig. 6**). This permits automakers and suppliers to manufacture red lamps with fewer LEDs or light sources with lower luminosity, which in turn cuts costs and reduces energy and resource consumption.

Fig. 5. The joint vehicle study "Oli" from Citroën and BASF is intended to show how future electric vehicles can become more sustainable and affordable. For improved recyclability, the seat is made completely of a mono-material. © Hanser/F. Streifinger

Old Tires Converted into a Green Door Handle

An exhibit at the BASF booth demonstrated very well how the CO_2 footprint of automotive components can be reduced. A door handle in matching green (**Fig. 7**) is made of a glass fiber-reinforced PA6. For its production, BASF used pyrolysis oil from chemically recycled old tires as well as biomethane from agricultural waste and waste from the foodstuffs industry. Both raw materials are used as feedstock for production, and subsequently assigned to the PA6 according to the mass balance principle. BASF says that production has been certified according to the REDcert2 scheme. The door handle was produced by the automotive supplier Witte Automotive. In future, the new component will be fitted as standard in different Mercedes Benz S-Class models and in their EQE electric vehicle. ■

Florian Streifinger, editor

Fig. 6. Tail lamps with low resource and energy consumption are made possibly by a PMMA from Röhm. The material is more transmissive for red light, permitting the lamps to be built using fewer and lower-luminosity LEDs. © Hanser/F. Streifinger

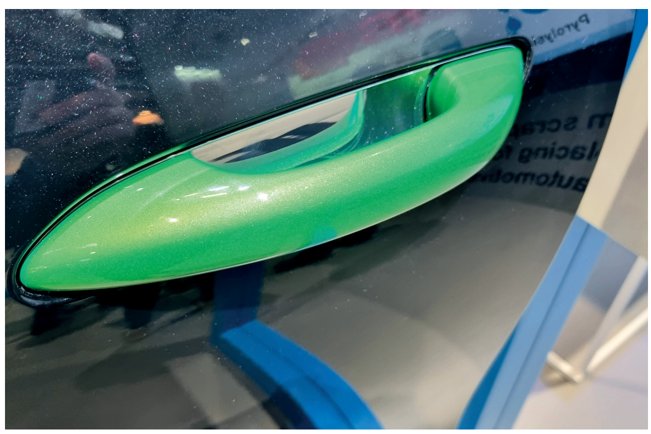

Fig. 7. Tires to door handles – the PA6 used to produce the Mercedes Benz S-Class component is made from pyrolysis oil from old tires and biomethane.
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