

Replacing metal in commercial vehicles

Truck air filter carriers made of highly reinforced polyamide 66 from LANXESS

- **Reduced costs and weight**
- **High dynamic strength**
- **Extensive HiAnt services**

Cologne – Polyamides reinforced with a high glass fiber content can also replace metals in commercial vehicles, as demonstrated by two air filter carriers, which will be installed in the Mercedes-Benz Actros starting early next year. These structural parts are made of Durethan AKV 50 H2.0 from LANXESS, a polyamide 66 with a glass fiber content of 50 percent by weight. They are the first plastic carriers to be used as load-bearing structural elements in a truck air filter system from Mercedes-Benz. “The advantage of our structural material is that it significantly reduces costs compared to the previous component design in steel, but still meets the high demands on dynamic strength. In addition, the weight of the components can be reduced by a total of 2.9 kilograms, or considerably more than 50 percent,” explains Jürgen Horstmann, Key Account Manager for the commercial vehicle industry at the LANXESS High Performance Materials business unit.

The carriers are manufactured by BBP Kunststoffwerk Marbach Baier GmbH for Daimler Trucks. While the parts were being engineered, BBP succeeded in establishing an economical industrial process for their fabrication. Based in Germany in Marbach am Neckar, the company developed a mold concept for the geometrically complex components in its own Mold Engineering department. “The numerous cores in the mold required a complex, contoured design of the cooling system,” explains Horst Hauke, President of BBP.

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Passes acid test

The air filter, together with the fender mounted below it, weighs 7.9 kilograms at installation. In operation, the weight of this assembly can increase as a result of dust in the air filter and dirt on components in the wheel arch. The two filter carriers must not only bear this weight and that of the fender attached to them, but also withstand the extremely high dynamic forces to which they are exposed, for example vibrations caused by hitting deep potholes on construction sites. The requirement for component design was that the plastic carriers had to display the same stiffness as the previous steel carriers. To test the dynamic strength and functionality of the polyamide carriers, the service life of several vehicles was tested on the company's own rough road test track. "Thanks to the high stiffness and strength of our polyamide, the two structural parts passed the test with flying colors," says LANXESS expert Horstmann. The carriers further stand up to the high static loads that occur, for instance, when a truck driver puts his entire weight on the air filter when making repairs (test load: 100 kilograms).

Cost-efficient bolt connection

Significant savings compared to the steel version resulted from directly bolting the filter to the carriers, eliminating the need for bushings. "In cooperation with a bolt manufacturer, we designed a solution that permits the part to be bolted multiple times, for example after repairs or replacement. The prestressing forces of the bolts in the carriers remain high enough that the air filter housing cannot loosen on its own," explains Horstmann.

Topology optimization and structural analysis

As part of its HiAnt services, LANXESS supported the manufacturer throughout component development. For example, a feasibility study was completed during the concept phase to determine if the component can be rendered in polyamide 66. By means of topology

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optimization, LANXESS experts calculated the most cost-efficient structure that achieves minimal material use and maximum stiffness, taking into account the limited space for installation. They also conducted computer simulations of various load scenarios. For example, they calculated the dynamic strength of the carriers at 135 °C and the static load caused by the weight of the driver at -40 °C and 150 °C. The calculations at a higher temperature were necessary because one carrier is in the vicinity of the turbocharger and warms accordingly during operation. The results of simulation were incorporated in the design of the components. Furthermore, the oscillation behavior of the carriers was analyzed in order to shift the resonant frequencies by structural means into a range not excited during driving, and thus avoid critical resonance frequencies.

Detailed information on properties, applications and processing technologies for Durethan and Pocan can be found in the HPM TechCenter under www.durethan.com and www.pocan.com.

LANXESS is a leading specialty chemicals company with sales of EUR 7.9 billion in 2015 and about 16,700 employees in 29 countries. The company is currently represented at 55 production sites worldwide. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, specialty chemicals and plastics. Through ARLANXEO, the joint venture with Saudi Aramco, LANXESS is also a leading supplier of synthetic rubber. LANXESS is listed in the leading sustainability indices Dow Jones Sustainability Index (DJSI World) and FTSE4Good.

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News Release



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