News Release

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Continuous-fiber-reinforced thermoplastic composites from LANXESS for safety-critical structural components

Tepex reinforces child seat headrest

- **Weight saving of up to 30 percent**
- **Excellent crash performance**
- **Particle-foam composite injection molding reduces number of parts**

Cologne – Tepex continuous-fiber-reinforced thermoplastic composite materials from LANXESS have huge potential for use in many areas, including the lightweight construction of structural safety components. A child seat headrest that has been developed as a technology demonstrator serves to illustrate the opportunities on offer here. The component is produced in a particle-foam composite injection molding (PCIM) process. “The insert made of Tepex can reduce the weight of the headrest by up to 30 percent in comparison with the commercially produced component variant – and with comparably good crash performance, too. It also simplifies the production process,” explains Dr. Klaus Vonberg, an expert in lightweight construction at the Tepex Automotive Group of the High Performance Materials (HPM) business unit at LANXESS. Tepex is developed and produced by LANXESS subsidiary Bond-Laminates GmbH, which is based in Brilon, Germany.

Publicly funded project

The demonstrator is the result of a transnational research project funded by the German Federal Ministry for Economic Affairs and Energy as part of the Central Innovation Programme for Small and Medium-Sized Enterprises (SMEs) (German acronym: ZIM). Participating in this program are the Department of Lightweight Structures and Polymer Technology (SLK) at Chemnitz University of Technology, Polycomb GmbH based in Auengrund in Thuringia and

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the child seat manufacturer Avionaut based in Szarlejka, Poland, which produces the child seat that serves as a reference.

Efficient production process

For the headrest, the project partners developed an alternative production process based on PCIM. To reinforce the headrest in individual places and reduce weight, they used a customized insert made of Tepex dynalite 104-FG290(4)/47%. This is a polypropylene-based composite material that is strengthened with two layers of continuous-glass-fiber rovings. The insert is formed in a single process operation using an injection molding tool with turning plate and back-injected with a short-glass-fiber-reinforced polypropylene compound to integrate the support structure for the headrest and backrest, for example. The prefabricated insert is then back-foamed in a second tool using particle foam based on expanded polypropylene (EPP).

From six to one

The reference headrest, by contrast, is currently produced in series using multiple individual components. The support structure consists of long-glass-fiber-reinforced polypropylene. It is assembled with a separately foamed EPP component using four polypropylene carrier pins. “Not only is the new, highly integrated production process more energy-efficient than the previous procedure, it also results directly in the finished component. This reduces the total number of parts from six to one, which also lowers production costs in terms of logistics and the machine expenditure required,” explains Norbert Schramm, scientific assistant at the Chemnitz University of Technology and head of the ZIM project there. The weight saving with the current version of the headrest component featuring glass fiber is roughly 26 percent, although there is still potential for more. According to Schramm: “If a reinforcement based on carbon fibers is used in the composite semi-finished product and in the injection molding material, the result is an assembly that is almost 30 percent lighter.”

Close cooperation

The project partners had different development focuses and tasks. For instance, the SLK chose the materials, analyzed the composite adhesion, designed the structure and carried out topology optimization. Polycomb's responsibilities included the development and design implementation of the demonstrator, production of prototypes and optimization of the system concept. Avionaut analyzed the force transmission areas, developed the design and examined the crash behavior of the headrest and the entire seat in realistic collision tests, for example. LANXESS helped the project partners to choose materials and also assisted with tasks such as the development of the hybrid molding process.

Enormous application potential, including in other assemblies

LANXESS sees a wealth of potential for Tepex and the new process in the production of infant carriers, backrests and armrests as well as seat shells for new, highly complex seating concepts in autonomous cars or for comfort seats for shuttle, VIP and family buses. Electric vehicles in particular would benefit from lightweight seats. "As part of our HiAnt customer service, we help project partners to develop and implement components like these and the associated process. Our services include draping simulations, tool design and tips for handling the heated and soft Tepex insert. We also support implementation of the series-production process," says Vonberg.

You can find more information about LANXESS products, developments, technologies and services that use polyamides, polyesters and thermoplastic composites for innovative vehicle concepts and particularly electromobility at https://new-mobility.lanxess.com and www.e-mobility.lanxess.com.

LANXESS is a leading specialty chemicals company with sales of EUR 7.2 billion in 2018. The company currently has about 15,500 employees in 33 countries and is represented at 58 production sites worldwide. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, additives,

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specialty chemicals and plastics. LANXESS is listed in the leading sustainability indices Dow Jones Sustainability Index (DJSI World and Europe) and FTSE4Good.

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Images

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The Tepex insert is formed in a single process operation using an injection molding tool with turning plate and back-injected with a short-glass-fiber-reinforced polypropylene compound to integrate the support structure for the headrest and backrest, for example. Photo: Professur Strukturleichtbau und Kunststoffverarbeitung an der Technischen Universität Chemnitz

The child seat headrest has been developed as a technology demonstrator and is produced in a particle-foam composite injection molding process. The Tepex insert can reduce the weight of the headrest by up to 30 percent in comparison with the commercial component variant – and with comparably good crash performance, too. Photo: Professur Strukturleichtbau und Kunststoffverarbeitung an der Technischen Universität Chemnitz