Materials expertise for lightweight construction: Fraunhofer IMWS presents new solutions at the K Trade Fair

From material design and semi-finished products to non-destructive testing of finished components – Fraunhofer Institute for Microstructure of Materials and Systems IMWS presents its expertise along the entire value chain at the K Trade Fair in Düsseldorf from 19 to 26 October 2016. The focus is on materials for polymer-based lightweight construction.

One of Fraunhofer IMWS’ latest innovations that will be shown at the Fraunhofer booth (hall 7/S01) at the leading trade fair for the plastics and rubber industry is thermoplastic fiber composite sandwich semi-finished products. Together with ThermHex Waben GmbH, the researchers from Halle have been working on the development of series-ready production and processing methods for high-performance fiber composite systems with thermoplastic honeycomb cores.

These semi-finished products are processed by the fiber composite technology industry in particular into sandwich panels and components, which are used, for example, in truck bodies or automotive interiors. The procedure developed by ThermHex makes it possible to manufacture a thermoplastic honeycomb core in a single work step through the extrusion of a foil web with subsequent vacuum rotation thermoforming process and folding. The subsequent inline lamination of thermoplastic surface layers of multi-directional laminates or impregnated fabrics on the honeycomb core allows for more resource efficient and significantly more cost-effective production compared with conventional procedures.

The series-ready sandwich construction resulting from this method is ideal for thermoplastic lightweight structures with complex geometry. The weight-specific bend and dent resistance is significantly increased which means that by using this so-called organo sandwich of semi-finished products, local ribbing is no longer necessary. At Fraunhofer IMWS, the characterization of the semi-finished products is based on their mechanical and thermal properties, as well as the determination of the optimal process and material technical parameters for production on the basis of experimental tests and accompanying numerical simulations. Through the work of the Fraunhofer researchers, the organo sandwich semi-finished products are to be made fit for large-scale production through targeted transformation for structural construction right up to the exact design of hybrid components.
“Lightweight design is one of the most important topics of the future for us,” says Prof. Peter Michel, head of the polymer applications business unit at the Fraunhofer IMWS. “We don’t just think about the processing methods, we take the entire value chain into account, from the micro-structure-based material design to the recycling,” he says.

An example of this is optimized materials for energy-efficient car tyres, which the Institute is also exhibiting at the trade fair. The researchers from Halle have succeeded in introducing recycled rubber as nanoscale fillers in the treads of commercial vehicle tires. Thanks to the exact knowledge of the rubber-based composite’s micro-structure, important mechanical properties such as hardness, modulus of elasticity or abrasion resistance can be influenced. The result is tires that retain wet grip and abrasion resistance while having less rolling resistance and thus help to reduce fuel consumption. At the same time, natural rubber resources are conserved. This innovation was awarded with the 2015 Hugo Junkers prize from the state of Saxony-Anhalt.

The Fraunhofer researchers also demonstrate a holistic view of material innovation with the Materials Data Space initiative. In this virtual space, digital data is available on constituent materials and semi-finished products to all the companies along the value chain – an important precondition for being able to supply appropriate materials and raw materials in the age of Industry 4.0. The platform is currently under development, with a key focus on fiber composite materials. “Our goal is intelligent, highly-functionalized fiber composite materials and components that can be custom-made in large-scale production technologies. We will do this using sensor processes, for example, to digitally capture the entire biography of the materials. The resulting interaction between material, component and process will lead to significantly improved material and process efficiency,” says Michel.

In hall 4, booth C03, Fraunhofer IMWS will also be presenting a joint project with Coatema Coating Machinery GmbH: a combined micro and nano embossing process, with which the surface of plastics can be modified exactly as required to produced optimized material properties based on the micro and nano levels.
Tapes with unidirectionally-aligned reinforcement fibers (the image shows the fiber-spreading facility) is one of the lightweight construction technologies seen as highly promising by researchers at Fraunhofer IMWS. © Fraunhofer IMWS.

The illustration may be used free of charge for editorial purposes for reports on this subject. The use of the image for other purposes is only permitted with the prior consent of Fraunhofer IMWS.

**The Fraunhofer Institute for Microstructure of Materials and Systems IMWS**

The greatest challenge facing mankind in the 21st century is the question of sustainability in all spheres of life, especially in the efficient use of limited raw materials. The Fraunhofer Institute for Microstructure of Materials and Systems IMWS conducts applied research in the field of material efficiency and is a major driving force, innovator and problem solver for the industry and public-service clients in the fields of reliability, safety, service life and functionality of materials used in components and systems. The key competences are to be found in the field of characterization of materials down to the atomic scale and in material development.

[www.imws.fraunhofer.de](http://www.imws.fraunhofer.de)

---

The **Fraunhofer-Gesellschaft** is the leading organization for applied research in Europe. Its research activities are conducted by 67 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of 24,000, who work with an annual research budget totaling more than 2.1 billion euros. Of this sum, more than 1.8 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft’s contract research revenue is derived from contracts with industry and from publicly financed research projects.

International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.