Strong, light, transparent: developing load-bearing panes made of fibre composite plastic

About this project

transComp

Strong, light, transparent: developing load-bearing panes made of fibre composite plastic

Markets:

Material: Glass fibres, Thermoset plastics, Thermoplastics, Laid webs, Woven fabrics, Glass-fiber reinforced plastics (GFRP)

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

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Context

Fibre-reinforced plastics (FRP) are established in lightweight construction because they combine high strength with low weight. So far, however, they have hardly been used in applications where transparency is required - for example, in viewing windows or glazing with a load-bearing function. Classic plastic panes made of polycarbonate fulfil optical requirements, but are unable to absorb structural loads. Combinations of glass and plastic also reach their limits when subjected to mechanical stress. Yet there is a great need for lightweight, stable and transparent materials, particularly in vehicle and aircraft construction. This is where the transComp project comes in.

Purpose

The researchers are investigating how fibre-reinforced plastics can be designed in such a way that they are not only strong and light, but also transparent. The team aims to combine two previously separate material properties in one material.

The aim of the project team is to develop transparent plastic discs that are mechanically resilient enough to take on structural tasks. Such components could be used in safety vehicles, for example, where glazing needs to offer protection and weigh as little as possible at the same time. The team is investigating various material combinations and production techniques in order to further develop both thermoplastic and thermoset solutions.

Using demonstrators - such as a visor with integrated heating - the researchers want to show that the combination of light transmission, impact resistance and mouldability is technically feasible. In addition to material development, they are also focussing on the CO# balance and recyclability of the plastics used in order to be able to assess the environmental impact of the new materials at an early stage.

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Procedure

The project team is initially developing suitable material systems in which the polymer matrix and reinforcing fibres have a similar refractive index - i.e. refract light in a comparable way. This is the only way to avoid optical distortions and enable a clear view.

At the same time, the researchers are adapting manufacturing processes such as resin transfer moulding - in which liquid resin is injected into a mould with inserted fibres and hardens there - hot pressing and thermoforming so that the new materials can be processed in flat or three-dimensional form. They are investigating both monolithic and multi-layer laminate structures, for example with layers of FRP, polycarbonate or glass. The team is focusing on the production of preforms using tailored fibre placement, which allows fibres to be placed in a load path-appropriate and material-efficient manner.

The scientists test the manufactured components with regard to optical and mechanical properties, for example by measuring dioptres and bullet impact tests. Finally, they evaluate the process from an ecological and economic perspective in order to identify potential for CO# savings and industrial implementation.

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Funding duration:

Funding sign:	03LB2023	**Funding amount:**	EUR 1.1 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2023A - transComp in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

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Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting Testing and trials, Engineering, Simulation	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight material construction	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Component and part analysis, Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Materials	✓
Plant construction & automation Others (Materials science and materials engineering)	✓
Recycling technologies Recycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing Others (Tailored Fibre Placement (TFP))	✓
Coating (surface engineering) Painting	✓
Fibre composite technology Resin infusion process, Resin transfer moulding, Others (Tailored Fibre Placement (TFP); RTM (Resin Transfer Moulding))	✓
Forming Thermal converting, Deep-drawing	✓
Joining	
Material property alteration Others (Modification of matrix systems)	✓
Primary forming	
Processing and separating Milling, Cutting	✓
Textile technology Fibre manufacturing	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Glass-fiber reinforced plastics (GFRP)	✓
Fibres Glass fibres	✓
Functional materials	
Metals	
Plastics Thermoset plastics, Thermoplastics	✓
Structural ceramics	
(Technical) textiles Laid webs, Woven fabrics	✓