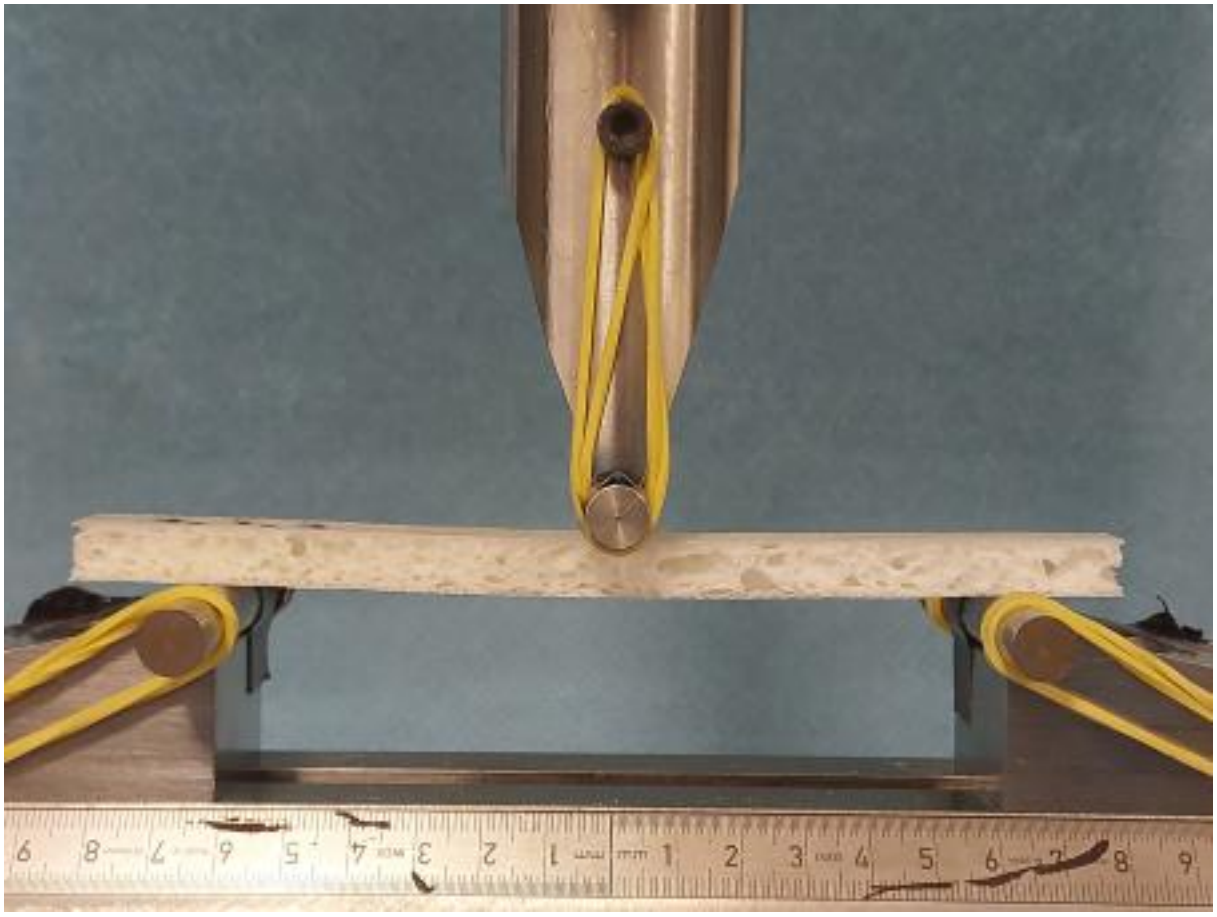
Building flame-retardant monomaterial-sandwich components: prepregs and epoxy resinfoams

About this project



FST-FoamPreg

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Markets:

Material: Bioplastics, Biocomposites, Glass fibres, Natural fibres, Thermoset plastics, Thermoplastics, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP), Natural fibre reinforced plastics (NFRP), Others (Metal inserts and semi-finished products manufactured using tailored fibre placement (TFP), sandwich components, assemblies with expandable moulding compounds), Closed-pore, Others (EP foam core)

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

Technology Transfer Program Leichtbau

Context

Sandwich components made from fibre-reinforced plastics (FRP) are well established in lightweight construction, particularly in the transport sector. They combine a lightweight foam core with stable cover layers and thus achieve high mechanical strength with low weight. In vehicles such as trains, aeroplanes or electric cars, the requirements for the fire behaviour of these materials are increasing significantly. In addition to strength and temperature resistance, properties such as flame propagation, smoke development and toxicity are becoming increasingly important.

There is a need for technological action, especially with foam cores and so-called prepregs - i.e. semi-finished fibre products that are already pre-impregnated with resin. This is because foams are often produced with chemical blowing agents. Prepregs, on the other hand, must be deep-frozen throughout storage and transport. This increases the energy requirement, causes additional costs and worsens the environmental balance. This is where the FST-FoamPreg research project comes in: The partners are developing flame-retardant, environmentally friendly and process-safe material systems for FRP components.

Purpose

The project team is developing a new material system for sandwich and lightweight components that fulfils high flame retardancy requirements while also offering ecological and economic benefits. The focus is on the combination of an epoxy resin foam that is foamed with CO# instead of conventional chemical blowing agents. The top layers are realised using thermally latent prepregs, i.e. prepregs that are stable at room temperature.

The partners harmonise the two components in such a way that they form an integral, industrially processable overall system. The two individual components (prepregs, foam) are both available as thermally latent semi-finished products. This opens up new possibilities for the use of sandwich components in applications where conventional materials reach their limits due to environmental regulations, cost pressure or technical restrictions.

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Procedure

The team is analysing the existing formulations of the epoxy resin foam and the prepreg top layer on the basis of a preliminary development on a laboratory scale. It is investigating the chemical composition, foaming behaviour with CO# as a blowing agent and reaction kinetics of both materials. The aim is to synchronise the curing of the core and top layer in such a way that both can be processed in a combined production step.

To increase production efficiency, the researchers favour isothermal over variothermal processes: The material is placed in a pre-heated mould and demoulded hot ("hot in/ hot out"). The foam can be available as a paste or flat semi-finished product for better handling. In the next step, the project team develops a process in which the foam expands in under 30 minutes and simultaneously reacts with the top layer to form a solid structure. To achieve this, they adjust the temperature curves, processing times and material parameters until a reliable component quality is achieved.

The layers are joined without any additional bonding steps. The partners also test the processability as well as the mechanical and thermal properties of the components. They test different geometries, layer thicknesses and production conditions, qualify the system for industrial use, prepare the transfer to specific applications in the transport sector and evaluate the scalability of the process.

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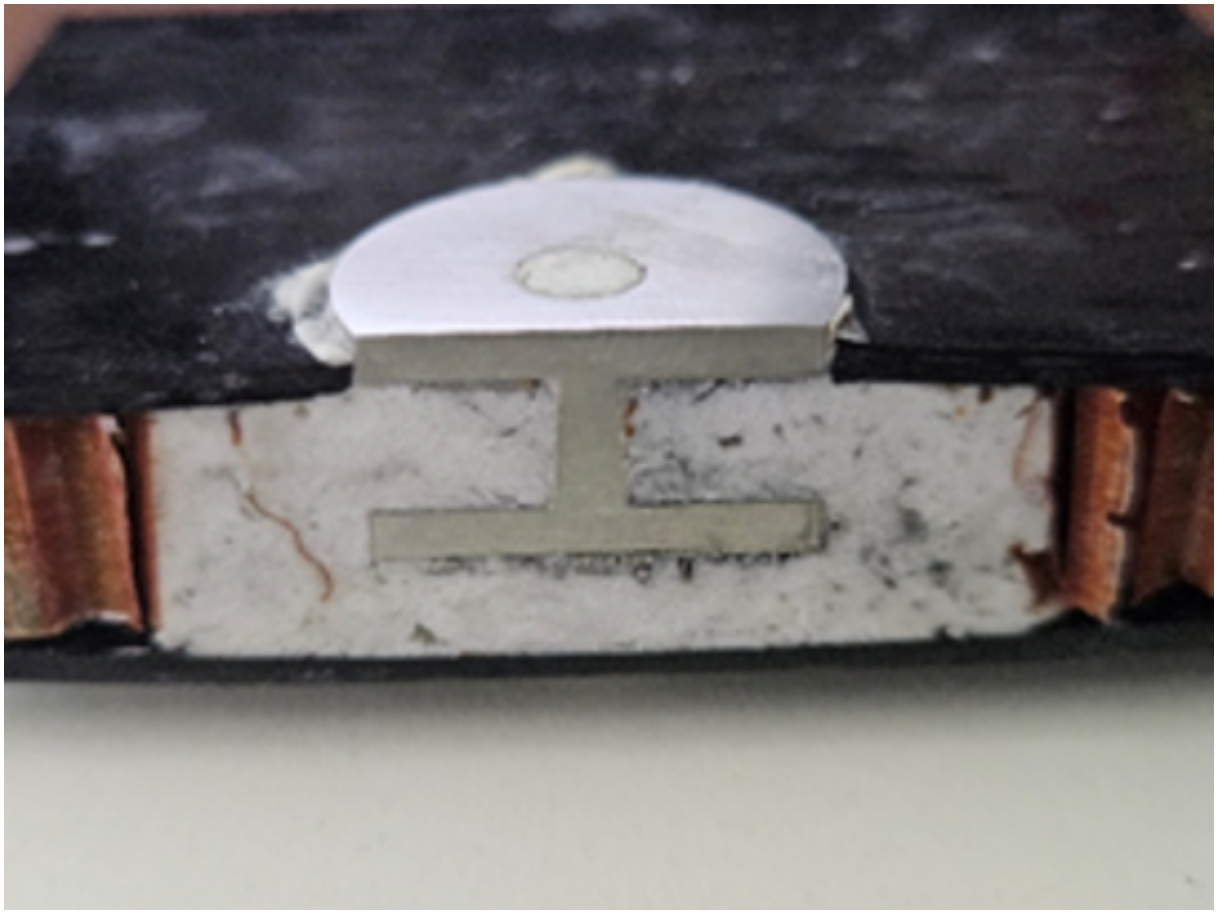

Funding duration:

Funding sign:	03LB2025	**Funding amount:**	EUR 1 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2025A - FST-FoamPreg in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts, Materials	✓
Services & consulting Testing and trials, Validation, Technology transfer, Others (Process development)	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Hybrid structures, Lightweight material construction	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Materials analysis	✓
Modelling and simulation Life-cycle analysis, Structural mechanics	✓
Plant construction & automation	
Recycling technologies Others (Life cycle assessment)	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering) Painting	✓
Fibre composite technology Resin transfer moulding, Pre-preg processing, Others (Tailored fibre placement (TFP); sandwich structures; SMC pressing processes; thermoplastic-SMC hybrid construction)	✓
Forming Compression moulding	✓
Joining Adhesive bonding	✓
Material property alteration Others (Material and process development for economical flame-retardant thermoset fibre composites)	✓
Primary forming Others (Foaming, prepreg compression moulding)	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials Bioplastics, Biocomposites	✓
Cellular materials (foam materials) Closed-pore, Others (EP foam core)	✓
Composites Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP), Natural fibre reinforced plastics (NFRP), Others (Metal inserts and semi-finished products manufactured using tailored fibre placement (TFP), sandwich components, assemblies with expandable moulding compounds)	✓
Fibres Glass fibres, Natural fibres	✓
Functional materials	
Metals	
Plastics Thermoset plastics, Thermoplastics	✓
Structural ceramics	
(Technical) textiles	