Carbon fibre-reinforced sheet moulding compound: building lightweight and sustainable vehicle parts

About this project

EcoDynamicSMC

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Markets:

Material: Carbon fibres, Thermoset plastics, Carbon-fiber reinforced plastics (CFRP)

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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

Chassis components are under constant mechanical stress - in road traffic as well as in aviation. At the same time, the requirements for climate protection and resource efficiency are increasing. In the future, these components should not only be efficient and safe, but also significantly lighter and more sustainable. Until now, they have mostly been made of steel or aluminium.

An interesting alternative is carbon fibre-reinforced sheet moulding compound (CF-SMC). This mouldable composite material made from short carbon fibres and plastic resin can be processed into particularly lightweight yet resilient components using a pressing process. This is why manufacturers are already using the material for many applications in lightweight construction However, CF-SMC has not yet been used for highly stressed structures in large-scale production. This is due to a lack of material data, inadequate prediction models and unestablished process chains.

Purpose

This is where EcoDynamicSMC comes in: The researchers are developing new methods to make CF-SMC usable for dynamically stressed, safety-relevant components - such as wishbones in cars or suspension elements in aeroplanes.

The project team wants to establish CF-SMC as a material for large-scale production - where aluminium or steel have dominated up to now. The partners are developing an end-to-end digital process chain from the material to the finished product. Their goal: to produce components that are significantly lighter, but just as resilient and safe.

For example, they want to build a CF-SMC wishbone that is around half as light as the previous aluminium component. At the same time, it should be possible to save CO2 over the entire life cycle.

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Procedure

The project team works along the entire development chain. It begins by recording material-relevant data directly during production - such as fibre flow, weight and quality. This data flows into a digital material twin, which enables automatic control of the production process. At the same time, the partners develop precise simulation models for forming, curing and component behaviour. The researchers align the fibres specifically along the main load paths and integrate functional elements directly into the extrusion process.

Two demonstrators show the practical suitability: a chassis wishbone for the automotive sector and a suspension part for a motorised glider. The team is evaluating both components in terms of performance, weight and recyclability. With a supplementary life cycle analysis, the researchers are analysing the environmental impact compared to the state of the art. In this way, the project partners want to demonstrate the potential of CF-SMC for sustainable series production in lightweight construction.

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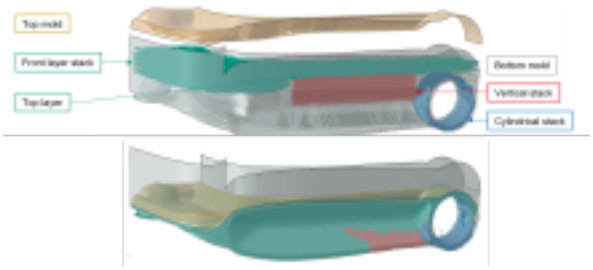

Funding duration:

Funding sign:	03LB3023	**Funding amount:**	EUR 2.2 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3023A - EcoDynamicSMC 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, Semi-finished parts, Materials	✓
Services & consulting	
Field of technology	
Design & layout Lightweight design, Lightweight construction concepts, Lightweight material construction	✓
Functional integration	
Measuring and testing technology Materials analysis, Destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Processes, Structural mechanics, Materials	✓
Plant construction & automation	
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Pre-preg processing, Others (Impact extrusion)	✓
Forming Impact extrusion, Thermal converting	✓
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology Others (SMC production)	✓
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Carbon fibres	✓
Functional materials	
Metals	
Plastics Thermoset plastics	✓
Structural ceramics	
(Technical) textiles	