Developing sustainable moulds for fibre composite components: with recycled paper

About this project

ReForm

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Markets:

Material: Others (Paper and (corrugated) cardboard), Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)

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 are used wherever lightweight and stable material is important - for example in aviation, vehicle construction or wind turbines. Fibre composite components are manufactured in moulds that specify the desired geometry and allow the laminate to cure. However, even minor deviations in the mould or in the process can lead to errors. To avoid this, manufacturers invest in elaborate simulations - but rejects remain high and reworking is frequent.

A central problem: moulding tools are usually made of metal or plastic. They are expensive, heavy, energy-intensive to manufacture and difficult to customise. Optimisation is often not worthwhile, especially for small series or prototypes. This creates a conflict of objectives: precise components require precise tools - but their production is expensive and resource-intensive. This is precisely where the ReForm research project comes in. The team is pursuing a new, sustainable approach to mould making for fibre composite components.

Purpose

The project team wants to make mould making simpler, more flexible and more resource-efficient. The aim is to replace conventional moulding tools, which are difficult to adapt, with modular alternatives made from bio-based materials - especially for small series, individual items and prototypes.

The researchers are focussing on the development of a new type of mould system based on corrugated cardboard. This established packaging material consists mainly of recycled waste paper, has a good ecological footprint and can be fully recycled. The scientists are combining a customisable corrugated cardboard structure with a flexible, shaping mat. Their aim is to develop moulding tools that can be produced quickly, modified easily and reused several times.

With this approach, the team aims to significantly reduce the use of materials and CO# emissions in mould making - and at the same time improve the quality and efficiency of fibre composite component production.

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Procedure

The researchers are developing a mould structure made of modular, pluggable corrugated cardboard elements. These form a three-dimensional compartment - a structuring, subdividing grid or honeycomb structure - which can be flexibly adapted to the desired geometry. They place a moulding mat on top of this structure, which defines the surface of the component. The result: lightweight, cost-effective and easily customisable moulds.

The team is also investigating the behaviour of the materials under real process conditions - for example during curing in an autoclave, a gas-tight sealable pressure vessel in which high-performance components are thermally treated and cured in the overpressure range. The aim is to prove the dimensional stability, thermal resilience and reusability of the cardboard structure.

Particularly in early development phases, this concept allows several successive versions or adaptations of a mould to be run through - without high resource consumption or high costs. This should not only make mould making more sustainable in future, but also faster and more practical.




Funding duration:

Funding sign: 03LB4012 **Funding amount:** EUR 566 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB4012A - ReForm in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Tools and moulds	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight design	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation	
Plant construction & automation	
Recycling technologies Recycling	✓
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Manual lamination, Pre-preg processing	✓
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials Others (Paper and (corrugated) cardboard)	✓
Cellular materials (foam materials)	
Composites Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)	✓
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles	