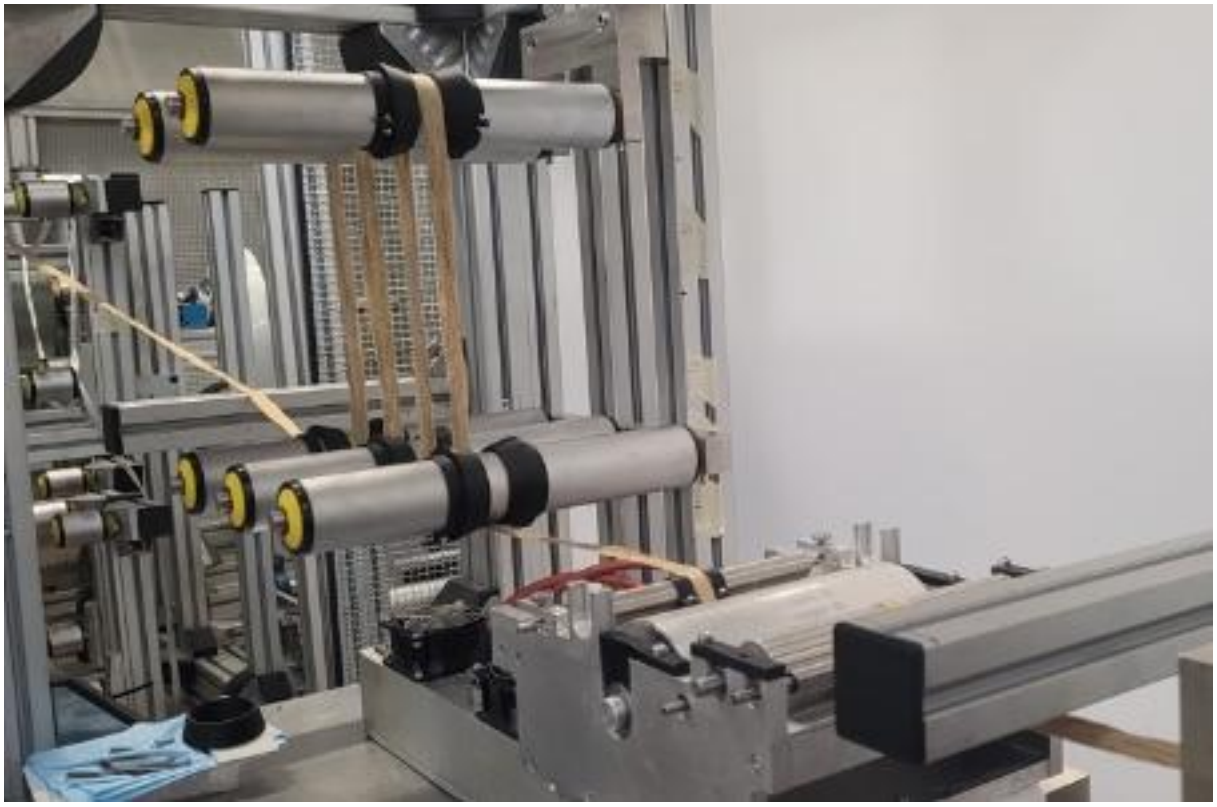
Bio-based fibre composites for lightweight products: Developing efficient series processes

About this project



Repro4Bio

Bio-based fibre composites for lightweight products: Developing efficient series processes

Markets:

Material: Biocomposites, Natural fibres, Others (Bio-based duromers), Yarns, rovings, Natural fibre reinforced plastics (NFRP)

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

Bio-based plastics and natural fibres can replace petrochemical raw materials. However, for end consumer products such as sports and leisure articles, there is often a lack of processes suitable for series production to manufacture load-bearing fibre composite components from such materials. Particularly in the case of thermoset composites, where the resin remains permanently solid after curing, this makes it difficult to return them to the material cycle, as the materials can only be separated and recycled to a limited extent.

The established manufacturing processes are also associated with high energy requirements. Conventional prepregs consist of fibres that are impregnated with resin in advance and usually require complex tempering and refrigerated storage.

This is precisely where the researchers in the Repro4Bio project come in: They are looking at natural fibre-reinforced lightweight components that can be produced in large quantities and also fulfil functional requirements. The researchers are using out-of-autoclave processes, i.e. production without energy-intensive pressurised ovens. The components achieve their strength directly in the process, without additional curing in an autoclave.

Purpose

The participants are developing a resource-efficient production technology to manufacture bio-based preliminary products such as pre-impregnated fibre tapes and fabrics and process them into components. They are demonstrating that the materials and processes are suitable for load-bearing applications and enable low reject rates and short cycle times.

They are also investigating how energy requirements and carbon footprint can be reduced compared to conventional solutions, for example through UV-cured resins, storage at room temperature and the use of natural fibres. The project team is proving the results using demonstrators from the sports and leisure sector, such as ski and outdoor poles and bicycle components, and evaluating scalability and cost-effectiveness.

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Procedure

First, the participants derive requirements for components and materials and select bio-based resins and natural fibres. They then carry out tests to evaluate the material combinations for processing and define the test methods.

The project team then develops production routes for pre-impregnated semi-finished products. This includes a pultrusion process with in-line impregnation for the production of bio-based fibre tapes. At the same time, the participants are developing compact UV LED modules that cross-link the resin in the process in a short time.

The researchers will then integrate the UV technology into deposition and winding processes, manufacture demonstrator components and test whether the curing process works reliably directly in the process. This is followed by material and component tests, practical tests, analyses of compostability and assessments of energy requirements, costs and transferability to industrial production.

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Funding duration:

Funding sign:	03LB2070	**Funding amount:**	EUR 852 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2070A - Repro4Bio 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, Machines and plants	✓
Services & consulting Consulting, Testing and trials, Prototyping, Validation, Technology transfer	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight material construction	✓
Functional integration	
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Destructive analysis, Non-destructive analysis	✓
Modelling and simulation	
Plant construction & automation Plant construction	✓
Recycling technologies Recycling, Others (Industrial composting)	✓
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Filament winding, Pre-preg processing	✓
Forming	
Joining	
Material property alteration	
Primary forming Pultrusion	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials Biocomposites	✓
Cellular materials (foam materials)	
Composites Natural fibre reinforced plastics (NFRP)	✓
Fibres Natural fibres	✓
Functional materials	
Metals	
Plastics Others (Bio-based duromers)	✓
Structural ceramics	
(Technical) textiles Yarns, rovings	✓