

Recycle glass fibres by type and without loss of quality: with debonding on demand

About this project



FVKCycle

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Markets:



Material:

Basalt fibres, Glass fibres, Metal fibres, Thermoset plastics, Thermoplastics, Glass-fiber reinforced plastics (GFRP), 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

Fibre-reinforced plastics (FRP) are key materials for lightweight construction - for example in the mobility, aerospace, construction and energy sectors. Glass fibre reinforced plastics (GRP) in particular currently have a large market share. However, while the advantages of composite materials in operation are convincing, the end of life of these materials poses a challenge: To date, there is no sustainable recycling strategy that allows the individual components to be separated by type and thus enables a circular material cycle.

Since 2005, FRPs have no longer been allowed to be landfilled. Instead, the components are shredded and used as low-grade fillers. Valuable raw materials such as glass fibres are lost in the process, as existing separation processes such as pyrolysis work at high temperatures - which massively damages the mechanical properties of the glass fibres. In addition to the technical challenges, a state-of-the-art industrial recycling process is also not economically attractive - primarily due to the low raw material prices for glass fibres. There is therefore a great need for an energy and cost-efficient recycling solution for GRP that preserves its value - not only from an ecological perspective, but also from an economic one. This is precisely where the team in the FVKCycle project comes in.

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Purpose

The participants want to develop a recycling technology for the pure recovery of glass fibres from GRP. The process should be economical and energy-efficient and enable glass fibre recovery without any loss of quality. The focus is on the principles of recyclability by design and debonding on demand. The material selection and the introduction of thermoresponsive substances during the GRP production process should enable the targeted and controllable loosening of the material bonds.

The thermo-activatable substances are to be activated at moderate temperatures of approx. 150 degrees Celsius, creating microcracks in the plastic. This weakens the polymer matrix locally without impairing the mechanical properties of the fibres. The advantage: The quality of the glass fibres remains unchanged and the glass fibres can be reused in new GRP components after separation from the plastic breakage. In addition, the broken plastic can continue to be used, for example as a filler. In this way, the project team aims to create a holistic solution and show that recycling is possible and marketable in the GRP sector.

Procedure

The participants are pursuing a novel approach and combining technologies from speciality chemicals production, glass fibre production, coating systems and textile technology. They are developing thermoresponsive substances that are introduced into both the plastic matrix and the sizing - the bonding layer on the glass fibre. To this end, the team is developing different encapsulation strategies for the thermoresponsive substances that are tailored to the respective application environment - aqueous sizing or solvent-free polymer matrix.

Moderate heating causes adhesion fractures at the fibre-polymer interface and cohesion fractures in the polymer matrix. This weakens the material at the crucial points and the glass fibres can be mechanically separated from the plastic without any loss of quality. The researchers will then test the process developed on a laboratory scale under realistic conditions to verify its suitability for practical use.

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About this project			
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Funding duration:			
<hr/>			
<hr/>			
Funding sign:	03LB1005	Funding amount:	EUR 713 thousand
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Final report			
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Further websites	foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB1005A - FVKCycle in the federal funding catalogue		

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Project coordination

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English (EN){ { Projektpartner } }



Institut für
Textiltechnik und
Labor für
Textilchemie



Albon-Chemie Dr. Ludwig-E. Gminder GmbH & Co. KG

Lightweighting classification

Realisation

Offer

Products

Semi-finished parts, Materials



Services & consulting

Testing and trials, Funding, Prototyping,
Technology transfer



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Lightweighting classification	
	Realisation
Field of technology	
Design & layout Hybrid structures	✓
Functional integration Thermal activation, Material functionalisation	✓
Measuring and testing technology Component and part analysis, Materials analysis	✓
Modelling and simulation Materials	✓
<i>Plant construction & automation</i>	
Recycling technologies Recycling	✓
Manufacturing process	
<i>Additive manufacturing</i>	
<i>Coating (surface engineering)</i>	
<i>Fibre composite technology</i>	
<i>Forming</i>	
<i>Joining</i>	
<i>Material property alteration</i>	
<i>Primary forming</i>	
<i>Processing and separating</i>	
Textile technology Fibre manufacturing, Yarn & roving production, Nonwoven & mats production, Knitting, laid web production	✓

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Lightweighting classification	
	Realisation
Material	
<i>Biogenic materials</i>	
<i>Cellular materials (foam materials)</i>	
Composites Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Basalt fibres, Glass fibres, Metal fibres	✓
<i>Functional materials</i>	
<i>Metals</i>	
Plastics Thermoset plastics, Thermoplastics	✓
<i>Structural ceramics</i>	
<i>(Technical) textiles</i>	