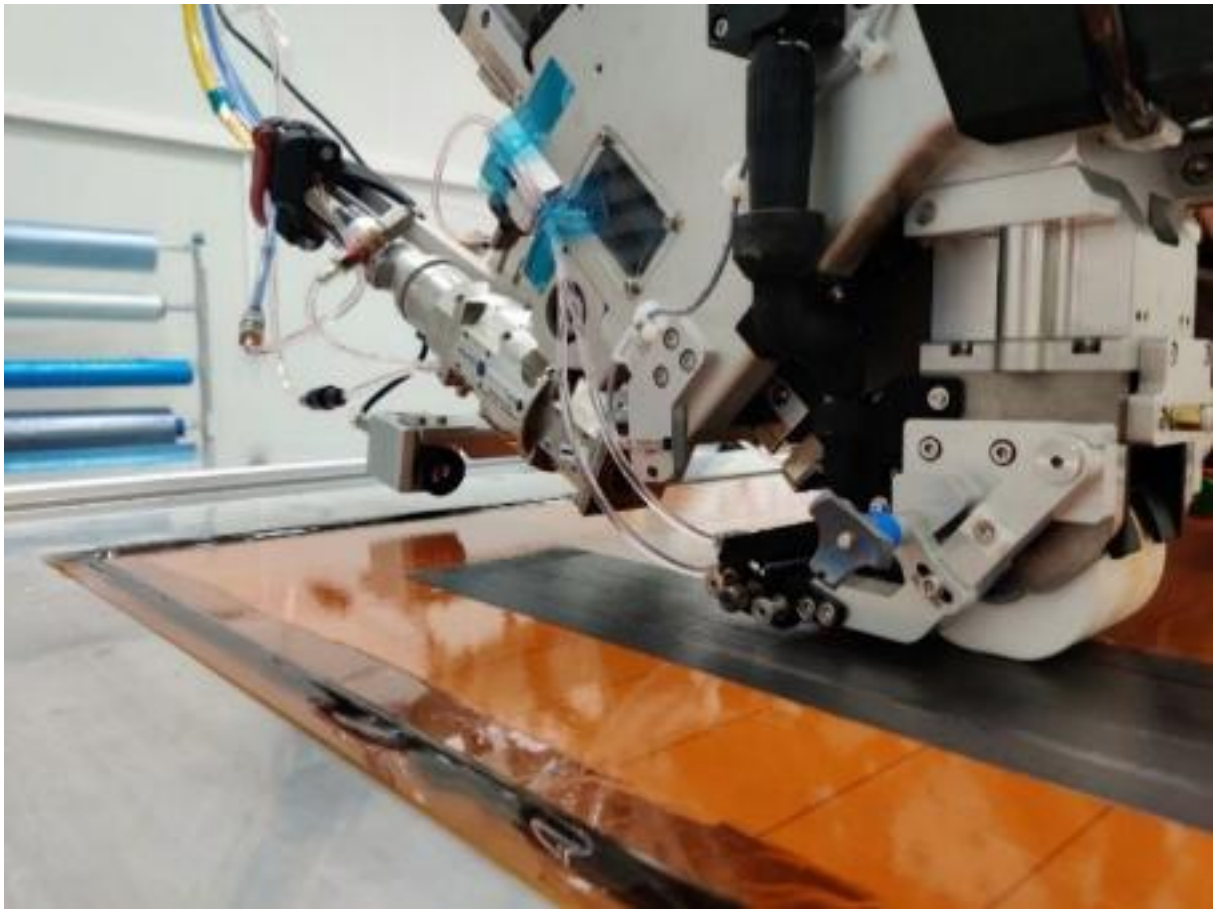
Recycling carbon fibre-reinforced plastics: raw materials for lightweight construction

About this project



Infinity

Recycling carbon fibre-reinforced plastics: raw materials for lightweight construction

Markets:

Material: Carbon fibres, Thermoplastics, Others (Tapes), 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 Climate Action.

Technology Transfer Program Leichtbau

Context

Carbon fibre reinforced plastics (CFRP) are important materials for many lightweight construction solutions, as they offer high strength and rigidity with low weight. However, the production of carbon fibres is energy and resource-intensive and emits large amounts of CO2. It also generates a great deal of production waste, as up to 40 per cent of the material is disposed of as offcuts or rejects during production. At the same time, this waste and CFRP components are often not recycled at the end of their product life cycle, but instead landfilled or incinerated - an environmentally damaging process that leaves valuable raw materials unused. In order to increase the recycling rate of CFRP, provide high-quality secondary raw materials and establish a closed material cycle for CFRP, new recycling technologies must be developed. This is where the scientists in the Infinity research project come in.

Purpose

The research team is pursuing the goal of recycling CFRP sustainably and economically and drastically reducing the use of primary material. To this end, the researchers are establishing a closed-loop system in which recycled carbon fibres (rCF) are recovered from CFRP waste and processed into semi-finished textile products. These materials should offer the same mechanical properties as primary material - but with a fraction of the energy and resource input. Using specially developed technologies, the researchers want to recycle not only the fibre itself, but also the pyrolysis oil - a by-product of the recycling process. With this holistic approach, the team aims to significantly reduce CO2 emissions along the entire process chain. The materials produced are not only more environmentally friendly, but also cost-efficient, which enables their broad application in various industries, such as aviation, automotive engineering and wind turbine construction.

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Procedure

The project team is initially developing a new type of pyrolysis pilot plant in which recycled carbon fibres are recovered in high quality and the resulting pyrolysis oil is processed for material recycling. At the same time, the researchers are developing a textile processing line that converts CFRP waste into high-quality intermediate products in the form of unidirectional tapes. They are testing these materials in industrial processes to prove their suitability for high-performance applications. With an accompanying life cycle analysis, the scientists are also ensuring that the targeted CO2 savings are measurable.

The developed Infinity tapes achieve around 88 per cent of the tensile strength and modulus of elasticity - this value indicates how much a material deforms under tension - of a comparable new fibre product. In addition, the life cycle analysis shows a reduction in greenhouse gas potential of up to 66 per cent depending on the choice of recycled fibre. The project thus makes an important contribution to the genuine substitution of new fibre CFRP instead of downcycling to weakly oriented materials and the associated loss of mechanical properties.

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Funding duration:

Funding sign:	03LB3006	**Funding amount:**	EUR 1.3 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3006A - Infinity in the federal funding catalogue

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Project coordination

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Organisation:

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V-Carbon GmbH

Lightweighting classification

	Realisation
Offer	
Products Semi-finished parts, Machines and plants, Materials	✓
Services & consulting Validation	✓

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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, Materials analysis, Non-destructive analysis	✓
Modelling and simulation Life-cycle analysis	✓
Plant construction & automation Plant construction	✓
Recycling technologies Recycling	✓
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Others (Organo-Tapes)	✓
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology Yarn & roving production, Nonwoven & mats production, Others (Tape production)	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Carbon fibres	✓
Functional materials	
Metals	
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles Others (Tapes)	✓