Recycled carbon fibres in concrete construction: forming thermoplastic reinforcement

About this project

REcyBAR

Recycled carbon fibres in concrete construction: forming thermoplastic reinforcement

Markets:

Material: Carbon fibres, Thermoplastics, Yarns, rovings, Carbon-fiber reinforced plastics (CFRP), Textile-reinforced concrete

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

Steel reinforcing bars are an integral part of concrete construction. They offer high strength, but are susceptible to corrosion, heavy and energy-intensive to produce. Fibre-reinforced plastics offer a lighter and corrosion-free alternative, but so far they are hardly malleable and difficult to recycle. In most cases, thermosetting plastics are used, which retain their shape after hardening and cannot be further processed. This means that they are only suitable to a limited extent for the diverse requirements in the construction industry. At the same time, the demand for resource-saving, durable building materials is growing.

This is precisely where the REcyBAR research project comes in: The project team is developing carbon fibre-reinforced reinforcements that are both adaptable and recyclable, thereby contributing to improved material and energy efficiency in the construction industry.

Purpose

The research team is developing reinforcing bars made from recycled carbon fibres and a thermoplastic matrix. This combination should make it possible for the first time to heat, bend or weld the rods after production - very similar to conventional reinforcing steel. This makes it possible to produce customised reinforcement shapes that can be precisely adapted to geometries and loads on site.

At the same time, the use of recycled fibres reduces the need for primary raw materials, while the thermoplastic matrix facilitates end-of-life recycling. Compared to steel, both CO# emissions during production and material and transport costs are reduced. The project therefore improves the resource efficiency and environmental footprint of concrete structures.

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Procedure

The researchers are initially developing a process for producing carbon staple fibre yarns from recycled fibres. These yarns are embedded in a thermoplastic matrix in an "in-situ pultrusion process", in which the liquid plastic material hardens directly in the mould. The result is a continuous rod whose surface is modified by thermal embossing or notching to create a secure bond with the concrete.

At the same time, the team is investigating how the rods can be thermally remoulded without losing strength or bonding properties. In laboratory tests, the scientists are analysing the load-bearing capacity, durability and behaviour of the concrete composite under various environmental conditions. Finally, a demonstrator component with fully integrated bars shows the technical feasibility and performance of the new reinforcement system.

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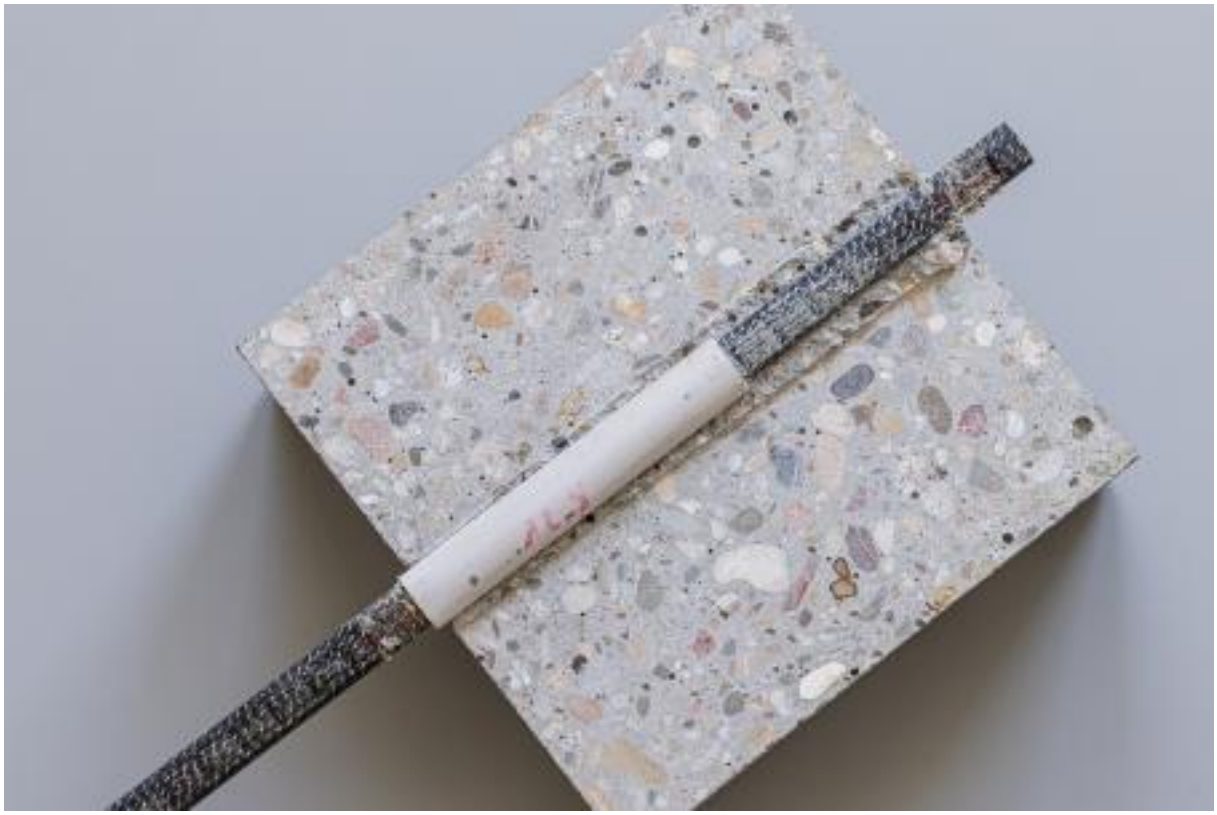

Funding duration:

Funding sign:	03LB2051	**Funding amount:**	EUR 1.2 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2051A - REcyBAR in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting Testing and trials, Prototyping, Technology transfer	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Hybrid structures	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Component and part analysis, Destructive analysis	✓
Modelling and simulation Life-cycle analysis	✓
Plant construction & automation Plant construction, Automation technology	✓
Recycling technologies Recycling	✓
Manufacturing process	
Additive manufacturing Others (Insitu pultrusion)	✓
Coating (surface engineering)	
Fibre composite technology Others (Insitu pultrusion)	✓
Forming Bending, Thermal converting	✓
Joining	
Material property alteration	
Primary forming Pultrusion	✓
Processing and separating Others (Profiling)	✓
Textile technology Yarn & roving production	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Carbon-fiber reinforced plastics (CFRP), Textile-reinforced concrete	✓
Fibres Carbon fibres	✓
Functional materials	
Metals	
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles Yarns, rovings	✓