Saving resources in concrete construction: new concepts for large-format carbon fibre reinforcement

About this project

CC-Mesh

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Markets:

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About this project

Material: Carbon fibres, Laid webs, 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

Context

Concrete is currently the most widely used building material in the world. However, its production causes high greenhouse gas (GHG) emissions. To increase the load-bearing capacity of concrete components, so-called reinforcement is inserted into the concrete. This usually consists of steel mats, rods or mesh, which require a thick concrete cover due to their susceptibility to corrosion and therefore cause high GHG emissions.

Carbon fibres, on the other hand, are six times more effective than steel and are not susceptible to corrosion. The use of carbon fibres instead of steel can therefore significantly reduce the amount of reinforcement and concrete required. However, different load cases have so far been considered separately when designing steel and carbon fibre reinforcement. This can lead to over-reinforcement and thus to an increased use of resources.

Purpose

The project partners want to develop innovative, large-format carbon reinforcements for concrete construction and optimise them for industrial application. These carbon structures should be force-flow-compatible and particularly durable, resulting in resource-saving concrete components. To achieve this, they want to combine design and construction principles from lightweight construction with those of conventional concrete construction. This would also reduce GHG emissions during production and release them into the environment. The project partners anticipate a GHG savings potential of 86 per cent in the area of building construction compared to conventional reinforced concrete construction.

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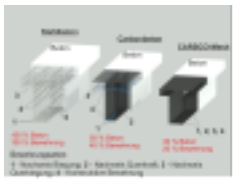
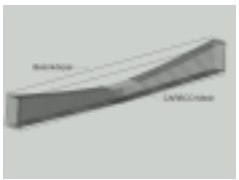
Procedure

The team no longer installs individual reinforcements for the different load cases, but an optimised and self-contained reinforcement structure. As a result, three-dimensional structures can be created that optimally adapt to the flow of forces and are therefore highly effective and resource-saving. The reinforcements can then be cast with a lower concrete cover. This allows significant material savings to be made on both the concrete and the reinforcement.

Thanks to its cross-technology composition, the team can cover the entire value chain. The researchers are optimising the geometry and mechanical properties of the new type of reinforcement structure and adapting the production process accordingly. They are developing a process for the production of impregnated and wrapped fibre strands that enables a very high utilisation of the fibre tensile strength in the strands by optimising the alignment of the individual fibres. The mechanical properties of the reinforcement within concrete components can also be optimally utilised by optimising the strand arrangement within the reinforcement cages on a test basis.


Funding duration:

Funding sign: 03LB3003 **Funding amount:** EUR 1.8 million

Final report

Further websites

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight construction concepts	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation	
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Filament winding	✓
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Textile-reinforced concrete	✓
Fibres Carbon fibres	✓
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles Laid webs	✓