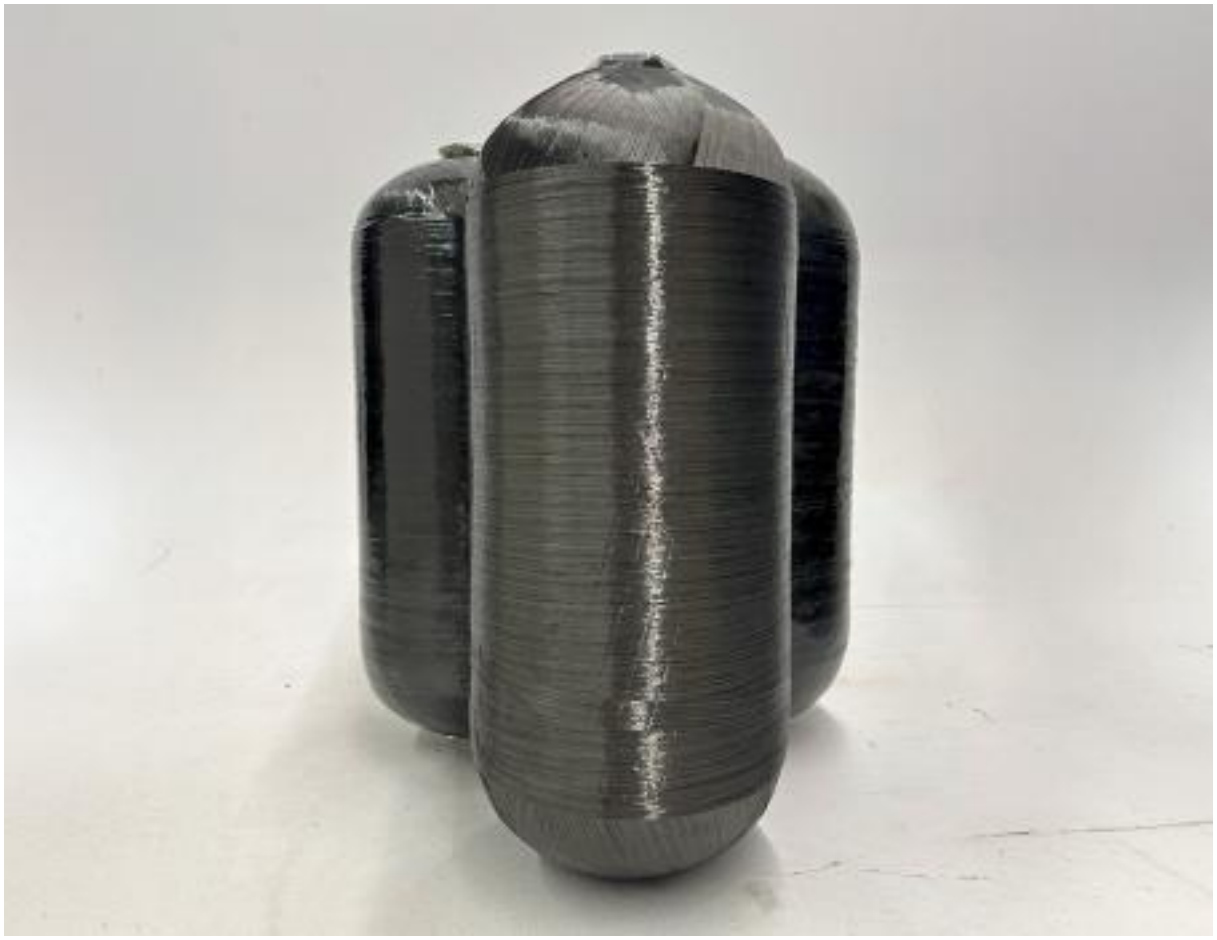
Virtual design and new materials: resource-efficient production of hydrogen tanks

About this project



HyCoPE

Virtual design and new materials: resource-efficient production of hydrogen tanks

Markets:

Material: Carbon fibres, Thermoset plastics, 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

The transport sector is responsible for a significant proportion of CO# emissions in Germany and is therefore a key area of action for climate protection. Hydrogen-powered drives are considered a key technology for climate-friendly mobility - especially in the commercial vehicle sector, where battery-powered solutions are reaching their limits. However, the widespread use of fuel cell vehicles has so far been thwarted by the high system costs - in particular the costly production of pressurised hydrogen tanks, which account for up to 30 percent of the total costs. The carbon fibres that make the tank stable and light at the same time are particularly expensive. Their energy-intensive production causes additional CO# emissions. In order to make fuel cell vehicles more competitive and accelerate their wider use, more economical and resource-efficient tank production is needed. This is precisely where the HyCoPE research project comes in.

Purpose

The project team is pursuing the goal of making hydrogen pressure tanks lighter, cheaper and more climate-friendly. The researchers are looking at the entire development and production process - from material production to manufacturing and quality assurance. They want to reduce the amount of material used without compromising safety or performance.

To achieve this, the researchers are using virtual design methods that enable precise tank dimensioning. This allows them to reduce the previously necessary safety margin and lower the consumption of resources. A newly developed measuring system is intended to make production more precise and detect errors at an early stage.

The team is also developing a new coil-infiltrated TowPreg semi-finished product that combines high-quality fibres with a resin matrix and can be produced much more cheaply than previous materials. TowPregs are pre-impregnated fibre bundles in which the resin is already evenly applied - this makes processing easier and saves material. The researchers hope to reduce tank costs by up to 15 per cent and at the same time reduce CO# emissions per tank by around 370 kilograms.

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Procedure

The project team is combining methods from simulation, material development and production technology in order to optimise the production of hydrogen pressure tanks in their entirety. First, the researchers are developing a cost-efficient TowPreg material that can be flexibly adapted to different fibre types and resin systems.

At the same time, the partners are developing digital simulation models that digitally map both the tank structure and the winding process. To this end, they are developing an innovative measuring system that records important quality features such as the fibre angle in real time during the winding process. Using the digital twin, they feed real production data back into the virtual design and continuously improve the design and process control. This allows the use of materials and weight to be reduced in a targeted manner.

The researchers then test the developed technologies under real conditions, integrate them into existing systems and prepare them for series production.

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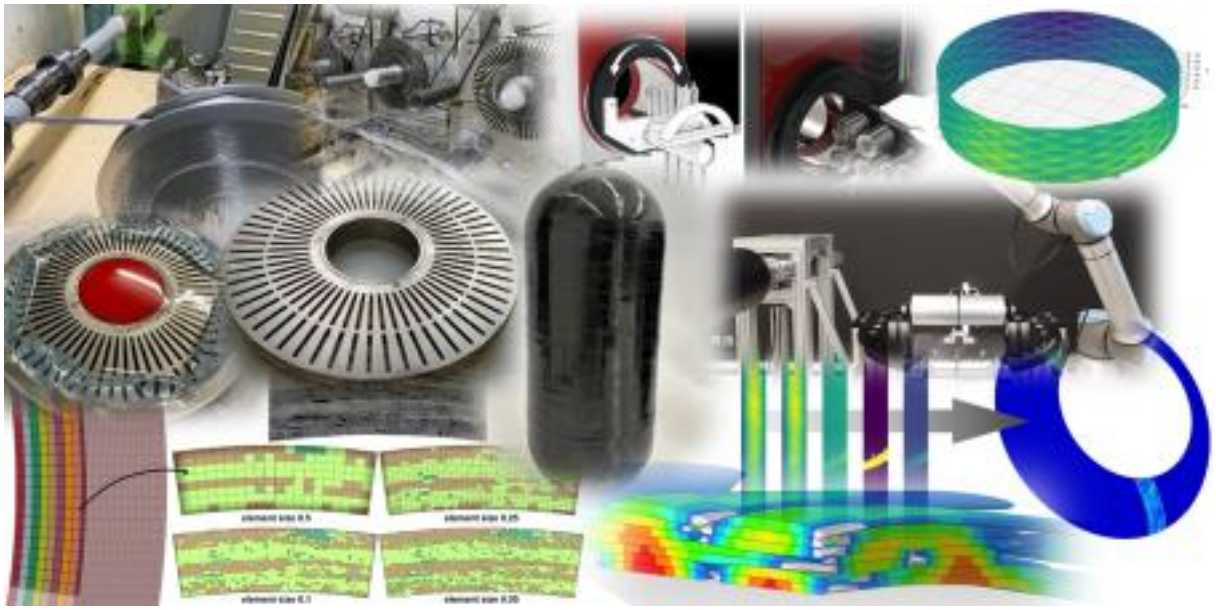

Funding duration:

Funding sign:	03LB2039	**Funding amount:**	EUR 1.4 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2039A - HyCoPE in the federal funding catalogue

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Project coordination

Contact:

Mr Dr.-Ing. Jan-Philipp Fuhr

+49 0711 2637-5600

fuhr@cikoni.com

Organisation:

CIKONI GmbH

Zettachring 12A
70567 Stuttgart
Baden-Württemberg
Germany

www.cikoni.com

English (EN){{ Projektpartner }}

Lightweighting classification

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

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Lightweighting classification

	Realisation
Field of technology	
Design & layout	
Functional integration	
Measuring and testing technology Materials analysis	✓
Modelling and simulation Processes, Materials	✓
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Filament winding, Pre-preg processing	✓
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology Preforming	✓

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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 Thermoset plastics	✓
Structural ceramics	
(Technical) textiles	