

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

About this project



H2Flex

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

Markets:  

Material: Bioplastics, Carbon fibres, Thermoset plastics, Aluminium, Yarns, rovings, Carbon-fiber reinforced plastics (CFRP)

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

About this project

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

Storing hydrogen is one of the key technical challenges of hydrogen-based mobility. In cars and small aircraft, hydrogen is usually stored in gaseous form and under high pressure in cylindrical pressurised containers. Tanks with a liner, i.e. an inner shell for sealing, and a load-bearing wrap made of fibre composite material are common.

This design is technically established, but only allows limited geometric adjustments in terms of length and diameter. However, in order to optimally utilise the available installation space, pressure tanks are required that can be flexibly adapted geometrically to the available installation space. For this reason, the Leibniz Institute for Composite Materials has developed and patented a pressure tank design in which the length and diameter can be adjusted almost at will.

A completely new manufacturing process was developed to produce these pressure tanks. However, this requires a lot of manual labour and is therefore not economical.

Purpose

In the H2Flex research project, the project team is developing a manufacturing concept with which this tank design can be produced automatically and economically. Based on the developed concept, the next step will be to set up a production plant to manufacture the pressurised tanks. The aim is to turn a proven construction method into an industrially usable overall concept.

In addition, the resource consumption resulting from the production of the pressure tanks is to be reduced. To this end, the researchers are using a bio-based resin system instead of a petroleum-based winding resin. They are also designing the metallic functional areas of the tank in such a way that loads are transferred safely and the sealing and wear properties meet the requirements of a hydrogen pressure tank.

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

About this project

Procedure

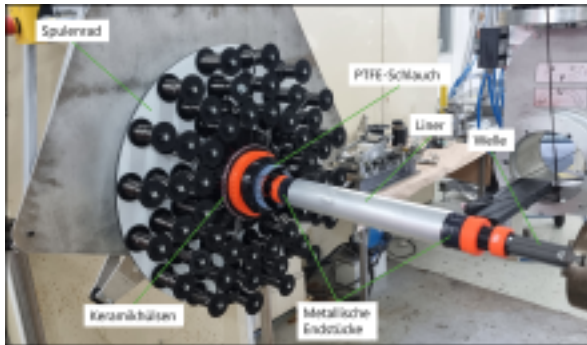
The project partners are transferring the new tank design into a continuous manufacturing process. To do this, they combine a liner with a load-bearing structure made of a fibre-plastic composite. The researchers apply the fibres in a targeted manner in the longitudinal and circumferential direction of the tank. In this way, they align the reinforcement with the loads in the pressurised tank. They transfer the forces from the cylindrical tank area to the metallic end pieces, known as domes, in a controlled manner.

As this design cannot be produced using conventional winding processes, the project team is developing a new, automatable process for this and is planning a near-series production system based on this.

At the same time, the partners are adapting a bio-based resin system to the requirements of the process. At the same time, they are optimising the materials and surfaces of the metallic components so that the joints remain tight, loads are transferred reliably and contact surfaces function with low wear over the long term. Simulations as well as material, structure and pressure tests on samples and demonstrators ensure the development.

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

About this project



Funding duration:

Funding sign:

03LB3100

Funding amount:

EUR 1.7 million

Final report

Further websites
leichtbauatlas.de

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3100A - H2Flex in the federal funding catalogue

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

Project coordination

Contact:

Ms Dr. Nicole Motsch-Eichmann

+49 631 2017-423

nicole.motsch@ivw.uni-kl.de

Organisation:

Leibniz Institute for Composite Materials GmbH

Erwin-Schrödinger-Straße 58
67663 Kaiserslautern
Rhineland-Palatinate
Germany

☞ www.ivw.uni-kl.de



English (EN){ { Projektpartner } }



Karl Wolf Präzision³ eK

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

Lightweighting classification	
	Realisation
Offer	
Products Parts and components, Machines and plants, Tools and moulds	✓
Services & consulting Testing and trials, Engineering, Validation, Simulation	✓
Field of technology	
Design & layout Lightweight manufacturing, Hybrid structures	✓
<i>Functional integration</i>	
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Structural mechanics, Materials	✓
Plant construction & automation Plant construction	✓
Recycling technologies Recycling	✓

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

Lightweighting classification	
	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering) Others (Diamond coating)	✓
Fibre composite technology Filament winding	✓
<i>Forming</i>	
Joining Adhesive bonding, Others (Positive locking)	✓
<i>Material property alteration</i>	
<i>Primary forming</i>	
Processing and separating Turning	✓
<i>Textile technology</i>	

Flexible design of hydrogen pressure tanks: Precise utilisation of limited space

Lightweighting classification	
	Realisation
Material	
Biogenic materials Bioplastics	✓
<i>Cellular materials (foam materials)</i>	
Composites Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Carbon fibres	✓
<i>Functional materials</i>	
Metals Aluminium	✓
Plastics Thermoset plastics	✓
<i>Structural ceramics</i>	
(Technical) textiles Yarns, rovings	✓