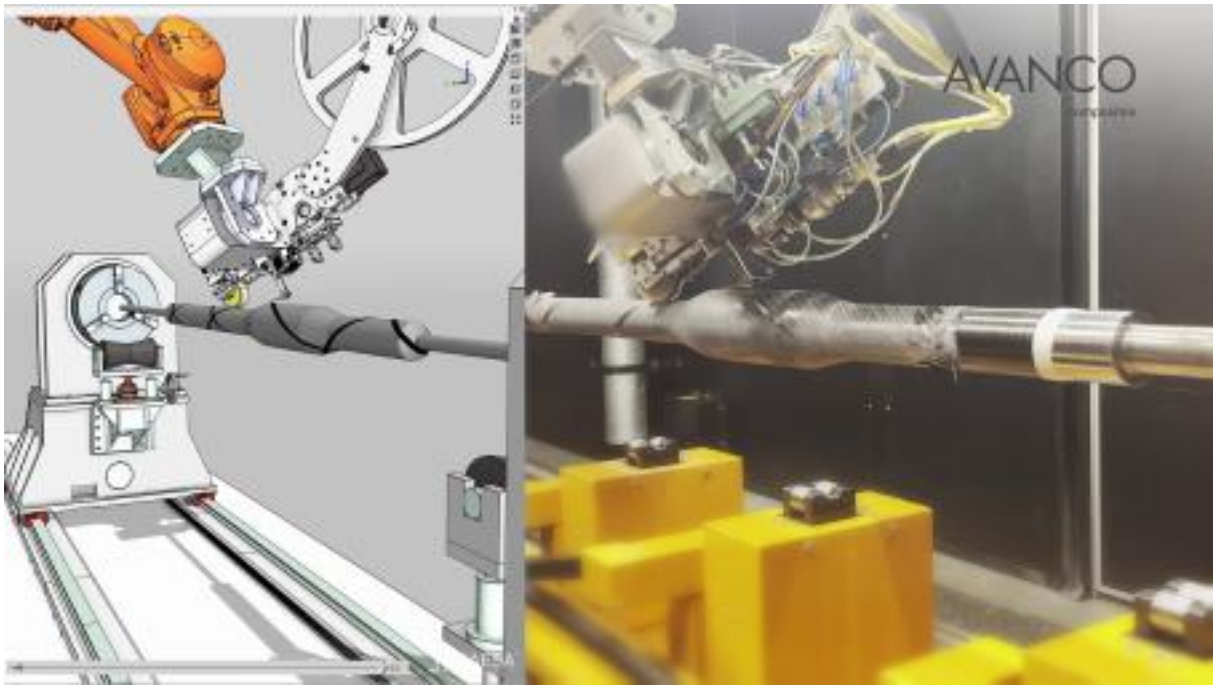
Lightweight and recyclable: Drive shaft made from thermoplastic fibre composite

About this project



AFP-Shaft

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Markets:

Material: Glass fibres, Carbon fibres, Others (FKV), Thermoplastics, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)

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

Drive and side shafts transmit the engine power directly to the wheels. Until now, manufacturers have usually made them from steel. However, this is heavy, susceptible to corrosion and requires additional bearing points. As heavy components in the drivetrain, they increase the energy requirement when driving.

Lighter alternatives made of carbon fibre-reinforced plastic (CFRP) are already in use, but are based on thermoset materials that are almost impossible to recycle and are energy-intensive to manufacture. There has also been a lack of end-to-end digitalised production control and process monitoring to date. This is where the AFP-Shaft research project comes in. The team is developing an improved CFRP shaft and, in parallel, a new, fully recyclable lightweight construction solution with digital process monitoring.

Purpose

The project partners are developing a new type of drive and side shaft made from a thermoplastic fibre-reinforced plastic (FRP) composite. The aim is to achieve a weight saving of over 65 per cent compared to conventional steel shafts - while at the same time achieving a high mechanical load-bearing capacity. The new shaft can be completely recycled. This closes the material cycle.

At the same time, the project team is optimising existing thermoset CFRP shafts by developing a digitally controlled process chain with integrated sensor technology. Both development strands are interlinked: the digital tools for process monitoring, material design and quality assurance support both further development and new development.

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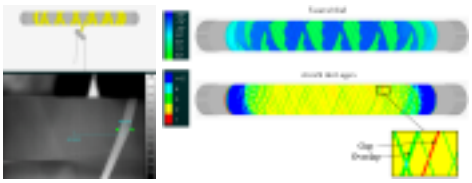
Procedure

The project team is initially analysing existing CFRP corrugations with a thermoset matrix. It is analysing energy consumption, material usage and process quality and developing a digital production chain with an integrated sensor system. This enables end-to-end quality control and traceability over the entire life cycle.

At the same time, a new shaft made of thermoplastic FRP is being produced using automated fibre placement technology (AFP). An automated system applies the fibres to a mould layer by layer - precisely, saving material and without subsequent curing. The researchers adapt the component precisely to loads such as bending, torsion and vibration.

An accompanying Life Cycle Assessment (LCA) evaluates the environmental impact over the entire product life cycle. The aim is to develop a recyclable lightweight construction solution suitable for series production for use in the automotive industry.



Funding duration:

Funding sign: 03LB3061

Funding amount: EUR 788 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3061A - AFP-Shaft in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

SINFOSY digital GmbH

Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight material construction	✓
Functional integration Sensor technology	✓
Measuring and testing technology	
Modelling and simulation Loads & stress, Life-cycle analysis, Multiphysics simulation, Processes, Materials	✓
Plant construction & automation	
Recycling technologies Recycling	✓
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Others (Automated fibre placement technology (AFP))	✓
Forming	
Joining	
Material property alteration Heat treatment	✓
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

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