Digital process control: manufacturing fibre composite components more efficiently

About this project

logischer

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Markets:

Material: Biocomposites, Aramid fibres, Glass fibres, Carbon fibres, Natural fibres, Others (Thermoplastic fibres), Thermoset plastics, Thermoplastics, Yarns, rovings, Nonwovens, mats, Aramid fibre composites, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP), Natural fibre reinforced plastics (NFRP), Laminates

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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

Fibre composite components consist of fibres embedded in a plastic matrix. They combine low weight with high strength. They are therefore used where components need to fulfil high requirements and at the same time be as light as possible.

In order for companies to be able to manufacture such components economically, even with complex geometries and in series production, the processes must be precise and stable. Tight tolerances, consistent component quality and efficient use of materials, energy and labour are required. At the same time, energy consumption, waste and the use of consumables should be minimised.

This is why digital and automated processes are becoming increasingly important in fibre composite production. They help to better monitor production processes, utilise process data in a targeted manner and manufacture components more consistently. The logischer project is dedicated to the question of how the production of lightweight fibre composite components can be made more resource-efficient and at the same time digitally controllable.

Purpose

The project partners are developing a resource-saving production method for lightweight fibre composite components. They are improving the production of complex series components and semi-finished products by increasing the quality of the components, reducing production fluctuations and making the processes digitally recordable and controllable. In this way, the researchers save material, energy and consumables while at the same time complying with tighter tolerance requirements. The team is thus creating an alternative to the processes currently in use. These are curing processes under pressure and temperature in closed systems.

At the same time, the researchers are integrating process data such as the degree of curing, temperature and pressure curve into a digital quality management system. In this way, they are making production more transparent, improving process reliability and creating the basis for more automated and climate-friendly fibre composite production.

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About this project

Procedure

The researchers are developing intelligent component moulds and reusable vacuum bonnets that can be adapted to different component geometries and production requirements. They are equipping these moulds with sensors, actuators and wireless data technology. In this way, the project partners record the degree of hardening of the resin as well as the temperature and pressure directly during production.

The data is available online and flows directly into the process control. On this basis, the researchers adjust the wall thicknesses and fibre volume content, i.e. the proportion of fibres in the component, in a targeted manner.

At the same time, the team uses vacuum bonnets with an integrated flow aid. This replaces some of the consumables previously required. The project partners are also designing the sensors and actuators in such a way that they can be transferred to a successor mould and reused after a mould has worn out.

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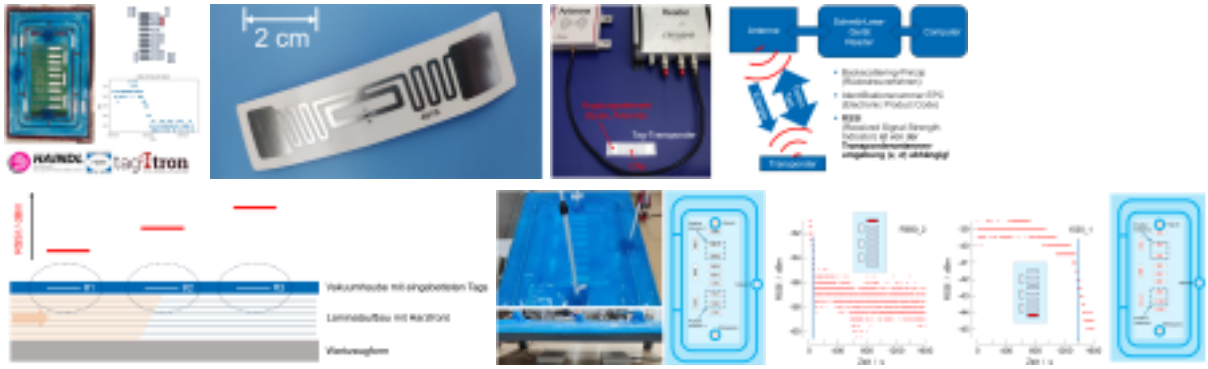

Funding duration:

Funding sign:	03LB1014	**Funding amount:**	EUR 747 thousand

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB1014A - more logical in the federal funding catalogue

www.faserinstitut.de/wp-content/uploads/2024/10/Liquid_Composite_Molding.pdf - Presentation of logical in the Liquid Com

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Project coordination

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English (EN){{ Projektpartner }}

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts, Software & databases, Systems and end products, Tools and moulds	✓
Services & consulting Training, Consulting, Testing and trials, Validation, Technology transfer, Maintenance and repair, Others (Research and development)	✓
Field of technology	
Design & layout Lightweight manufacturing, Lightweight material construction	✓
Functional integration Actuator technology, Sensor technology	✓
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Environmental simulation, Materials analysis, Destructive analysis, Non-destructive analysis, Others (RFID transponder analysis)	✓
Modelling and simulation Crash behaviour, Loads & stress, Processes, Structural mechanics, Materials	✓
Plant construction & automation Automation technology	✓
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology Filament winding, Manual lamination, Resin infusion process, Resin transfer moulding, Pre-preg processing, Vacuum infusion	✓
Forming Thermal converting	✓
Joining Welding	✓
Material property alteration	
Primary forming Pultrusion, Injection moulding	✓
Processing and separating	
Textile technology Fibre manufacturing, Preforming, Nonwoven & mats production	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials Biocomposites	✓
Cellular materials (foam materials)	
Composites Aramid fibre composites, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP), Natural fibre reinforced plastics (NFRP), Laminates	✓
Fibres Aramid fibres, Glass fibres, Carbon fibres, Natural fibres, Others (Thermoplastic fibres)	✓
Functional materials	
Metals	
Plastics Thermoset plastics, Thermoplastics	✓
Structural ceramics	
(Technical) textiles Yarns, rovings, Nonwovens, mats	✓