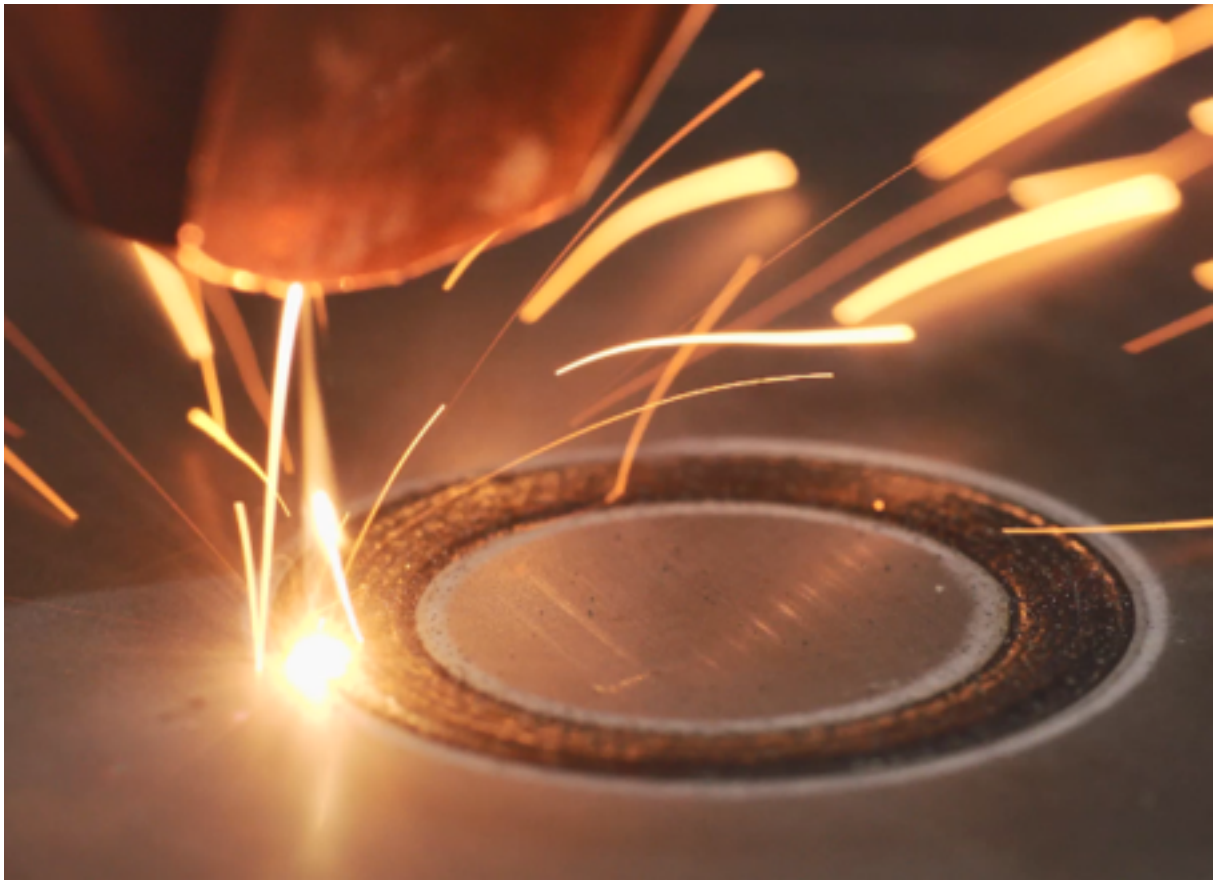
Producing components in a resource-saving way: with forming technology and 3D printing

About this project



HyConnect

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Markets:

Material: Steel

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This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Climate Action.

Technology Transfer Program Leichtbau

Context

Industrial companies need to make their manufacturing processes more efficient, resource-saving and environmentally friendly. At the same time, there is a growing demand for lightweight components that reduce the weight of machines and vehicles and thus save energy.

However, many conventional manufacturing methods consume large amounts of energy and material. Highly resilient components are often produced in several complex steps that require high temperatures and long processing times. This leads to high resource consumption and considerable CO2 emissions. In addition, conventional processes waste a lot of material because components are often milled or cut from solid raw material.

This is where the HyConnect research project comes in. The researchers are combining forming technology with additive manufacturing to produce high-performance lightweight components using less energy and material. Instead of removing excess material, they use materials only where they are needed. This saves resources and makes production more sustainable.

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Purpose

The project team is developing a hybrid manufacturing method that combines the advantages of forming technology and additive manufacturing. While forming processes are characterised by high material and energy efficiency, additive manufacturing enables flexible and precise adaptation of component properties. The combination of both processes results in components that require fewer resources.

The focus is on the development of a barrel sleeve that has to withstand high mechanical loads. Until now, this component has been produced in several energy-intensive steps. The research team is pursuing a new approach: using laser powder deposition welding (LPAS), the researchers want to apply wear-resistant layers in a targeted manner in order to improve the material properties locally. One particular advantage is the in-situ alloy formation, which allows them to adjust the material composition during production. This eliminates the need for subsequent heat treatment, which normally requires high temperatures and a lot of energy.

The researchers also rely on digital process monitoring. It controls production in real time so that machines react immediately to deviations. This not only improves the quality of the components, but also increases the efficiency of the entire value chain.

Procedure

First, the researchers test how additively applied structures can be moulded and which material properties are created in the process. They then produce a demonstrator sleeve with specifically reinforced wear areas. They use new material models to precisely predict the behaviour of the material during forming.

Another focus is on process monitoring and digitalisation. A blockchain-based data platform documents all production steps in a tamper-proof manner and enables data to be shared across companies. This allows production processes to be traced back precisely and optimised in a targeted manner. The continuous synchronisation of process parameters reduces waste and the researchers increase resource efficiency.

At the end of the project, the team will test the new production method under real-life conditions. The results are not only interesting for the automotive industry, but also for other sectors that require sustainable and high-performance components - from aviation to mechanical engineering.

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Funding duration:

Funding sign: 03LB3010 **Funding amount:** EUR 1.1 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3010A - HyConnect in the federal funding catalogue

Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts, Software & databases, Materials, Tools and moulds	✓
Services & consulting Testing and trials, Prototyping, Validation, Simulation, Technology transfer	✓
Field of technology	
Design & layout Lightweight manufacturing, Hybrid structures	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Processes, Materials	✓
Plant construction & automation	
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing, Deposition welding	✓
Coating (surface engineering)	
Fibre composite technology	
Forming Deep-drawing	✓
Joining	
Material property alteration Thermomechanical treatment, Heat treatment	✓
Primary forming	
Processing and separating	
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Steel	✓
Plastics	
Structural ceramics	
(Technical) textiles	