3D printing with metal: utilising industrial waste materials as a powder source

About this project

AddUp

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Markets:

Material: Steel

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

3D printing with metal enables lightweight construction solutions that are almost impossible to realise with conventional manufacturing processes. Complex geometries, variable use of materials and a functional design can be implemented directly - without expensive moulds or machining. However, although these advantages are well known, industrial use remains limited. One reason: the production of the required metal powder is energy-intensive, expensive and causes high CO# emissions.

At the same time, the production of metallic blasting abrasives generates large quantities of unused powder. Until now, they have been considered waste. This is precisely where the project team comes in: it wants to utilise these high-quality residual materials for 3D printing, thereby reducing the ecological burden and increasing the economic efficiency of additive manufacturing with metal.

Purpose

In the AddUp project, the researchers are pursuing the goal of improving the additive manufacturing of lightweight structures both ecologically and economically. They want to recycle metallic production waste from abrasive production as a starting material for 3D printing and thus significantly reduce the use of conventionally produced metal powder. This upcycling eliminates a large part of the energy-intensive manufacturing process - especially atomisation and annealing.

At the same time, the project partners are developing functional lightweight components. The combination of resource-saving powder recycling and material-selective component design should significantly improve the carbon footprint and at the same time increase the cost-effectiveness of 3D printing with metal. In this way, AddUp is creating the conditions for the wider industrial use of additively manufactured lightweight construction - especially for dynamically loaded components in small series.

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Procedure

The researchers are developing a process to utilise metallic waste from abrasive production for 3D printing. They are investigating the powder properties, preparing the material and testing it in generative build-up welding - a process in which a laser melts metal powder in a targeted manner and applies it layer by layer. Unlike the powder bed process, large, load-bearing components can also be manufactured efficiently using this method.

The project partners are designing a new print head in order to be able to process powders of different qualities in a targeted manner. This mixes the materials in real time and delivers them directly to the component - without long downtimes. At the same time, the researchers are using bionic topology optimisation to design the component geometries in such a way that they only use material where it is mechanically necessary. This saves mass and energy.

Finally, they will test the practical suitability of the method using specific applications in mechanical engineering - for example, for components that need to move quickly and precisely. This is how the transfer to industrial practice should succeed.

Funding duration:

Funding sign:	03LB3060	**Funding amount:**	EUR 826 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3060A - AddUp in the federal funding catalogue

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Project coordination

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CHIRON Group ERVIN DREHER AUTOMATION

Lightweighting classification

	Realisation
Offer	
Products Machines and plants, Materials	✓
Services & consulting Engineering, Simulation	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight manufacturing, Lightweight design	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation Processes, Materials	✓
Plant construction & automation Plant construction	✓
Recycling technologies Upcycling	✓
Manufacturing process	
Additive manufacturing Selective laser melting (SLM, LPBF, ...)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Steel	✓
Plastics	
Structural ceramics	
(Technical) textiles	