Recycling plastics: pioneering cascade model for 3D printing in lightweight construction

About this project

MonoMat

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Markets:

Material: Thermoplastics

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

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Context

Additive manufacturing enables companies to produce high-quality everyday products, some with complex functions, from a single material in a short space of time. This allows them to significantly reduce material and energy consumption compared to conventional processes. However, the reuse of the materials used to create new raw materials is still unresolved in 3D printing. For the design, manufacture and recycling of these products, the project team has developed a cascade model that interlinks medicine, sport and lifestyle. This combines powder bed-based additive manufacturing, extrusion-based additive manufacturing and conventional injection moulding.

Purpose

The researchers' aim is to recycle the materials used in additive manufacturing processes as completely and repeatedly as possible so that they become part of a cross-industry ecological circular economy. The scientists are focussing on polymers, i.e. plastics, and their application in medical, sports and lifestyle products. These include, for example, midsoles for running shoes, rucksack pads, shin guards and prostheses. These products must be customised to individual requirements so that they contribute to an improved quality of life in everyday life.

The researchers are also using demonstrators to calculate how many greenhouse gas emissions can be saved thanks to the cascade model developed. For this forecast, the project team is not only looking at the respective materials and production processes, but also at recycling and the ecological impact, such as by-products and waste.

Procedure

The cascade begins with the additive manufacturing of products that need to be of outstanding quality for individualised applications in medicine. The researchers use the powder bed-based processes of laser sintering, multi-jet fusion and high-speed sintering for this purpose. If the products can no longer be used, the material is recycled: depending on its condition, it is processed again in the powder bed or goes on to material extrusion. This can result in products for sports or lifestyle - i.e. areas in which qualitative requirements for material properties are easier to fulfil. In this process, the plastic can be reused until it has finally worn out. It is then available for injection moulding in mass production.

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Funding duration:

Project partner: Neue Materialien Bayreuth, AM Polymers, VW

Funding sign:	03LB3054	**Funding amount:**	EUR 1.1 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3054A - MonoMat in the federal funding catalogue

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Project coordination

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Materials	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight design	✓
Functional integration	
Measuring and testing technology Component and part analysis, Materials analysis, Destructive analysis	✓
Modelling and simulation Life-cycle analysis, Optimisation	✓
Plant construction & automation	
Recycling technologies Downcycling	✓
Manufacturing process	
Additive manufacturing Selective laser sintering (SLS)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming Extrusion, Injection moulding	✓
Processing and separating	
Textile technology	

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Lightweighting classification

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