Making particle foams more sustainable: Process energy-efficiently, enable recycling

About this project

GePart

Making particle foams more sustainable: Process energy-efficiently, enable recycling

Markets:

Material: Bioplastics, Thermoplastics, Aluminium, Closed-pore, Open-pore

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Technology Transfer Program Leichtbau

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Context

Particle foams such as expanded polypropylene (EPP) are key materials for lightweight construction. In the automotive industry in particular, they help to reduce vehicle weight and thus lower fuel consumption and CO2 emissions. However, traditional production using hot water vapour is very energy-intensive. Only around one per cent of the energy is used for welding the particles, the rest is lost unused.

At the same time, the recycling of EPP material is not yet sufficiently realised. At the end of its useful life, the material is usually thermally utilised. A genuine circular economy is not yet possible, as the processing of recycled material impairs the quality. This is where the GePart research project comes in: The team wants to improve processing and close the material cycle of EPP sustainably.

Purpose

The GePart project team is pursuing two key objectives: developing an energy-efficient processing technology and increasing the proportion of recycled material. With the help of radio frequency (RF) technology, the researchers want to weld EPP without water vapour in the future. This saves up to 90 per cent energy, as the heat is generated directly inside the foam beads. At the same time, the scientists want to increase the proportion of recycled EPP material to between 50 and 70 per cent. To achieve this, the project team is further developing the recycling processes and precisely analysing the material properties. The aim is to optimise the quality of recycled EPP so that it meets the requirements for series production.

Procedure

In order to industrialise the RF technology for EPP, the researchers have further developed the process at laboratory level. In doing so, they were able to confirm the advantages of RF technology over vapour-based processing: uniform heating, minimal energy loss and the use of cost-effective plastic tools. At the same time, the team developed new recycling strategies for high-quality reprocessing of EPP material after its utilisation phase.

The scientists analysed the degradation behaviour of the material along the cycle and optimised the processes for removing impurities. Comprehensive tests showed that a recyclate content of up to 70 per cent is realistic without compromising the quality of the components. An accompanying life cycle assessment confirmed the successes: 15 per cent energy savings during production and 25 per cent fewer CO2 emissions thanks to the use of recycled material.

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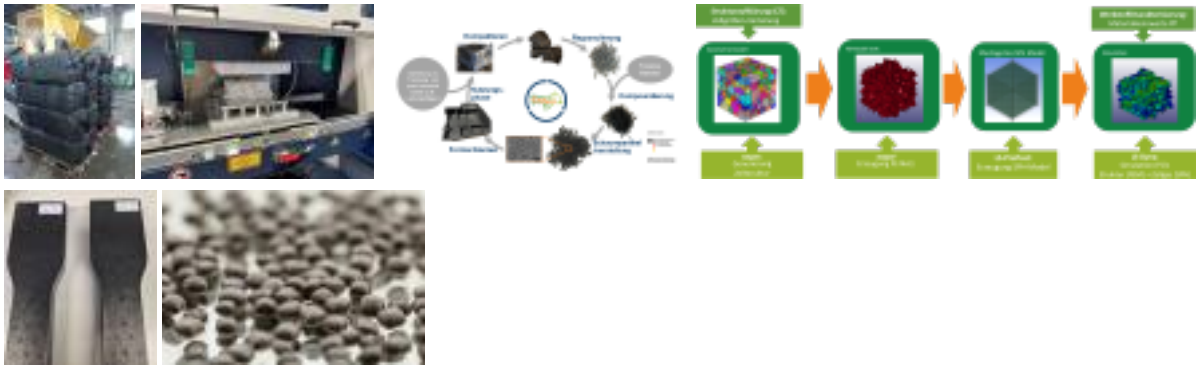

Funding duration:

Project partner:

VOLKSWAGEN AKTIENGESELLSCHAFT

kurtz ersa

PLAST

T. MICHEL

Neue Materialien Bayreuth

Institut für Leichtbau und Kunststofftechnik

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Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2000A

plattform-forel.de/gepart/

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Project coordination

Contact:

Mr Dipl.-Ing. Thomas Doll

+49 7802 806-746

tdoll@ruch.de

Organisation:

RUCH NOVAPLAST GmbH

Appenweierer Strasse
77704 Oberkirch
Baden-Württemberg
Germany

www.ruch.de

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts	✓
Services & consulting Consulting, Testing and trials, Engineering, Prototyping, Technology transfer	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Hybrid structures, Lightweight construction concepts, Lightweight material construction	✓
Functional integration Actuator technology, Sensor technology	✓
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), System analysis, Environmental simulation, Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Crash behaviour, Life-cycle analysis, Optimisation, Structural mechanics, Materials	✓
Plant construction & automation	
Recycling technologies Recycling, Upcycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining Adhesive bonding, Riveting, Welding	✓
Material property alteration	
Primary forming Others	✓
Processing and separating Drilling, Shearing/punching, Cutting	✓
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials Bioplastics	✓
Cellular materials (foam materials) Closed-pore, Open-pore	✓
Composites	
Fibres	
Functional materials	
Metals Aluminium	✓
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	