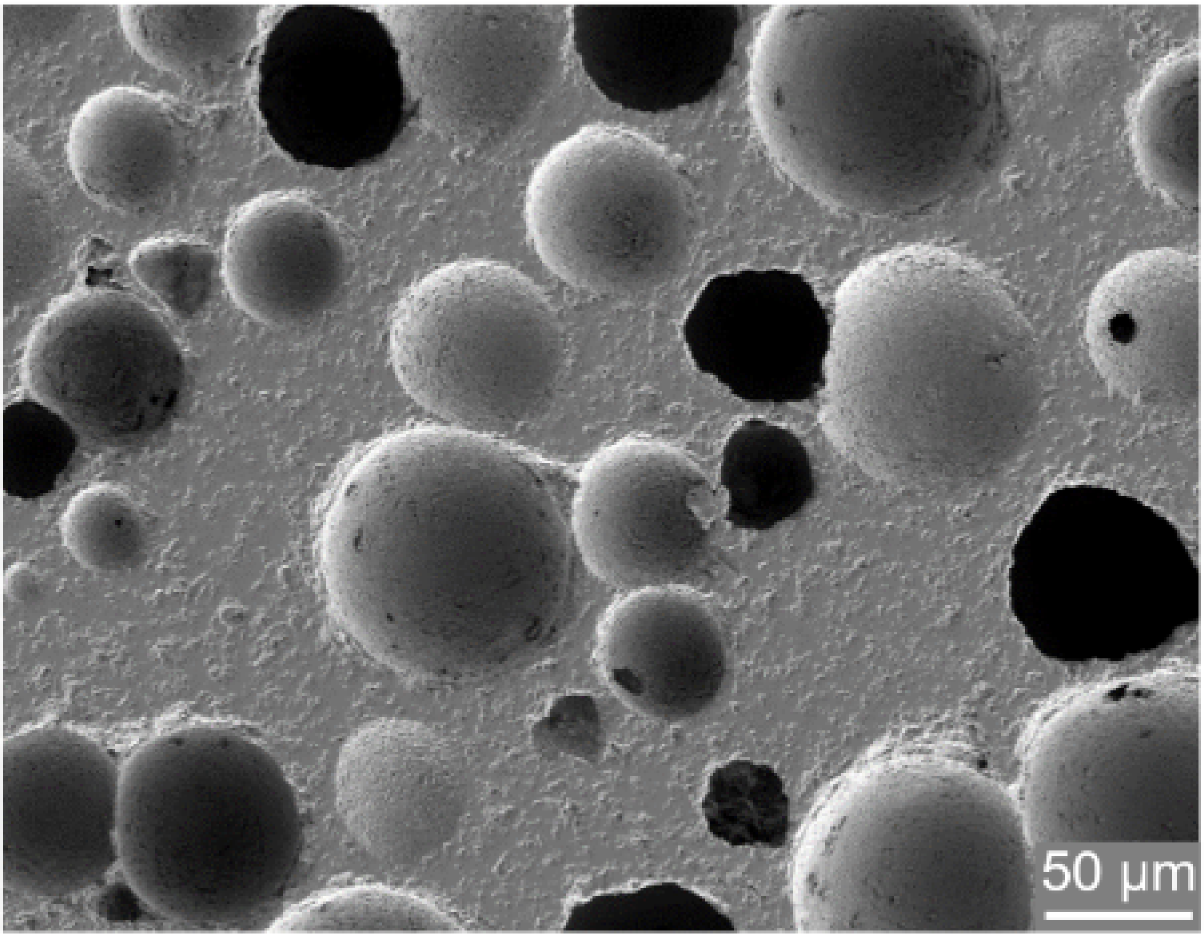
Foam ceramics for lightweight construction: economical production, porosity control

About this project



KeraSchaum

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Markets:

Material: Oxidic ceramics, Ultra-high-temperature ceramics

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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

Ceramic materials can withstand high temperatures, chemicals, corrosion and mechanical stress. However, their use is often limited - mainly due to their high weight, their brittleness and the energy-intensive manufacturing process. These disadvantages make ceramic materials expensive and not very flexible for many applications.

At the same time, the demand for lightweight, resilient materials is growing in many industries - for example in e-mobility, filter technology and thermally stressed assemblies. Foam ceramics offer great potential here: they combine the advantages of ceramic materials with significantly reduced weight and can be customised to specific applications thanks to adjustable pore structures. The concept of lightweight construction plays a key role here - because less mass means lower energy consumption, both in production and in operation. This is where the KeraFoam project comes in.

Purpose

The researchers in the KeraFoam project want to develop an economical, end-to-end process chain for the production of porous foam ceramics. The aim is to produce ceramic structures with adjustable porosity. The basis is a thermoplastic feedstock - a processable material mixture of ceramic particles, foamable filler and plastic matrix. The team wants to use this to produce mechanically stable, dimensionally accurate and functionally customisable components.

The project is also focussing on the machinability in various production states: In the green state, the moulded body still contains plastic components and is easy to machine; in the white state, the plastic has been removed and the body has been sintered but not yet finally hardened. The researchers want to develop suitable machining processes for both stages and integrate bionically inspired pore structures in order to further improve the strength. Finally, demonstrators for specific fields of application are to be developed - for filters, catalyser carriers or fuel supports, for example. The focus here is on a measurable reduction in the use of materials and CO# emissions.

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Procedure

In the first step, the researchers formulate the ceramic-filled feedstock and optimise its processability. They then develop tools and processes to transform the material into defined geometries - including profiled sheets or rods - under controlled conditions. They focus on the design and control of the pore structure and the development of suitable foaming processes.

In the green and white processing stages, the scientists are investigating machining and laser-based methods to refine the moulding process. The integration of bionic structural principles supports the mechanical stability. Finally, the team manufactures demonstrators to test the technology in terms of component properties and CO# savings potential - for example through reduced sintering mass and lower energy requirements.

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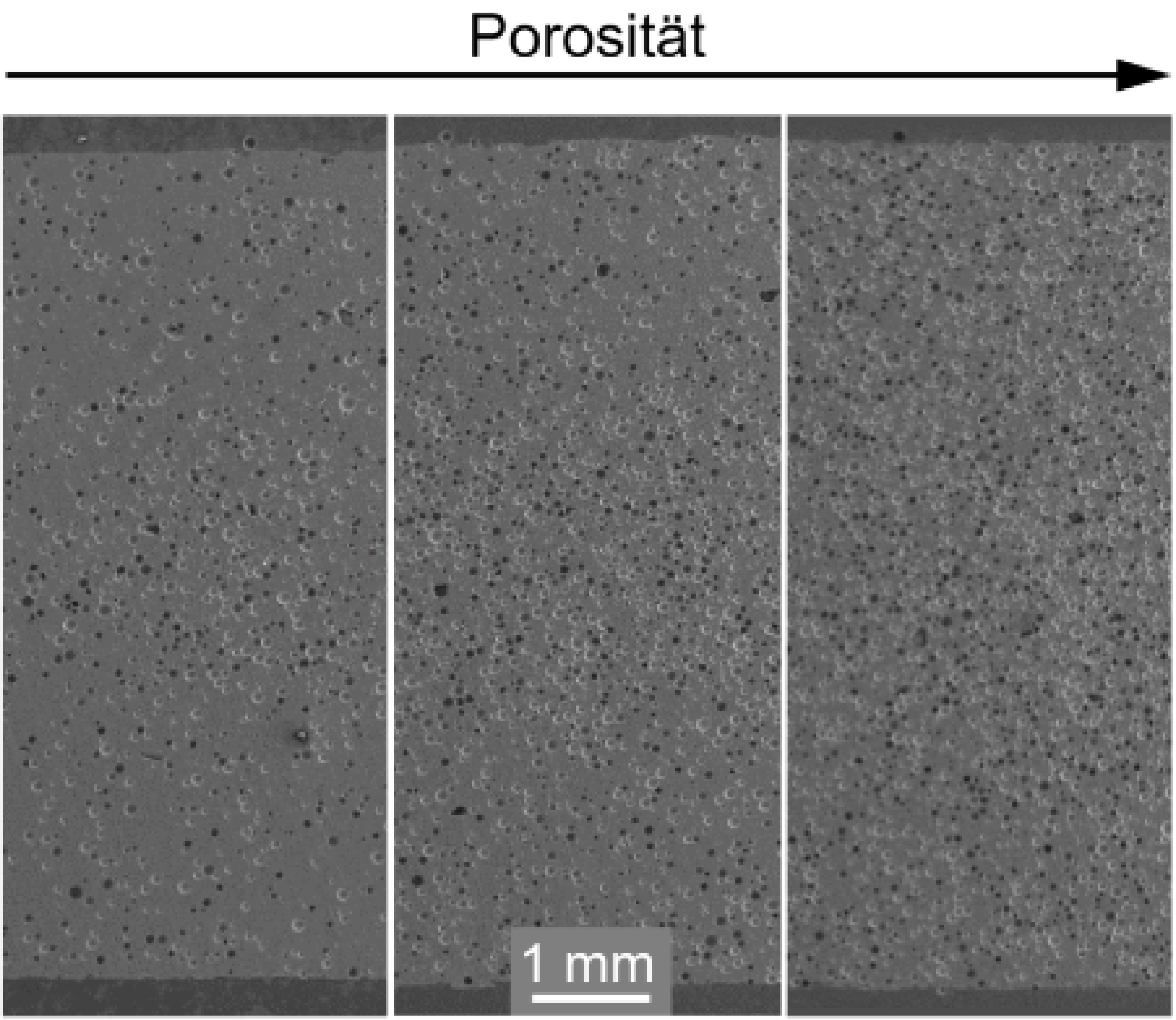

Funding duration:

Funding sign:	03LB2044	**Funding amount:**	EUR 1.6 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2044A - KeraSchaum in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

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

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Lightweighting classification

	Realisation
Field of technology	
Design & layout	
Functional integration Sensor technology, Material functionalisation	✓
Measuring and testing technology	
Modelling and simulation	
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming Sintering	✓
Processing and separating Drilling, Turning, Milling, Cutting, Others (Laser beam cutting)	✓
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics Oxidic ceramics, Ultra-high-temperature ceramics	✓
(Technical) textiles	