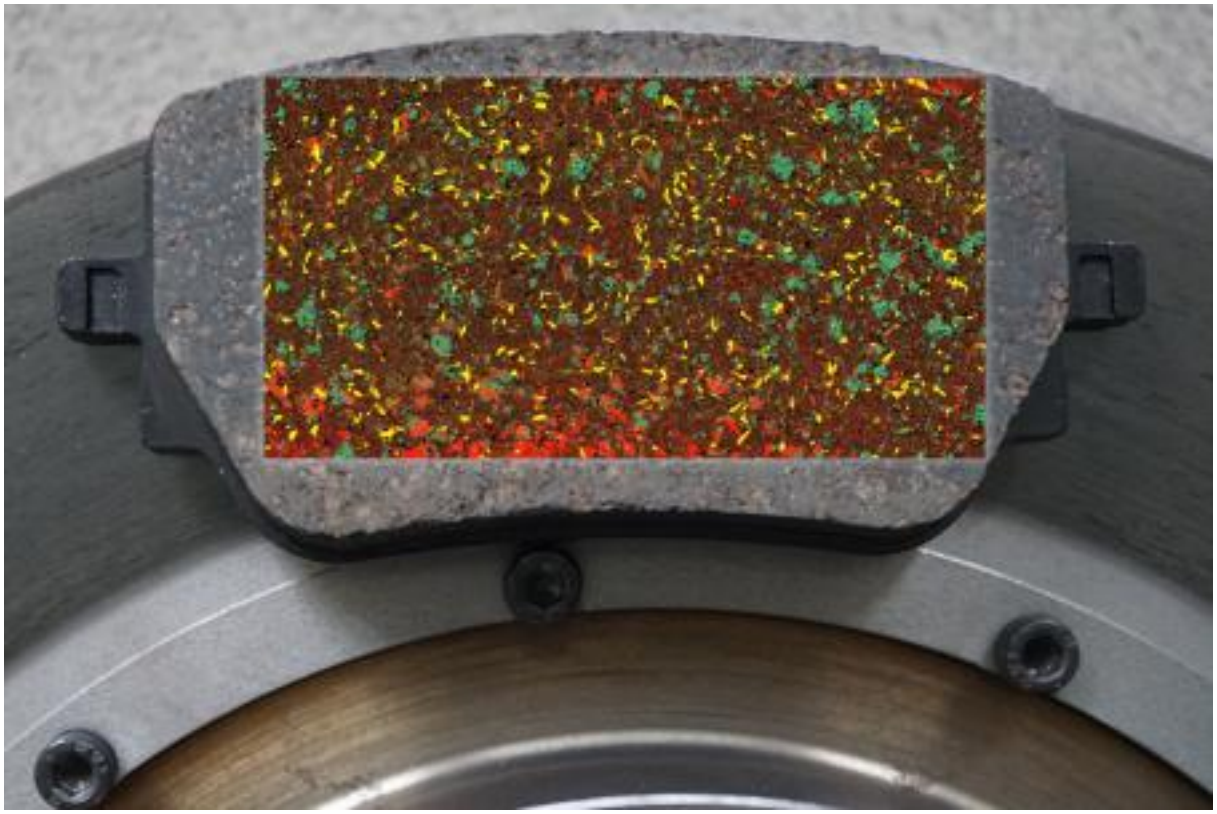
Sustainable braking system: reducing particulate matter and enabling circularity

About this project



BrakeThrough

Sustainable braking system: reducing particulate matter and enabling circularity

Markets:

Material: Elastomers, Thermoplastics, Others (Polyurethane), Metal matrix composite, Particulate composites, Closed-pore, Open-pore

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

Urban road traffic releases large amounts of particulate matter, which can pose significant health risks. Around half of the particulate matter is caused by brake abrasion – regardless of the drive system of the vehicle. Due to their small size, about 90 percent of these particles enter deep into the respiratory tract and can cause serious damage.

The main problem lies in the braking systems currently in use: these are mostly made of gray cast iron alloys and matching brake linings. During braking, the materials wear down and the released particles enter the air. There are currently no alternatives to traditional braking materials for the series production market.

Purpose

The project team aims to develop a cost-effective, low-wear, low-emission and recyclable braking system for industrial production. To this end, the researchers are using brake discs made of highly hard-material particle-reinforced aluminum matrix composites (AMC, short for: aluminum matrix composites). AMC brake discs are almost wear-free in combination with suitable brake pads, so that hardly any particulate matter is produced. This significantly improves air quality, especially in cities and at traffic junctions.

In addition, AMC braking systems are lightweight constructions, which in turn reduces CO# emissions while driving. Unlike conventional gray cast iron brake discs, AMC brake discs are also recyclable and reusable.

Procedure

One of the biggest challenges for the use of AMC brake systems is the development of suitable brake pads. These must be designed in such a way that a so-called tribofilm forms during braking. This is created by chemical reactions and acts like a protective layer that prevents wear and the formation of fine dust.
In order to develop suitable brake pads, the project team is therefore analysing the surface structure of the materials using electron and 3D scanning microscopes. Conventional brake pads consist of up to 30 individual components.

The team is optimising these parts, particularly with regard to friction coefficient, durability and noise development. The researchers are also replacing questionable materials, such as copper alloys, with more environmentally friendly alternatives that also support the formation of the tribofilm.

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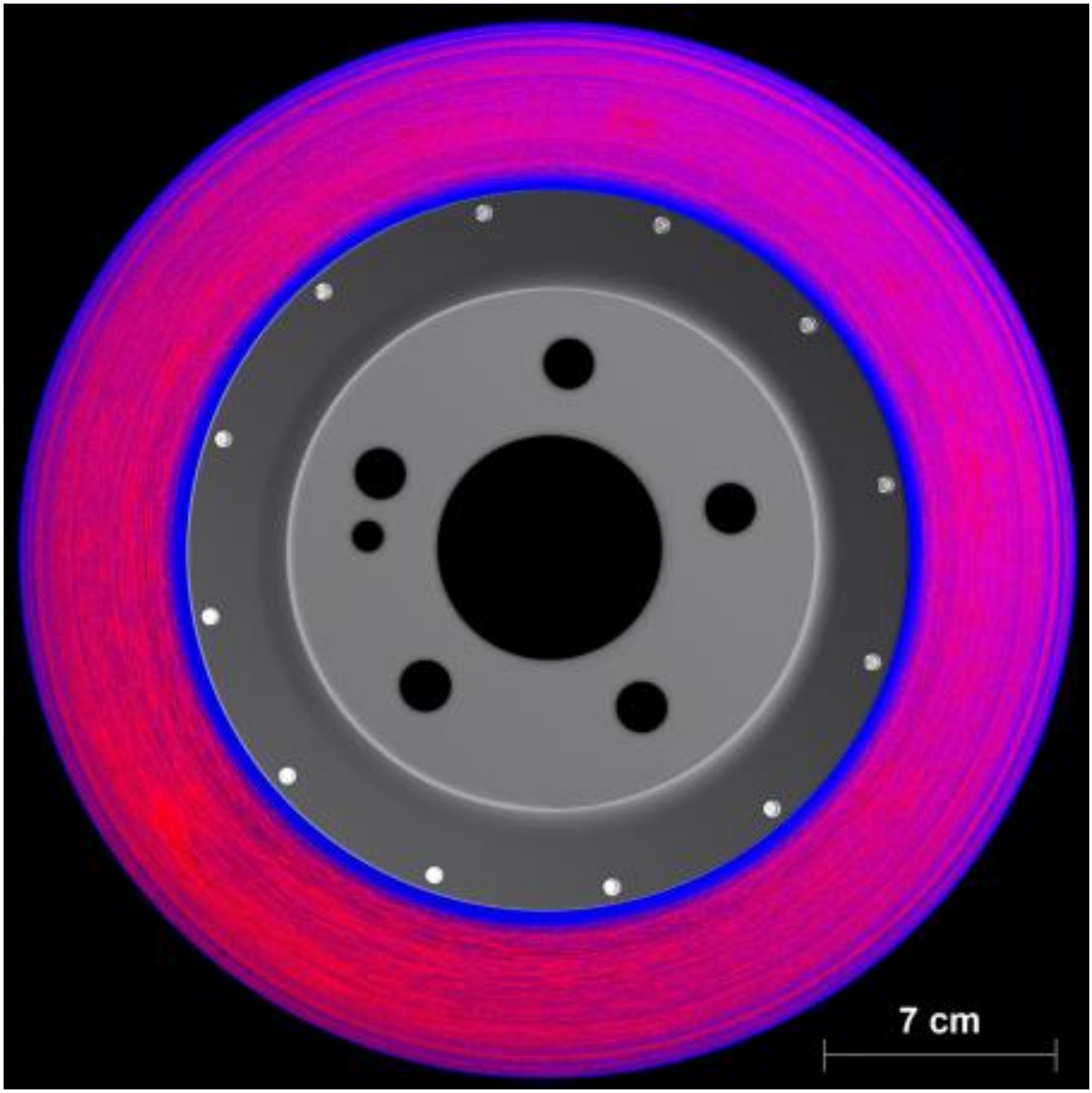

Funding duration:

Funding sign:	03LB3035	**Funding amount:**	EUR 2.4 million

Final report

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Project coordination

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English (EN){{ Projektpartner }}

DTS GmbH Deutschland

BREMSKERL

Mercedes-Benz

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Materials	✓
Services & consulting Training, Validation	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout	
Functional integration	
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Environmental simulation, Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation	
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating Drilling, Turning, Milling, Grinding, Cutting	✓
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials) Closed-pore, Open-pore	✓
Composites Metal matrix composite, Particulate composites	✓
Fibres	
Functional materials	
Metals	
Plastics Elastomers, Thermoplastics, Others (Polyurethane)	✓
Structural ceramics	
(Technical) textiles	