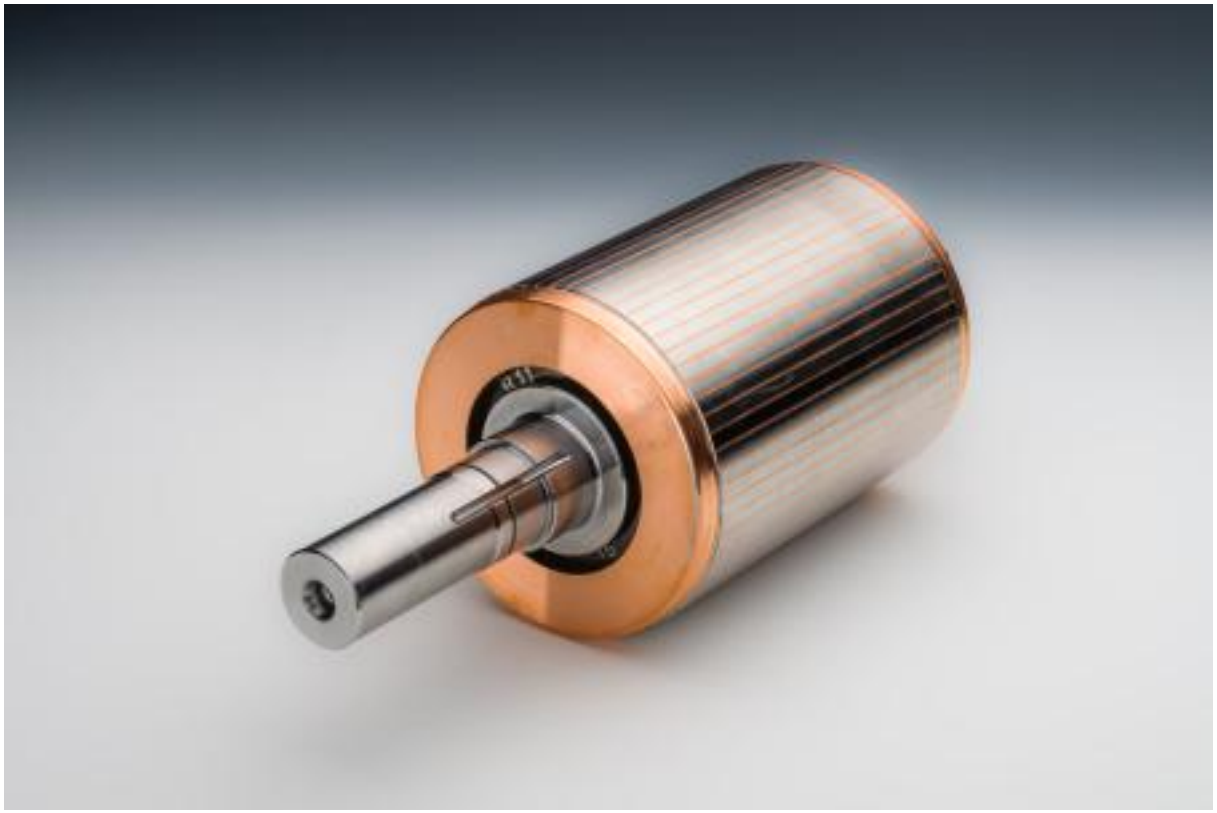
Efficient production of electric motors: with copper die casting and 3D printing

About this project



ATREA

Efficient production of electric motors: with copper die casting and 3D printing

Markets:

Material: Others (Rotors with 3D structures and a conductivity > 56 MS/m), Others (Copper and copper alloys | Nickel alloy Inconel 718)

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

Electric vehicles face the challenge of being as energy-efficient, resource-saving and powerful as possible. Drive technology is particularly challenging in this respect. Until now, machines with permanent magnets have dominated - but their dependence on rare earths is problematic both ecologically and geopolitically. Asynchronous machines (ASM) are considered a robust and cost-effective alternative, but they quickly reach their technical limits at high speeds. At the same time, the demands on performance and resource efficiency are increasing. This is precisely where the ATREA project comes in. The aim is to make electric drives fit for the future - with new design approaches and modern production technologies.

Purpose

The researchers want to further develop asynchronous machines for use in high-speed drives - for example in electric cars - and thus realise the full potential for electromobility in an ecologically sensible way. To do this, they are combining two key technologies. Firstly, additive manufacturing of mechanically resilient 3D support structures. Secondly, copper die-casting for rotor rotors - the rotating part of the electric motor in which the electricity is generated for movement. This combination should lead to a new generation of lightweight, efficient and sustainable electric motors. The focus is not only on increasing the power density - i.e. more power with less mass - but also on reducing material costs and dispensing with critical raw materials such as rare earths. The project team wants to show that asynchronous machines with copper rotors are an alternative to today's standard drives. By combining innovative materials, customised designs and new production methods, the researchers are aiming for a solution that is ready for series production.

Procedure

On the one hand, the researchers are reinforcing the areas of the asynchronous machine that are subject to particular mechanical stress - such as the rotor rings - with additively manufactured structures. These structures not only have to withstand high centrifugal forces at speeds of over 21,000 revolutions per minute, but also have to be optimised electromagnetically and thermally. They are also continuing to develop the copper die-casting process so that it can be precisely combined with additive components. The focus here is on the optimum mould design, the behaviour of the material during solidification and the process-related requirements. The team is trialling various material combinations in numerous tests and evaluating them with the help of simulations. The results are incorporated into optimised designs and innovative manufacturing processes.

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Funding duration:

Funding sign:	03LB3033	**Funding amount:**	EUR 1.1 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3033A - ATREA in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT DRESDEN
UNIVERSITY OF APPLIED SCIENCES

Oerlikon AM Europe GmbH

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Lightweighting classification

	Realisation
Offer	
Products Machines and plants, Others (3D printing | additive manufacturing (metal))	✓
Services & consulting Training, Testing and trials, Simulation	✓
Field of technology	
Design & layout	
Functional integration Actuator technology	✓
Measuring and testing technology	
Modelling and simulation Multiphysics simulation, Materials	✓
Plant construction & automation	
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming Casting, Others (Casting of rotors with minimal porosity (Zero Porosity Rotor, ZPR®), also with inlaid 3D structures (porosity < 1 % in both longitudinal and cross-section))	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials Others (Rotors with 3D structures and a conductivity > 56 MS/m)	✓
Metals Others (Copper and copper alloys | Nickel alloy Inconel 718)	✓
Plastics	
Structural ceramics	
(Technical) textiles	