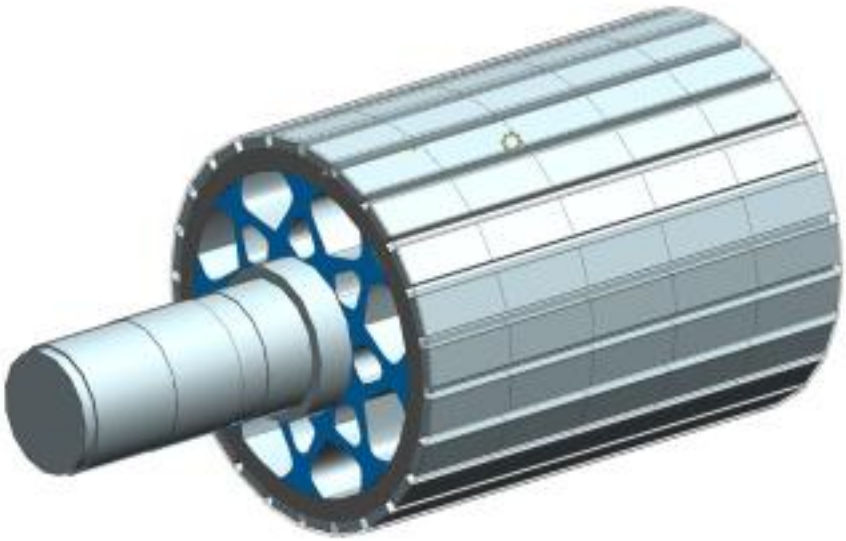
Resource-efficient systems: developing sustainable circuit-breakers and electric motors

About this project



LiKE

Resource-efficient systems: developing sustainable circuit-breakers and electric motors

Markets:

Material: Glass fibres, Carbon fibres, Thermoset plastics, Aluminium, Steel, Others (Copper, rare earths), Laid webs, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)

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Technology Transfer Program Leichtbau

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Context

High-performance energy transmission and conversion systems are essential to mastering the energy transition. These include electrical circuit breakers and motors, for example, which rely on critical raw materials such as neodymium and dysprosium, as well as many metals such as copper. Currently, these materials are often insufficiently recycled, which increases dependence on raw materials from third countries.

At the same time, linear production processes are reaching their ecological limits. The industry urgently needs solutions to increase the efficiency of electrical systems, reduce resource consumption and orientate products towards a circular economy. Lightweight construction offers enormous potential here by enabling resource-saving use of materials and integrating innovative recycling concepts.

Purpose

The LiKE research project aims to make key components of energy and drive technology more sustainable. Using the example of a circuit breaker and an electric motor, the project team wants to investigate how the use of materials and CO2 emissions can be reduced without compromising technical performance. The researchers want to reduce material consumption by 20 per cent and increase the efficiency of the components by 10 per cent.

In addition, the project team wants to introduce new labelling technologies and recycling approaches to enable a closed-loop material economy. The project team also wants to develop a digital process that determines the environmental impact of design measures during the development phase. The project is thus setting new standards for sustainable product development and the transformation of the energy industry.

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Procedure

Firstly, the researchers added ecological criteria to existing product development and manufacturing processes. Novel labelling technologies with fluorescent markers made it possible to clearly identify materials and components throughout their entire life cycle and to sort them by type at the end of their life cycle. The team also linked this labelling with a digital product passport, which provides important information such as material properties for recycling.

The scientists used additive manufacturing methods such as cold gas spraying to produce multi-material compounds that combine mechanical stability with excellent separability for unmixed disassembly. At the same time, the team improved the development processes with optimised life cycle analyses. With this interdisciplinary approach, LiKE was able to show how resources can be saved, components can be designed more efficiently and the recyclability of products can be significantly improved.

Funding duration:

Funding sign:	03LB2008	**Funding amount:**	EUR 4.1 million

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2008A - LiKE in the federal funding catalogue

plattform-forel.de/like - Project website on the FOREL platform

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Project coordination

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Software & databases, Materials	✓
Services & consulting Engineering, Prototyping, Simulation, Technology transfer, Others (Permanent labelling and link to the product passport)	✓

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Lightweighting classification

Field of technology	Realisation
Design & layout Lightweight manufacturing, Hybrid structures, Lightweight construction concepts	✓
Functional integration Actuator technology	✓
Measuring and testing technology Component and part analysis, Environmental simulation, Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Multiphysics simulation, Optimisation, Processes, Structural mechanics	✓
Plant construction & automation Automation technology, Robotics	✓
Recycling technologies Material separation, Recycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing, Selective laser melting (SLM, LPBF, ...), Others (Cold gas spraying)	✓
Coating (surface engineering)	
Fibre composite technology Resin infusion process, Resin transfer moulding	✓
Forming	
Joining Adhesive bonding	✓
Material property alteration	
Primary forming	
Processing and separating	
Textile technology Braiding, Preforming	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Glass fibres, Carbon fibres	✓
Functional materials	
Metals Aluminium, Steel, Others (Copper, rare earths)	✓
Plastics Thermoset plastics	✓
Structural ceramics	
(Technical) textiles Laid webs	✓