Electric drive rotors: reduce material usage, enable remanufacturing

Electric drive rotors: reduce material usage, enable remanufacturing

About this project

Roflex

Electric drive rotors: reduce material usage, enable remanufacturing

Markets: 

Material: Intermetallic alloys

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Climate Action.

Technology Transfer Program Leichtbau

Context

The growing market for fully electric vehicles and increasing environmental regulations are presenting the automotive industry with new challenges. Manufacturers need to design electric drives that are more efficient and conserve resources. For non-stationary drives in particular, companies are striving for high power densities with maximum speeds of over 20,000 revolutions per minute and are focussing on lightweight materials. However, high speeds require very precise manufacturing techniques. In order to achieve these high speeds and counteract the associated high mechanical stresses, the components currently have to be joined together in some cases using bonding, screwing and thermal processes. These processes do not meet today's sustainability requirements as they are energy-intensive and stand in the way of effective repair, refurbish and recycling strategies.

Until now, many processes have relied on thermal joining techniques, in which components are joined using heat. However, this increases production waste. In addition, firmly bonded magnetic fasteners hinder the recycling of rare earths. Another critical point is the recycling of rotors. This is not possible with current manufacturing processes.

Electric drive rotors: reduce material usage, enable remanufacturing

About this project

Purpose

In the Roflex project, the project team aims to develop new concepts for the lightweight construction and remanufacturing of rotors for electric drives. The aim is to reduce the use of materials and enable repair, refurbish and recycling strategies. The researchers are designing a new type of rotor shaft produced using forming technology and a thin-walled balancing disc that serves as an integrated clamping mechanism.

The team is also developing flexible magnetic fixings with resilient behaviour. These innovations replace energy-intensive thermal joining processes, reduce the weight by up to 15 per cent and allow the reuse of rare earth magnets. The researchers are also testing two new measuring and testing methods that precisely record mechanical properties and thus ensure the quality and durability of the components.

Procedure

The researchers begin with a detailed definition of requirements in which all manufacturing and operating parameters are specified. They develop the new components using modern forming techniques to produce lightweight, thin-walled rotor shafts and balancing discs. On a newly constructed test rig, the researchers test the components under real operating conditions, for example in spin and burst tests.

The scientists create digital twins that map the entire production process. Using artificial intelligence, they analyse the recorded data, identify sources of error at an early stage and thus optimise the production steps. This approach not only ensures the high quality of the new rotors, but also enables systematic reprocessing of the components.

Electric drive rotors: reduce material usage, enable remanufacturing

About this project

Funding duration:

Funding sign: 03LB3041 **Funding amount:** EUR 2.3 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3041A - Roflex in the federal funding catalogue

Project coordination

Contact:

Mr Dr.-Ing. Benjamin Dönges

+49 15115907704

benjamin.doenges@mubea.com

Organisation:

Mubea Fahrwerksfedern GmbH

Mubea-Platz 1
57439 Attendorn
North Rhine-Westphalia
Germany

www.mubea.com

Electric drive rotors: reduce material usage, enable remanufacturing

English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Systems and end products, Materials, Tools and moulds	✓
Services & consulting Testing and trials, Engineering, Prototyping, Validation, Simulation, Maintenance and repair	✓
Field of technology	
Design & layout Lightweight design, Lightweight construction concepts	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Component and part analysis, System analysis, Destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Optimisation, Structural mechanics, Materials, Reliability validation	✓
Plant construction & automation Automation technology, Handling technology	✓
Recycling technologies Material separation, Recycling	✓

Electric drive rotors: reduce material usage, enable remanufacturing

Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing Others (Joining technology)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming Bending, Compression moulding	✓
Joining Hybrid joining	✓
Material property alteration	
Primary forming	
Processing and separating Grinding, Cutting	✓
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Intermetallic alloys	✓
Plastics	
Structural ceramics	
(Technical) textiles	