Building plastic gearboxes more efficiently: thanks to new standardised test methods

About this project

LeKkA

Building plastic gearboxes more efficiently: thanks to new standardised test methods

Markets:

Material: Carbon fibres, Thermoplastics, Steel, Carbon-fiber reinforced plastics (CFRP)

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

Technology Transfer Program Leichtbau

Building plastic gearboxes more efficiently: thanks to new standardised test methods

About this project

Context

Plastic gears with intersecting axes are a key technology in numerous applications such as e-bikes, industrial robots and medical technology. They enable precise movements and save energy thanks to their low weight. Nevertheless, there is a lack of scientific data on their behaviour under load. In particular, there are no standardised findings on load-bearing capacity, efficiency and wear behaviour.

Companies have therefore had to rely on conservative assumptions, which has often led to oversized components. At the same time, the potential for material and weight savings was not fully utilised. In view of increasing demands for efficiency and sustainability, there is an urgent need to deepen the scientific understanding of these gears and optimise their performance.

Purpose

This is where the LeKkA research project comes in. The aim is to fundamentally improve the design and utilisation of these drive components. To this end, the project team is developing new test methods that precisely record load-bearing capacity and wear.

The focus is on the material pairing PEEK/PEEK, which is characterised by high temperature resistance, low friction and excellent wear properties. The researchers want to significantly reduce the weight of the gears without compromising their performance. This should enable companies to realise resource-saving and high-performance drives for demanding applications in the future.

Procedure

The researchers are systematically investigating the load-bearing capacity and wear behaviour of plastic gears in laboratory tests. They are developing a standardised test procedure that delivers reproducible results under different load and temperature conditions.

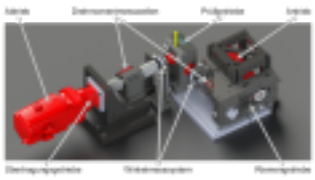
In addition, the project team is developing a theoretical model that describes the complex interactions between tooth geometry, material properties and operating conditions. This model makes it possible to precisely dimension gears and optimise their efficiency. The experimental results showed that PEEK/PEEK pairings have the potential to significantly improve previous material utilisation.

The knowledge gained creates a reliable basis for the development of lighter, more efficient drive systems and at the same time reduces material consumption and the carbon footprint.

Building plastic gearboxes more efficiently: thanks to new standardised test methods

About this project



Funding duration:

Funding sign:	03LB5002	**Funding amount:**	EUR 350 thousand

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB5002 - LeKkA in the federal funding catalogue

www.mec.ed.tum.de/fzg/projekte/abgeschlossene-projekte/2024-bmwk-03lb5002-lekka/ - LeKkA on the chair website of the FZG

Building plastic gearboxes more efficiently: thanks to new standardised test methods

Project coordination

Contact:

Mr Prof. Dr.-Ing. Karsten Stahl

+49 89 289-15805

karsten.stahl@tum.de

Organisation:

Technical University of Munich

Boltzmannstraße 15
85748 Garching b. München
Bavaria
Germany

www.mec.ed.tum.de/fzg/startseite/

English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products	
Services & consulting Training, Consulting, Testing and trials, Standardisation, Validation, Simulation, Technology transfer	✓

Building plastic gearboxes more efficiently: thanks to new standardised test methods

Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight material construction	✓
Functional integration	
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Structural mechanics, Materials, Reliability validation	✓
Plant construction & automation Robotics, Others (Drive technology)	✓
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Fibre spraying	✓
Forming	
Joining	
Material property alteration	
Primary forming Injection moulding	✓
Processing and separating Drilling, Turning, Milling	✓
Textile technology	

Building plastic gearboxes more efficiently: thanks to new standardised test methods

Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Carbon fibres	✓
Functional materials	
Metals Steel	✓
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	