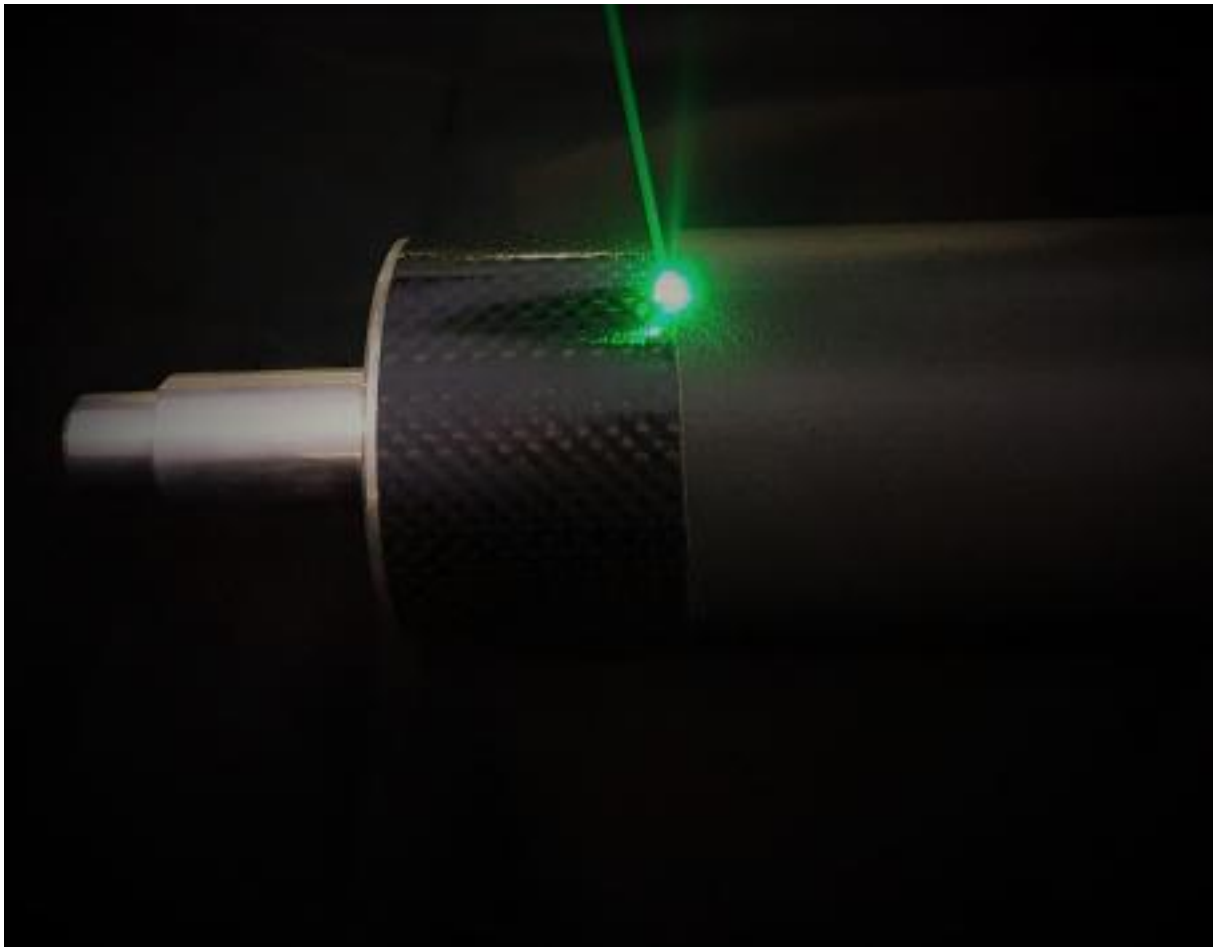
# Rollers made from carbon fibre-reinforced plastic: creating a highly functional coating

## About this project



### LACK

### Rollers made from carbon fibre-reinforced plastic: creating a highly functional coating

**Markets:**

**Material:** Thermoplastics, Oxidic ceramics, Aramid fibre composites, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)

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

Technology Transfer Program Leichtbau

## Context

In many branches of industry, rollers fulfil key functions in production - from hygiene products and packaging to vehicle parts. Manufacturers usually produce these rollers from steel or aluminium, which results in high weight and the associated energy losses and mechanical wear. As an alternative, CFRP, i.e. carbon fibre reinforced plastic, is becoming increasingly important.

CFRP is produced by combining carbon fibres with a plastic and offers low weight and high strength. However, CFRP can only withstand temperatures between 80 and 120 degrees Celsius. Conventional non-stick coatings, which are designed to prevent materials from sticking to the rollers, often require 200 to 400 degrees Celsius to harden and would therefore damage the CFRP rollers during application.

Processes such as the sol-gel process - in which fine particles are applied in a liquid and cross-linked using heat - reach their limits here. The challenge is to develop a coating that does not overheat the sensitive CFRP and yet reliably prevents the adhesion of production materials.

## Purpose

In the LACK research project, the project team is developing an innovative, laser-based coating process for CFRP rollers. The researchers want to realise a highly functional non-stick coating that keeps the CFRP substrate below 120 degrees Celsius despite high curing temperatures (over 200 degrees Celsius). They are pursuing two approaches: Polymer-based systems with FEP (fluoroethylene propylene) and PFA (perfluoroalkoxy) as well as sol-gel-based processes in which silicone oil is also used.

The scientists optimise the material composition through the targeted addition of laser absorbers, which use the laser radiation effectively to cure the coating with pinpoint accuracy. The process lowers energy consumption, reduces CO# emissions and extends the service life of machines - an important step towards greater efficiency and sustainability in production.

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### Procedure

The researchers start by applying a special adhesion layer. This layer acts as an adhesion promoter between the CFRP and the subsequent non-stick coating and protects the material from thermal stress. They apply the adhesion layer by thermally spraying metal or ceramic particles.

The scientists then apply the non-stick material mechanically by spraying. The material formulation is specifically adapted to the laser wavelength - for example by adding laser absorbers and low-viscosity components. Using a precise laser beam, they cure the coating in fractions of a second so that only the coating is heated.

At the same time, the project team is testing the process under real production conditions and developing concepts for repairs directly on the system (in-situ repair). The researchers are also carrying out a comprehensive life cycle analysis to demonstrate the economic and ecological benefits.

**Funding duration:**

| | | | |
|---|---|---|---|
| **Funding sign:** | 03LB3051 | **Funding amount:** | EUR 1 million |

**Final report**

**Further websites** foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3051A - LACK in the federal funding catalogue

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## Project coordination

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## English (EN){{ Projektpartner }}

Fraunhofer ILT

## Lightweighting classification

| | Realisation |
|---|---|
| **Offer** | |
| **Products**<br>Materials | ✓ |
| *Services & consulting* | |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Field of technology** | |
| *Design & layout* | |
| **Functional integration**<br>Material functionalisation | ✓ |
| **Measuring and testing technology**<br>Materials analysis, Destructive analysis | ✓ |
| **Modelling and simulation**<br>Life-cycle analysis | ✓ |
| **Plant construction & automation**<br>Plant construction | ✓ |
| *Recycling technologies* | |
| **Manufacturing process** | |
| **Additive manufacturing**<br>Selective laser sintering (SLS) | ✓ |
| **Coating (surface engineering)**<br>Painting, Plasma process, Powder coating, Others (Thermal spraying) | ✓ |
| *Fibre composite technology* | |
| *Forming* | |
| *Joining* | |
| **Material property alteration**<br>Others (Laser process) | ✓ |
| *Primary forming* | |
| *Processing and separating* | |
| *Textile technology* | |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Material** | |
| *Biogenic materials* | |
| *Cellular materials (foam materials)* | |
| **Composites**<br>Aramid fibre composites, Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP) | ✓ |
| *Fibres* | |
| *Functional materials* | |
| *Metals* | |
| **Plastics**<br>Thermoplastics | ✓ |
| **Structural ceramics**<br>Oxidic ceramics | ✓ |
| *(Technical) textiles* | |