

# New testing and simulation methods for tape fabrics: design of fibre composite components

## About this project



TaGeT

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Markets:



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**Material:** Carbon fibres, Thermoset plastics, Yarns, rovings, Woven fabrics, Others (Tape fabric), 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](#)

## Context

Fibre-reinforced plastics contribute to weight reduction in vehicles and aircraft and can therefore reduce energy requirements and CO<sub>2</sub> emissions. Tape fabrics are special reinforcing textiles made from spread-out fibre bundles, known as tapes. The fibres run almost in a straight line and enable high mechanical properties with very low surface weights. If the tapes are processed into fabrics, thin semi-finished textile products with low fibre waviness are created. As a result, higher strengths and stiffnesses as well as good resistance to layer detachment can be achieved in the laminate.

Nevertheless, tape fabrics have rarely been used in structural components to date due to the lack of reliable material parameters. Existing test standards do not take sufficient account of their special features. The large width of the tapes results in large, repetitive fabric structures. In order to represent these, wide test specimens would be required, which are often not testable according to current standards. Smaller test specimens, on the other hand, do not adequately capture the tissue structure and provide less reliable results. The uncertain data basis makes component design more difficult and leads to high safety margins. In addition, tape fabrics exhibit different draping behaviour than conventional fabrics due to their high stiffness, meaning that established simulation and empirical approaches are only transferable to a limited extent.

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### Purpose

With TaGeT, the project partners want to lower the entry barriers for the use of tape fabrics in semi-finished fibre composite products by reducing the uncertainties regarding material properties and design.

To this end, the researchers are developing new, standardisable test methods for fibre composite plastics based on tape fabrics. The aim is to determine representative and resilient material characteristics and thus enable reliable, material-saving component design. In addition, the team is developing a draping simulation that realistically depicts the forming behaviour of tape fabrics. This makes it possible to avoid exceeding the critical shear angles of the tape fabrics and thus typical draping errors such as creases or fibre misorientation.

The researchers show that the new methods significantly reduce measurement scatter and allow a more reliable design. Using demonstrator components, they show how material usage and weight can be reduced. In doing so, they are creating the basis for using tape fabrics more widely and saving resources and CO<sub>2</sub> as early as the design process.

### Procedure

First, the project team analyses which test specimen dimensions are suitable for the fabric structures and how this affects the measured values. Based on this, the researchers develop customised test specifications and construct a new testing device that is designed for higher forces and larger specimen formats. In tests, they compare the newly developed methods with the previous standardised tests.

At the same time, the researchers are experimentally analysing the drapability of different tape fabrics and deriving relevant characteristic values. This data is incorporated into a simulation model that predicts the fibre orientation and the critical shear angles after forming.

Finally, the project team designs, manufactures and tests demonstrator components using the material data obtained. In this way, the consortium evaluates the new testing and simulation methods and prepares their transfer to industrial application.

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**Funding duration:**

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**Funding amount:** EUR 909 thousand

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**Final report**

**Further websites**

[foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB5012A](https://foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB5012A) - TaGeT in the federal funding catalogue

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## Project coordination

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## English (EN){{ Projektpartner }}



## Lightweighting classification

### Realisation

#### Offer

#### Products

Materials



#### Services & consulting

Testing and trials, Standardisation, Validation,  
Simulation



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Lightweighting classification	
	Realisation
<b>Field of technology</b>	
<b>Design &amp; layout</b> Lightweight manufacturing, Lightweight material construction	✓
<i>Functional integration</i>	
<b>Measuring and testing technology</b> Materials analysis, Destructive analysis	✓
<b>Modelling and simulation</b> Loads & stress, Materials, Reliability validation	✓
<b>Plant construction &amp; automation</b> Robotics	✓
<i>Recycling technologies</i>	
<b>Manufacturing process</b>	
<i>Additive manufacturing</i>	
<i>Coating (surface engineering)</i>	
<b>Fibre composite technology</b> Resin infusion process, Vacuum infusion	✓
<i>Forming</i>	
<i>Joining</i>	
<i>Material property alteration</i>	
<i>Primary forming</i>	
<i>Processing and separating</i>	
<b>Textile technology</b> Preforming, Weaving	✓

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Lightweighting classification	
	Realisation
<b>Material</b>	
<i>Biogenic materials</i>	
<i>Cellular materials (foam materials)</i>	
<b>Composites</b> Carbon-fiber reinforced plastics (CFRP)	✓
<b>Fibres</b> Carbon fibres	✓
<i>Functional materials</i>	
<i>Metals</i>	
<b>Plastics</b> Thermoset plastics	✓
<i>Structural ceramics</i>	
<b>(Technical) textiles</b> Yarns, rovings, Woven fabrics, Others (Tape fabric)	✓