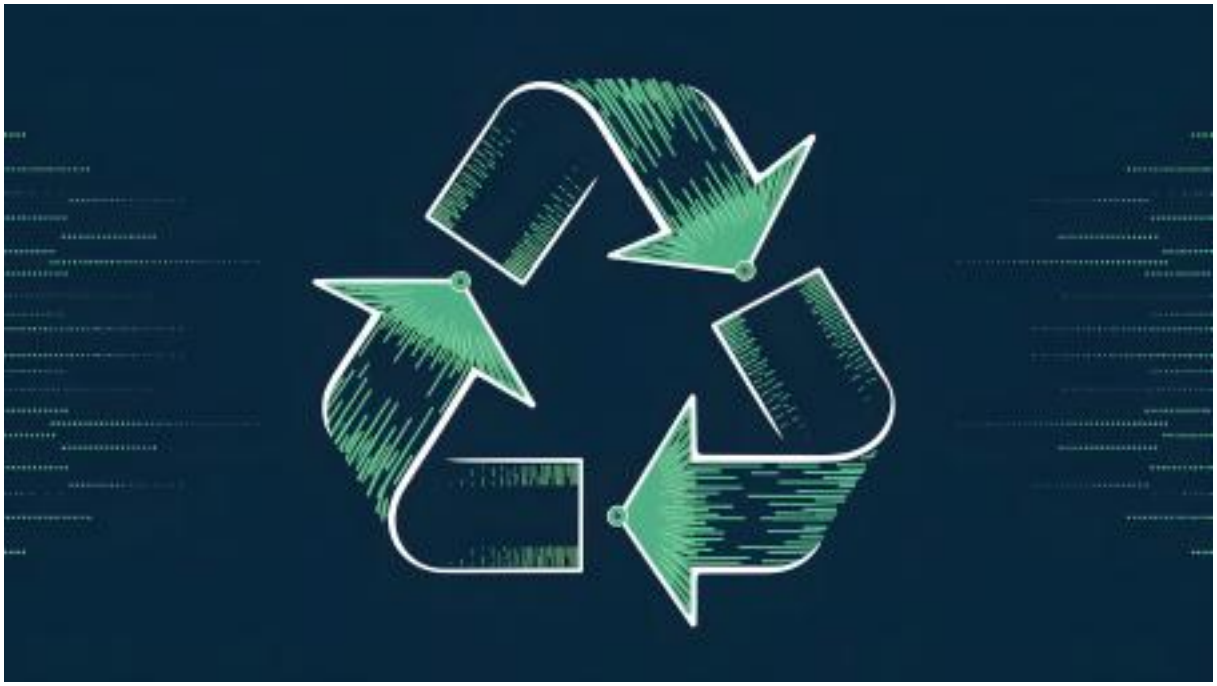
# High-quality recycling of hybrid components: Digital process chain for composites

## About this project



### DIGITAL_RE-ALISE

### High-quality recycling of hybrid components: Digital process chain for composites

**Markets:**

**Material:** Thermoplastics, 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

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### Context

Hybrid lightweight components made of metal and fiber-reinforced plastics (FRP) are used in many industries, such as automotive engineering, because they save weight and also have good mechanical properties. However, recycling these materials at the end of their useful life poses challenges for the industry: it is often not economically viable to separate the materials by type and reuse them in comparable quality.

Common recycling processes also shorten the fibers and change their orientation—both of which are crucial for the load-bearing capacity of new components. The recovered materials are then usually only suitable for applications with lower requirements. This is particularly relevant for fibers whose production requires a lot of energy. At the same time, there is a lack of application-oriented processes that specifically recycle production waste and end-of-life components into high-quality materials.

The research team in the DIGITAL_RE-ALISE project is addressing this issue and developing recycling methods that maintain material quality, reduce energy consumption, and take industrial constraints into account.

### Purpose

The participants are developing a recycling process for hybrid components made of metal and fiber-reinforced thermoplastics that enables high-quality reuse of the materials they contain. Their goal is to separate the components into pure plastic, FRP, and metal fractions and use them to produce new, resilient FRP semi-finished products. These semi-finished products should be suitable for structural applications once again.

In addition, the team is examining how much energy and greenhouse gas emissions the new process saves compared to established methods. An accompanying life cycle analysis confirms the ecological and economic effects. Typical hybrid components serve as demonstrators, on which the recycling process is tested and the reuse of the recyclates in new components is demonstrated.

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### Procedure

The project follows a continuous process chain. First, the researchers derive requirements from real hybrid components and develop methods to separate them into their main components in a targeted manner and with low thermal stress. They then prepare the FRP components in such a way that fiber lengths and fiber orientation are preserved as far as possible and can be used for new semi-finished products.

At the same time, the participants use digital methods such as sensor technology and image-based recording. They use these to monitor and document material and process data along the chain in order to ensure quality and build up process knowledge. They then process the manufactured semi-finished products into demonstrator components and test their properties. Finally, life cycle and sustainability analyses evaluate the new recycling process and support its transfer to industrial applications.

**Funding duration:**

| | | | |
|---|---|---|---|
| **Funding sign:** | 03LB3082 | **Funding amount:** | EUR 1.2 million |

**Final report**

**Further websites** foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3082A - DIGITAL_RE-ALISE in the federal funding catalogue

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## Project coordination

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## English (EN){{ Projektpartner }}

## Lightweighting classification

| | Realisation |
|---|---|
| **Offer** | |
| **Products**<br>Parts and components, Machines and plants, Tools and moulds | ✓ |
| **Services & consulting**<br>Engineering | ✓ |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Field of technology** | |
| *Design & layout* | |
| **Functional integration**<br>Sensor technology | ✓ |
| **Measuring and testing technology**<br>Materials analysis | ✓ |
| *Modelling and simulation* | |
| *Plant construction & automation* | |
| **Recycling technologies**<br>Recycling | ✓ |
| **Manufacturing process** | |
| *Additive manufacturing* | |
| *Coating (surface engineering)* | |
| *Fibre composite technology* | |
| *Forming* | |
| *Joining* | |
| *Material property alteration* | |
| *Primary forming* | |
| *Processing and separating* | |
| *Textile technology* | |

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## Lightweighting classification

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