

Modular, recyclable lightweight trailers: from fibre composites and recycled materials

About this project



ReLeiMi

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Markets:



Material:

Glass fibres, Thermoplastics, Others (Glass mat reinforced thermoplastic (GMT))

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

Delivery traffic in cities is increasing. The so-called last mile in particular, the final section of the supply chain from the depot to the customer, involves many journeys with frequent starting, stopping and manoeuvring. This costs energy and causes emissions.

Micromobile transport solutions such as electrically assisted cargo bikes or compact electric vehicles can cover short inner-city distances, but quickly reach their limits in terms of payload and range. These vehicles often tow a trailer to transport goods. Its mass is a decisive lever: every additional kilogram puts a strain on the drive and battery.

At the same time, conventional trailers are often made up of many individual parts. Complex joining processes and manual steps increase energy requirements, costs and CO₂ in production. What is needed are construction methods that reduce weight, integrate functions and use materials in such a way that they can be returned to the cycle. This is where ReLeiMi comes in.

Purpose

The researchers are developing a modular trailer for smart pedal vehicles, i.e. electrically assisted light vehicles that combine pedal power with an electric drive system, for commercial use over the last mile.

The team is replacing the previous metallic basic structure with load-bearing structural components made of glass mat-reinforced thermoplastic. For non-load-bearing shell elements, it uses recycled plastics such as PET and designs the mixed construction in such a way that the materials can be separated and returned to the cycle at the end of their useful life.

The parties involved reduce the mass of the trailer and minimise the number of individual parts by integrating functions. This includes integrated fastenings, cable routes and defined areas for the application of force. They integrate sensors for condition monitoring and develop a plug-and-play interface so that superstructures can be changed quickly depending on the application.

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Procedure

Firstly, the team defines requirements and typical load cases for the trailer in commercial use and translates them into a concept for modular design, interfaces and functional integration. It develops the structural components made of glass mat-reinforced thermoplastic with computer-aided design and uses simulations for load-appropriate reinforcement.

The team then implements a near-series process chain consisting of pressing and downstream injection moulding in order to manufacture and specifically functionalise structural components. At the same time, it produces shell elements from recycled plastics in the injection moulding process and designs them to be separable for later return to the cycle.

The team then assembles prototypes and tests them for dynamic stress and suitability for use, supplemented by application tests in real operation. Finally, it evaluates the weight, assembly effort, production data, recycling concept and carbon footprint with a life cycle analysis and derives design guidelines for transferable lightweight applications.

Funding duration:

Funding sign:	03LB3093	Funding amount:	EUR 1.4 million
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Final report

Further websites	foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3093A - ReLeiMi in the federal funding catalogue
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Project coordination

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English (EN){ { Projektpartner } }



Lightweighting classification

Realisation

Offer

Products

Parts and components, Semi-finished parts



Services & consulting

Prototyping



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Lightweighting classification	
	Realisation
Field of technology	
Design & layout Lightweight manufacturing, Hybrid structures, Lightweight material construction	✓
Functional integration Sensor technology, Thermal activation	✓
Measuring and testing technology Component and part analysis, System analysis, Materials analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Optimisation, Processes, Structural mechanics, Materials	✓
<i>Plant construction & automation</i>	
Recycling technologies Material separation, Recycling	✓
Manufacturing process	
<i>Additive manufacturing</i>	
<i>Coating (surface engineering)</i>	
Fibre composite technology Fibre spraying, Others (Pressing and injection moulding process)	✓
Forming Compression moulding	✓
<i>Joining</i>	
Material property alteration Thermomechanical treatment	✓
Primary forming Injection moulding	✓
<i>Processing and separating</i>	
<i>Textile technology</i>	

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Lightweighting classification	
	Realisation
Material	
<i>Biogenic materials</i>	
<i>Cellular materials (foam materials)</i>	
Composites	
Others (Glass mat reinforced thermoplastic (GMT))	✓
Fibres	
Glass fibres	✓
<i>Functional materials</i>	
<i>Metals</i>	
Plastics	
Thermoplastics	✓
<i>Structural ceramics</i>	
<i>(Technical) textiles</i>	