

Lightweight wheels made from secondary aluminium: reducing CO# emissions over the entire life cycle

About this project



SUPA-Wheel

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Markets:  

Material: Bioplastics, Thermoplastics, Aluminium

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

Aluminium wheels are widely used in automotive engineering because they are light, stable and flexible. However, their production has a considerable impact on the climate and environment: the extraction of primary aluminium is energy-intensive and releases large amounts of CO₂. Although aluminium is easy to recycle, manufacturers have so far relied almost exclusively on primary material for safety-relevant components such as wheels. This is due to the high requirements in terms of strength, corrosion resistance, surface quality and acoustic properties. The change in mobility is further exacerbating this situation: electric vehicles require lighter components with particularly good acoustic properties, as the usual engine noise is no longer an issue.

This is where the SUPA-Wheel project comes in. The team is investigating how aluminium wheels can be developed from secondary materials that meet both technical and ecological requirements.

Purpose

The team wants to develop a wheel made from secondary aluminium that meets the highest technical and ecological standards. The focus is on significantly reducing CO₂ emissions over the entire life cycle - from material extraction to production and recycling.

To this end, the researchers are developing a development and design methodology that takes the carbon footprint into account from the design phase through development to production. They design the wheels in such a way that functionality, durability and resource conservation are guaranteed even with fluctuating material properties.

At the same time, the team is investigating the use of bio-based or recyclable plastics for inserts that improve aerodynamics and save weight. These approaches are creating a methodology that supports future development processes and takes CO₂ limits into account as an integral part of the design.

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Procedure

The project team is looking at the entire process chain - from sorting the recycling material to the finished wheel construction. The researchers analyse old scrap using laser-based processes and sort it in such a way that the purest possible secondary alloys are produced. The researchers melt new alloys, heat treat them and test them in laboratory and pilot plants.

At the same time, the scientists are developing digital models that closely link material properties, design, process parameters and CO₂ balances. They use simulations of strength, stiffness, vibration behaviour and aerodynamics to optimise constructions in such a way that lower material qualities can be compensated for by innovative design. The team produces prototypes, tests them for durability and compares the results with the simulations.

In addition, the team creates a life cycle analysis that includes energy mixes, production locations and future scenarios. Step by step, a modular system is being created that allows recycled materials to be integrated into high-quality wheels and other lightweight components.

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Funding duration:

Funding sign:

03LB2054

Funding amount:

EUR 1.2 million

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2054A - SUPA-Wheel in the federal funding catalogue

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Project coordination

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English (EN){ { Projektpartner } }

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Lightweighting classification	
	Realisation
Offer	
Products Parts and components, Materials	✓
Services & consulting Training, Consulting, Testing and trials, Engineering, Prototyping	✓
Field of technology	
Design & layout Lightweight manufacturing	✓
Functional integration Others	✓
Measuring and testing technology Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Structural mechanics, Materials	✓
Plant construction & automation Others	✓
Recycling technologies Recycling	✓

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Lightweighting classification	
	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration Heat treatment	✓
Primary forming Casting, Injection moulding	✓
Processing and separating	
Textile technology	
Material	
Biogenic materials Bioplastics	✓
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Aluminium	✓
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	