Semi-finished products made of magnesium: efficient and climate-friendly production and processing

About this project

CLEAN-Mag

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Markets:

Material: Magnesium

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

Magnesium offers great opportunities in lightweight construction. The material is particularly light, easy to mould and fully recyclable. This makes it ideal for components in vehicles, trains and aeroplanes. However, industrial processing is complex: Up to now, semi-finished products such as sheets or wires have been produced in several separate process steps that require a lot of energy. Melting in particular causes high CO# emissions, as fossil fuels such as natural gas are often used. At the same time, a large proportion of the process heat remains unutilised.

This is where new technological approaches come in: They combine renewable energy sources with intelligent process management and targeted heat utilisation. The aim is to make magnesium processing more energy-efficient, lower-emission and economically viable - and thus future-proof for industrial series application. The possible fields of application range from car body components, seat supports and structural profiles in vehicle construction to interior panelling in rail vehicles and electronic and housing components in aviation.

Purpose

In the CLEAN-Mag project, the partners are developing new, completely climate-friendly processes for the production of semi-finished magnesium products for lightweight construction. The aim is to significantly reduce CO# emissions and energy consumption along the entire process chain. To achieve this, the team is replacing fossil natural gas in the melting process with climate-neutral hydrogen. By linking the forming process directly to the casting process, the existing melting heat is utilised efficiently. In addition, the researchers are processing a flexible new type of magnesium alloy that is characterised by good cold formability. This also reduces the energy required for further processing.

The project aims to develop specific prototypes for functional applications in the transport sector and to transfer these to small series production. The basis is being created to technically convert existing systems, make new process routes industrially usable and realise specific applications in the mobility sector. To this end, the entire production chain from semi-finished product production to prototype is being considered, including challenges in the areas of joining technology and surface treatment to prevent corrosion. The CO# calculation for the value chain is an important aspect that is taken into account in the project. The project focuses on the development of prototypes in the field of transport.

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Procedure

The project team begins by analysing the existing melting process. It measures the energy flows and emissions of a real plant and evaluates its energy optimisation potential. At the same time, the researchers are testing various hydrogen burners in practical use in order to completely replace fossil natural gas as a heat source. They use the data collected to create a digital twin of the furnace. This virtual model replicates the real process and enables precise simulation and control of the operating states.

The partners are pursuing various process chains for the production and processing of the semi-finished magnesium products. On the one hand, they work with the so-called GieWaCon process, which combines casting-rolling with a continuous extrusion process (Conform®). Secondly, they utilise the extrusion of magnesium sheets from the casting heat.

The researchers process the magnesium alloy ZAX210, which can be easily moulded at lower temperatures so that a wide range of components can be produced. Exemplary prototypes include rail seat backs, various hovercraft components, lightweight PC housings and forged parts for shipping containers. To this end, the project consortium is investigating issues relating to surface treatments for corrosion protection and joining processes such as welding. Finally, the researchers will calculate the CO# impact using a specially developed tool based on the cradle-to-cradle approach.

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Funding duration:

Funding sign:	03LB3080	**Funding amount:**	EUR 4.7 million

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3080A - CLEAN-Mag in the federal funding catalogue

www.cleanmag.de - Project website CLEAN-Mag

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Project coordination

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English (EN){{ Projektpartner }}

WSM Weber Schweißmaschinen GmbH

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Lightweighting classification

	Realisation
Offer	
Products Semi-finished parts, Materials	✓
Services & consulting Training, Testing and trials, Prototyping, Validation, Technology transfer	✓
Field of technology	
Design & layout	
Functional integration	
Measuring and testing technology	
Modelling and simulation Others (CO2 footprint according to Cradle to Cradle)	✓
Plant construction & automation	
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering) Painting, Powder coating	✓
Fibre composite technology	
Forming Forging, Extrusion moulding, Rolling, Others (GieWaCon: Combination of (wire) casting rollers and Conform® process for Mg)	✓
Joining Welding	✓
Material property alteration Heat treatment	✓
Primary forming Others (Wire and belt casting rollers)	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Magnesium	✓
Plastics	
Structural ceramics	
(Technical) textiles	