Low-pressure iron and steel casting: save material and CO# with moulded shells

About this project

SUPREME

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Markets:

Material: Steel, Others (Iron and steel casting)

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

The iron and steel casting industry is under increasing pressure to innovate and cut costs. On the one hand, e-mobility is changing demand: traditional cast parts for combustion engines are becoming less important, while new applications are emerging. On the other hand, stricter environmental regulations and rising disposal costs for used foundry sands are putting the industry under additional pressure. Conventional processes such as gravity casting are material and energy intensive. They reach their limits when it comes to thin-walled components in particular - even though there is great potential for lightweight construction here. New approaches are needed to utilise this potential.

One key lies in the further development of moulding materials: inorganic binders are considered a promising alternative to organic binders: they cause fewer emissions, simplify disposal and enable new process routes. These systems offer the advantage of being able to work with preheated moulding materials. This enables longer flow paths for the melt during mould filling for both conventional gravity casting and low-pressure casting and helps to further reduce wall thicknesses, thereby expanding the lightweight construction potential for applications in iron and steel casting. So far, however, inorganic binders have mainly been established in light metal casting. For iron and steel casting, with its high melting temperatures and mechanical requirements, a solution is still lacking.

Purpose

The researchers are further developing low-pressure casting technology so that thin-walled yet high-strength iron and steel castings can be produced close to series production. To this end, they are using inorganic binder systems and optimising them for the special stresses in iron and steel casting.

The project pursues not only technical, but also ecological and economic goals: The researchers want to reduce the amount of moulding material used by up to 80 per cent, significantly reduce the need for recycled material and thus save energy and CO#. The disposal of used sand is also to be drastically reduced.

At the same time, the partners want to shorten process times and increase productivity. In this way, SUPREME is helping to secure the competitiveness of the German foundry industry and open up new markets in lightweight construction, particularly in vehicle technology.

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Procedure

The scientists are developing new inorganic moulding material systems that can withstand high temperatures and can be used in both 3D printing and core shooting processes. At the same time, they are setting up a low-pressure moulding system tailored to iron and steel alloys.

The project team is relying on innovative moulding material carriers: these stabilise thin, shell-like sand cores and significantly reduce material consumption. Heating and cooling systems in the carrier precisely control solidification, increase component quality and shorten cycle times.

The researchers are testing the process chain on representative demonstrator components and verifying its feasibility in industrial-scale trials. This is supplemented by life cycle assessments and economic analyses. The result is a holistic picture that takes equal account of technical performance, ecological impact and economic viability.

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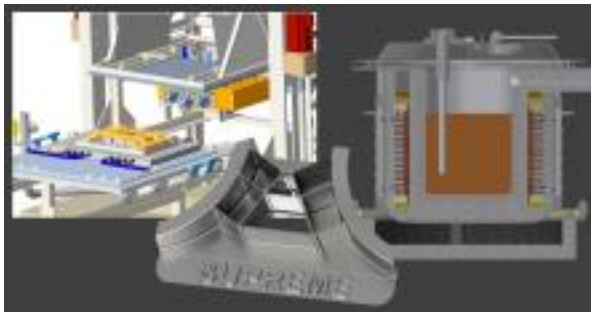

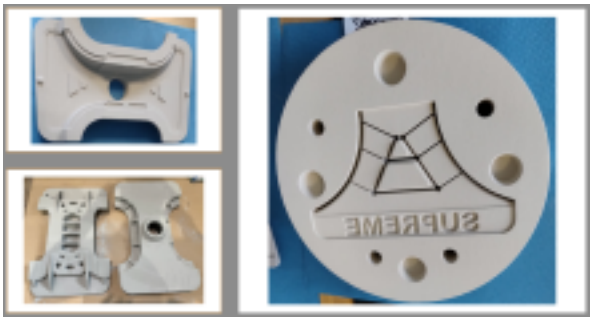

Funding duration:

Funding sign:	03LB4011	**Funding amount:**	EUR 1.7 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB4011A - SUPREME 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, Machines and plants, Systems and end products, Materials, Tools and moulds	✓
Services & consulting Testing and trials, Technology transfer	✓
Field of technology	
Design & layout Lightweight manufacturing, Lightweight design	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation Others (Casting simulation)	✓
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing, Selective laser sintering (SLS)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming Casting	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Steel, Others (Iron and steel casting)	✓
Plastics	
Structural ceramics	
(Technical) textiles	