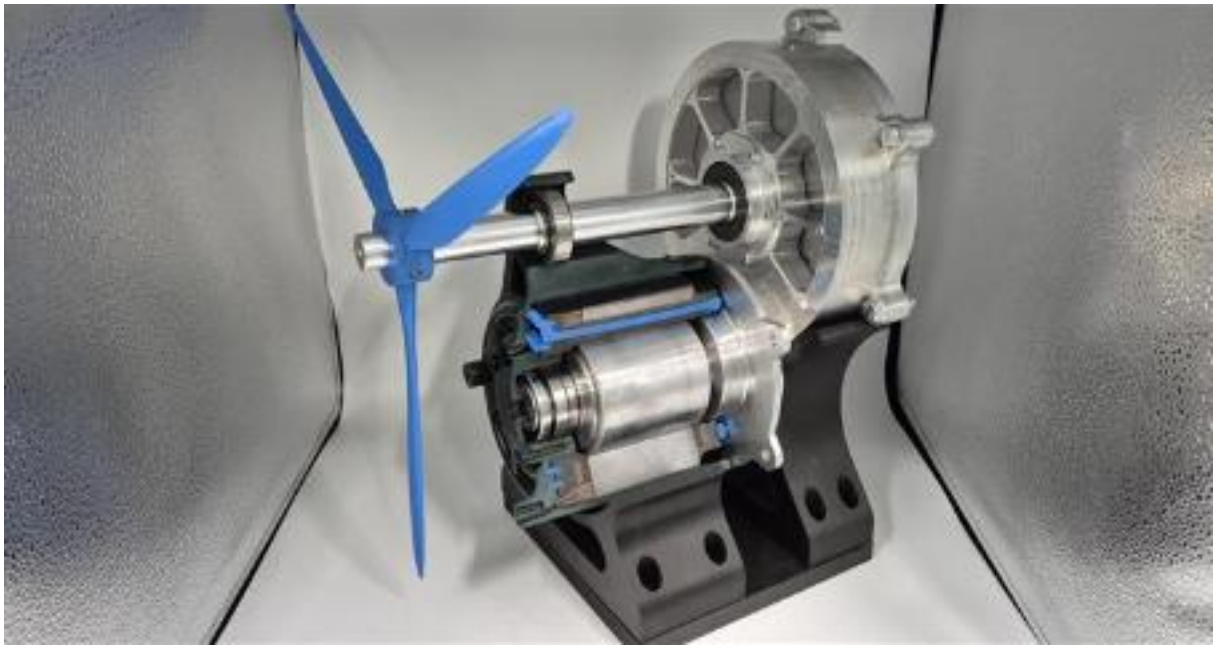
Cavity balancing and sprue recycling: optimising injection moulding of thermoset plastics

About this project



Lite2Duro

Cavity balancing and sprue recycling: optimising injection moulding of thermoset plastics

Markets:

Material: Glass fibres, Thermoset plastics, Others (Glass fibre reinforced compounds)

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

Whether in the automotive industry, aviation or medical technology - lightweight construction is a key component in conserving resources and reducing emissions. Plastics make an important contribution to this. Up to now, thermoplastics, whose processing is well researched, have mainly been used in applications suitable for large-scale production. Thermosetting plastics, on the other hand, which remain permanently dimensionally stable after curing and are characterised by high temperature and chemical resistance, often offer superior thermomechanical properties. However, their processing is associated with particular challenges - especially when it comes to injection moulding on an industrial scale and recycling. Unbalanced filling behaviour, limitation of maximum shot volumes and non-recyclable sprues lead to material losses and poor energy efficiency. These deficits hinder the sustainable use of thermoset materials in large-scale production. This is precisely where the Lite2Duro project comes in.

Purpose

The researchers are working on three key process innovations to make the injection moulding of thermoset moulding compounds more resource-efficient, economical and suitable for large-scale production. In this way, they want to open up new areas of application for thermoset materials, particularly in areas such as mobility, household and medical technology.

On the one hand, the team is developing what is known as active cavity balancing, which allows several components to be filled evenly in one mould. This is a technology that specifically controls the melt flow into the individual cavities of an injection mould in order to ensure uniform filling. This is a decisive factor for reproducible component quality and minimised reject rates. The technology is known from thermoplastic processing, but has not yet been used for thermosets.

On the other hand, the researchers want to further develop injection moulding technology so that larger plastic volumes can be processed per cycle - an important step towards the economical production of large-format components. They are also pursuing a recycling strategy for hardened sprue residues: in future, these are to be processed and directly reused as filler material.

The researchers want to test the practical suitability of all three approaches using two demonstrators - an innovative electric motor housing and a robustly encapsulated transponder for sporting events.

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Procedure

Firstly, the scientists are developing a new type of balancing technology for the injection moulding of thermosets: Using sensor technology and simulation, they record the filling process in real time and control the temperature of the flow channels in a targeted manner in order to achieve a uniform component appearance.

At the same time, they are testing a new plasticising unit for injection moulding machines that allows larger shot volumes - an important prerequisite for the production of larger, more complex components. The scientists are specifically coordinating the energy input, dwell time and temperature control in order to reliably control the processing of the thermosets in the process.

Thirdly, the team is pursuing an approach to recycling sprue residues by granulating them and feeding them directly back into the production process as a filler. In test series, the researchers are investigating how this affects processability in injection moulding and the mechanical properties of the end products. All developed process steps are then transferred to two industrial demonstrators and analysed in terms of their sustainability - including the CO# efficiency of the process.

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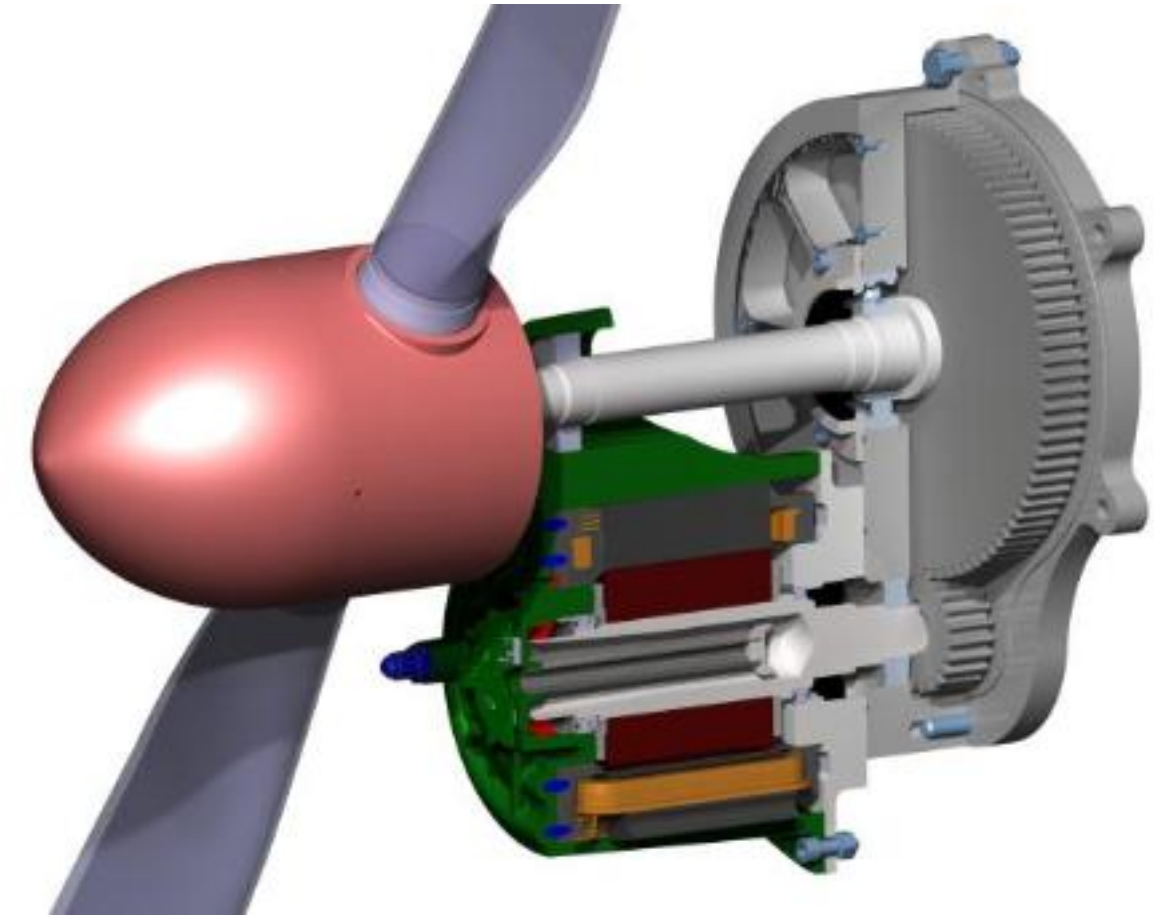

Funding duration:

Funding sign:	03LB3015	**Funding amount:**	EUR 1.9 million

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3015A - Lite2Duro in the federal funding catalogue

www.ict.fraunhofer.de/de/projekte/Lite2Duro.html - Project description of the Fraunhofer ICT

www.fast.kit.edu/lbt/4590_15090.php - Project description of the KIT-FAST

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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, Software & databases, Tools and moulds	✓
Services & consulting Training, Consulting, Testing and trials, Engineering, Validation, Simulation, Technology transfer	✓
Field of technology	
Design & layout Lightweight manufacturing, Lightweight design, Lightweight material construction	✓
Functional integration Actuator technology, Others (Transponder/ Antenna)	✓
Measuring and testing technology	
Modelling and simulation Loads & stress, Life-cycle analysis, Optimisation, Processes, Materials	✓
Plant construction & automation Plant construction	✓
Recycling technologies Recycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Others (Injection moulding of fibre-reinforced compounds)	✓
Forming	
Joining	
Material property alteration Heat treatment	✓
Primary forming Injection moulding	✓
Processing and separating	
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Others (Glass fibre reinforced compounds)	✓
Fibres Glass fibres	✓
Functional materials	
Metals	
Plastics Thermoset plastics	✓
Structural ceramics	
(Technical) textiles	