

Hybrid presses for complex vehicle components: Efficiently combining metal and plastic

About this project



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MuSt-HyF

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Markets: 

Material: Glass fibres, Thermoplastics, Aluminium, Steel, Woven fabrics, Glass-fiber reinforced plastics (GFRP)

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

[Technology Transfer Program Leichtbau](#)

Context

Lightweight construction is a central building block for the automotive industry in order to conserve resources, increase energy efficiency and reduce CO₂ emissions during the service life of vehicles. Mixed material construction - the combination of metals and plastics - plays a key role here, as it combines the positive properties of both materials. The aim is to develop components that are not only lighter, but also more stable and energy-efficient.

One of the challenges is the efficient and economical production of hybrid components that combine metal and fibre-reinforced plastic (FRP). Previous processes such as hybrid pressing are promising, but have reached their technical limits, particularly when using high-strength steels and complex component geometries. This is where the researchers in the MuSt-HyF project come in: They are developing an innovative process for the production of such hybrid components.

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Purpose

The main aim of the project team is to develop a two-stage hybrid pressing process in order to optimise the production of high-strength hybrid components made of metal and FRP. Until now, only components with simple geometries and low steel strengths could be manufactured using hybrid pressing. The new process should also make it possible to produce complex components from high-strength steels.

By separating the forming processes for metal and plastic into two mould cavities - the cavities in a mould in which the material is brought into the desired shape during the forming process - local detachment and cracks are to be avoided. In this way, the researchers not only increase process reliability, but also significantly reduce CO₂ emissions and energy consumption in production. They are taking care to design the process in such a way that it is compatible with existing production systems and thus enables broad application in series production.

Procedure

The project team is pursuing an innovative, two-stage process approach. First, the sheet metal is formed in the first tool cavity, whereby the researchers optimise the material springback and forming properties by adjusting the temperatures and tool configurations. In the second step, they apply the semi-fluid, long-fibre-reinforced thermoplastic PA6-Flowcore to the preformed metal sheet and simultaneously press it into the desired shape. This process enables the integration of complex component geometries and improves the bond between steel and plastic through the use of a specially developed bonding agent. At the same time, the mould for both stages is designed so that production can take place at constant temperatures and short cycles.

In addition to process development, the project participants are also optimising the PA6-Flowcore material in order to meet the specific requirements for crash safety and vibration resistance. This combination of innovative production technology and customised materials should result in components that offer significant weight savings and a better carbon footprint compared to traditional manufacturing processes.

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Funding duration:

Funding sign:	03LB3075	Funding amount:	EUR 1.2 million
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Final report

Further websites	foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3075A – MuSt-HyF in the federal funding catalogue
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Project coordination

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English (EN){ { Projektpartner } }



Lightweighting classification

Realisation

Offer

Products

Services & consulting

Training, Testing and trials, Engineering,
Simulation



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Lightweighting classification	
	Realisation
Field of technology	
Design & layout Lightweight manufacturing, Hybrid structures	✓
<i>Functional integration</i>	
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis	✓
Modelling and simulation Crash behaviour, Loads & stress, Life-cycle analysis, Optimisation, Materials	✓
<i>Plant construction & automation</i>	
<i>Recycling technologies</i>	
Manufacturing process	
<i>Additive manufacturing</i>	
<i>Coating (surface engineering)</i>	
<i>Fibre composite technology</i>	
Forming Impact extrusion, Deep-drawing	✓
Joining Welding	✓
Material property alteration Heat treatment	✓
<i>Primary forming</i>	
<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 Glass-fiber reinforced plastics (GFRP)	✓
Fibres Glass fibres	✓
<i>Functional materials</i>	
Metals Aluminium, Steel	✓
Plastics Thermoplastics	✓
<i>Structural ceramics</i>	
(Technical) textiles Woven fabrics	✓