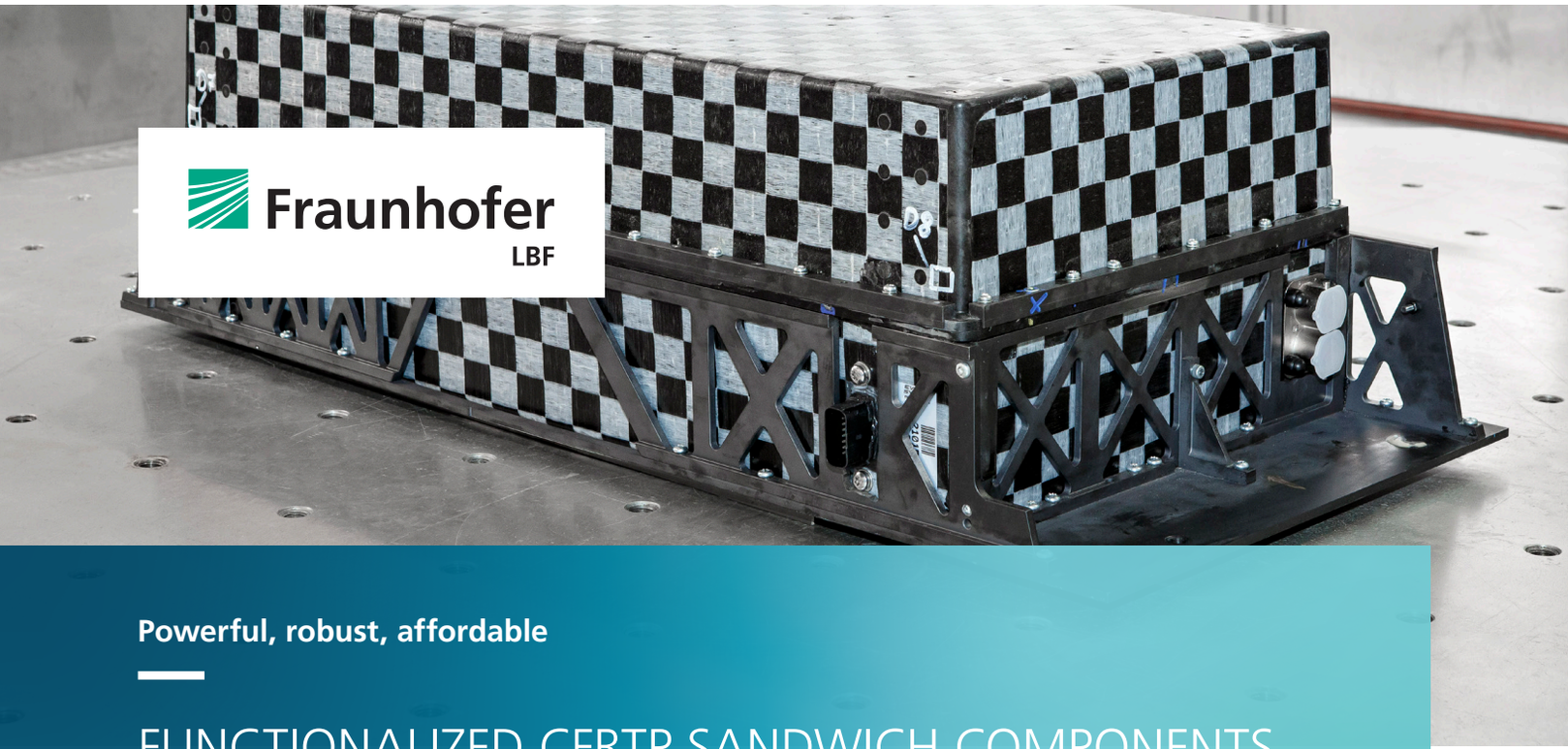

Fraunhofer LBF

Powerful, robust, affordable

FUNCTIONALIZED CFRTP SANDWICH COMPONENTS WITHIN MINUTES

Battery packs for electric vehicles (EVs) are very heavy due to the high quantity of battery cells needed if the targeted high driving ranges beyond 500 kilometers are to be achieved. The housing, which is currently made of aluminum or steel, add up to a high total weight of several hundred kilograms in addition to the electrical components. Within the EU project "GHOST" (InteGrated and Physically Optimised Battery System for Plug-in Vehicles Technologies) a composite battery housing was developed, which is not only light but also cost-efficient. This was achieved using continuous fiber reinforced thermoplastics (CFRTP) and novel processing technologies, enabling the manufacture of a sandwich composite battery housing within only two minutes.

Challenge

- EV weight is significantly increased by battery pack and its structure
- Manufacture of battery housings using metals involves issues e.g. electric conductivity and limited component integration
- The cost of battery housing manufacture still is high due to the variability of processes and process steps involved

	BMW i3	BMW i8	E-Golf	Tesla Model S
Total weight battery system (kg)	283	98	318	600
Weight (excl. cells) (kg)	58	38	191	270
Potential weight saving of the battery system (%)	10	25	20	25
Potential battery system energy density (Wh/kg)	117	72	76	141
Increase of battery system energy density (%)	11	26	25	30

Solution

- Design and manufacture of a sandwich composite battery housing reducing the weight by up to 40%
- The stress-equivalent use of glass fiber reinforced polymers enables electrical isolation and function integration
- A highly efficient manufacturing technique leads to ready to use battery housings within two minutes

Novel lightweight battery housing consisting of thermoplastic composites in a sandwich design

Challenge: Reduce battery pack weight using a cost-efficient composite housing

- Resulting from the required driving ranges and current energy densities of Li-Ion batteries, electric vehicles (EVs) and their battery packs respectively are relatively heavy
- The design and manufacture of battery housings is based on aluminium or steel, leading to issues regarding their electrical conductivity and their ease of manufacture.
- The EU-project GHOST has targeted an decrease of housing weight by 30 % and a reduction of cost by 20%.

Solution: Cost-efficient manufacture of a composite battery housing

- A novel lightweight battery housing was developed using thermoplastic composites leading to a weight reduction of up to 40%
- A hybrid process technology was developed enabling the cost efficient manufacture of a high-strength battery housing with stress equivalent use of thermoplastic composites in a sandwich construction.
- The use of glass fiber reinforced thermoplastics and the manufacturing technique enables high function integration and low cycle times of only two minutes, which results in a significant cost reduction

Battery Housing: CFRTP Sandwich Structure

- Integral polymer foam provides high thermal insulation
- Composite facesheets (CFRTP) bear mechanical loads
- Novel hybrid manufacturing process enables low cycle times and low component cost

Battery Housing: Efficient Hybrid Manufacture

- Novel in-situ manufacturing process enables production of CFRTP sandwich components
- A polymer foam core is injection moulded between preformed CFRTP facesheets
- The facesheets consist of a consolidated laminate of UD tapes (UDMAX™, SABIC) with cross composite (0/90/90/0) layup
- After preforming of the laminate, the CFRTP preforms are inserted in the mould and polymer foam is injected between two preform covers.
- The process enables the manufacture of functionalized CFRTP sandwich structures in only about two minutes.

More Information

Further information: www.lbf.fraunhofer.de/ghost

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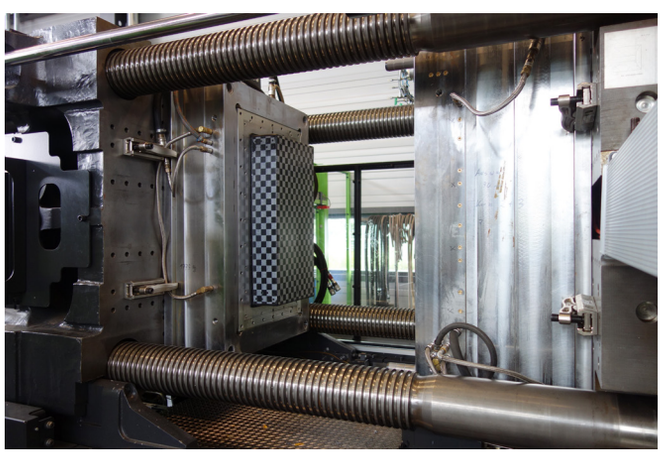
InteGrated and Physically Optimised Battery System for Plug-in Vehicles Technologies

GHOST

European Commission

Horizon 2020
European Union funding
for Research & Innovation



Hybrid process technology for the cost efficient manufacture of composite battery housings

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