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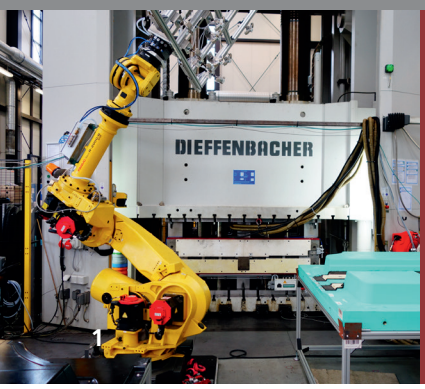

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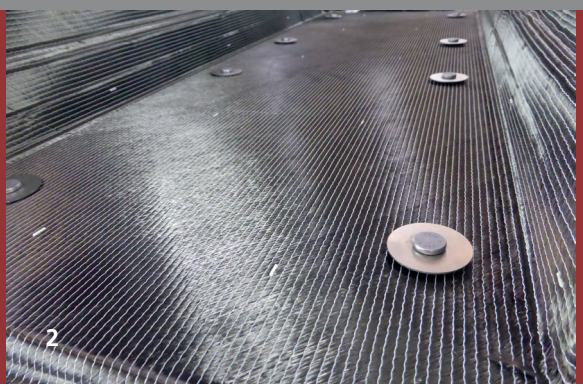
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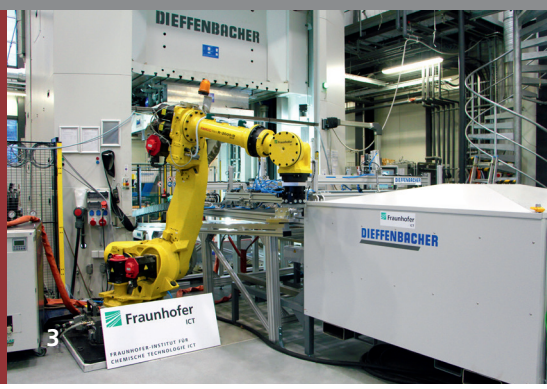

3

1 *Production of thermoset floor module.*
2 *Intrinsically joined metallic inserts.*
3 *Production of thermoplastic floor module.*

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SYSTEM-INTEGRATED MULTI-MATERIAL LIGHTWEIGHT DESIGN FOR E-MOBILITY

SMiLE

Introduction

The publicly funded research project SMiLE "System-integrated multi-material lightweight design for e-mobility" is developing a detailed understanding of efficient lightweight construction using intelligent FRP-metal multi-material design. A central research focus is the use of fiber composites for complex, three-dimensional structural components in an automotive series production. The project addresses fiber-reinforced plastic (FRP) components with a thermoplastic and a thermoset matrix. The processing of semi-finished continuous-fiber-reinforced thermoplastic products is conducted in combination with long-fiber-reinforced thermoplastic (LFT) compression molding, whereas the resin transfer molding (RTM) and wet compression processes are used for the production of FRP components based on thermoset matrix systems.

Project facts

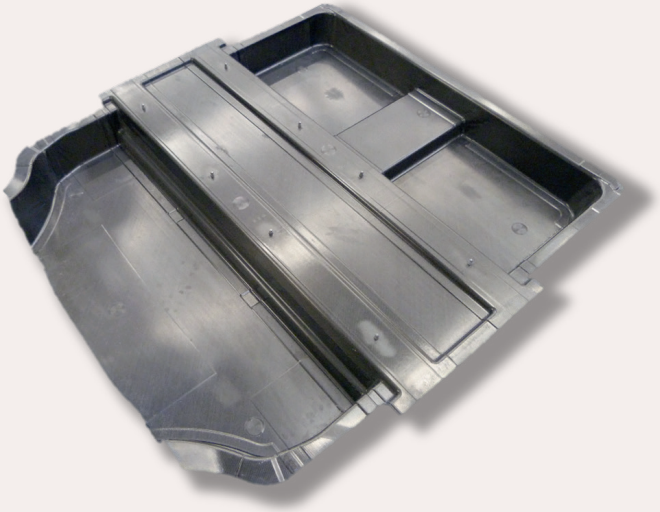
- Research project funded by the Federal Ministry of Education and Research (BMBF)
- Project executing organization: Projektträger Jülich (PTJ)
- Project duration: 01.09.2014 – 28.02.2018
- Overall project management: AUDI AG
- Declared as "BMBF lighthouse project" of the National Platform for Electro-Mobility, Berlin 2015

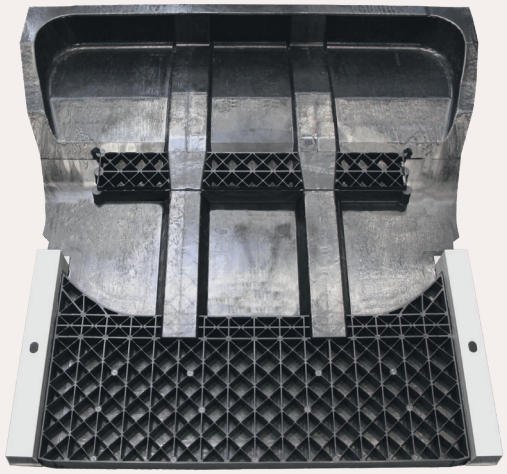
NATIONALE PLATTFORM ELEKTROMOBILITÄT

ptj Projektträger Jülich Forschungszentrum Jülich

SPONSORED BY THE

Federal Ministry of Education and Research





THERMOSET FLOOR MODULE

Material

- Carbon fiber non-crimp fabric (NCF) material
- Several subpreforms make up the complex 3-dimensional preform structure of the floor module
- Local carbon fiber reinforcements via stack-internal NCF patches
- Sandwich structures with cost-efficient polyurethane foam cores
- Process-integrated metallic inserts for load transfer

Process

- Novel and innovative HP-RTM process variant: ultra-RTM
- Cavity pressure controlled infiltration
- Preforming concept with minimized fiber material wastage
- Development of supreforms with load-optimized fiber orientations (layup)
- Simulation of relevant process steps for obtaining an optimal process strategy:
  - Structural simulation
  - Mold filling simulation
  - Minimization of cutoff
  - Draping simulation
- Analysis of the process and evaluation of alternative production routes using a virtual process chain

THERMOPLASTIC FLOOR MODULE

Material

- Combination of continuous- and long-fiber-reinforced thermoplastics to fulfill technical requirements e.g. high load capacity with high freedom of design
- Unidirectional-fiber-reinforced pre-impregnated tapes (UD tapes) processed with the fast and efficient automated tape laying system Fiberforge
- Long-fiber-reinforced thermoplastics as a compound from the economically efficient direct process (D-LFT) in compression molding
- Metallic inserts and profiles for load induction, joining and reinforcing

Process

- Development of local advanced tailored D-LFT technology
- Further reduction of component weight by local use of LFT to reinforce the structure and to avoid buckling of tape laminate
- Use of large tape laminates (1.3 by 1.3 meters)
- Intrinsic joining of aluminum profiles and metallic inserts as elements for material-specific load induction
- Automated and industrial-scale one-shot process in co-compression molding

PROJECT PARTNERS

V02.0