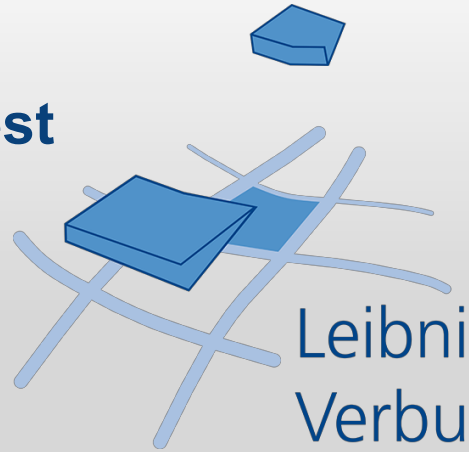
Leibniz Gemeinschaft

Verbundwerkstoff trifft andere Kunststoffe – 7. Jour Fix des CU West

17.01.2022

Dr.-Ing. Nicole Motsch-Eichmann



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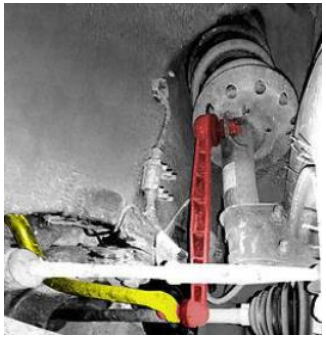
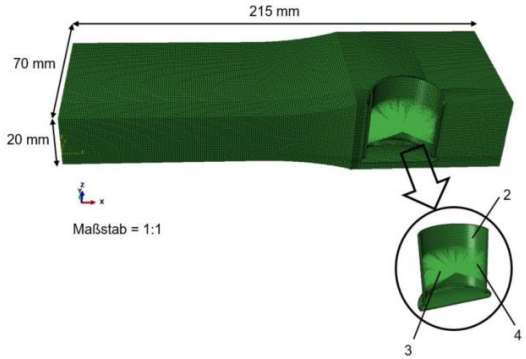
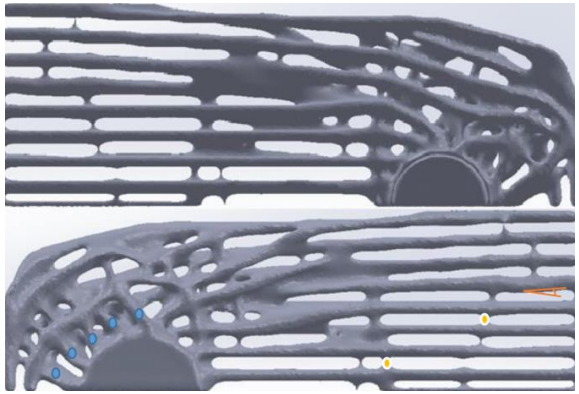
Topology Optimization - FRP- and load path adapted design

1. Reference and design space

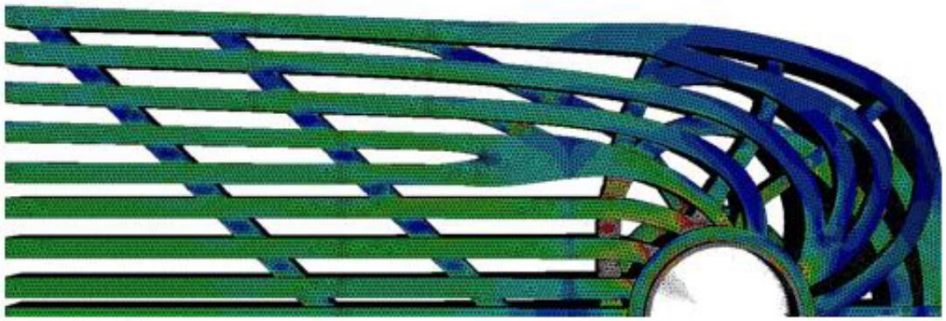




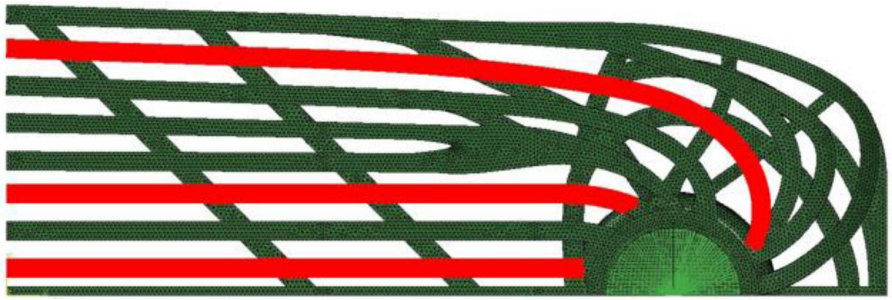
2. Optimization result



4. FRP- and load path adapted design



3. Adaption to FRP design- and manufacturing issues



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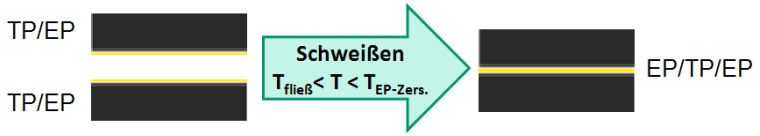
LuFoIV-1 – Corinna: Schweißen von duromeren Werkstoffen mittels Thermoplasten (2012-2015)

Objective:

- Development of an efficient joining technology for thermoset shells

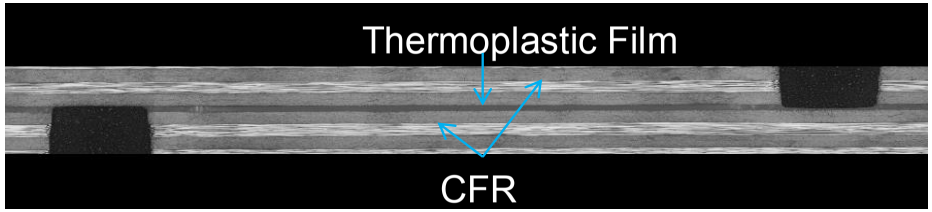
Approach:

- Selection of materials and geometry for continuous induction welding process
- Establishment of induction welding process for thin thermoset plates coated with thermoplastic film and optimization of welding parameters
- Physio-chemical characterization of the welding zone
- Mechanical characterization of the joint strength
- Process optimization
- Finite-Element Modelling of the joint and its failure characteristics (crack appearance and propagation)



Results:

- Shear strength up to 40 MPa



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Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

LuFoV-3 – InjectProfile (2018-2022)
Budget: 425.000 €

Objective:

- Development of a highly efficient C-fiber press-injection molding process for the manufacturing of load and weight optimized thermoplastic low-cost aviation struts

Approach:

- Material combination of pressed endless fiber reinforcement and short fiber injection molding (PPS)
- Topology optimization, FE-analysis and design development
- Process simulation and process chain development
- Digital process chain for digital twin
- Mechanical characterization of strut strength

Status quo:

- Design finalized and tool manufactured
- Injection Molding and final testing (Quasi-static and fatigue) + Simulation (quasi-static) still to come

Supported by:
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GFK-Welle (2015)

Objective:

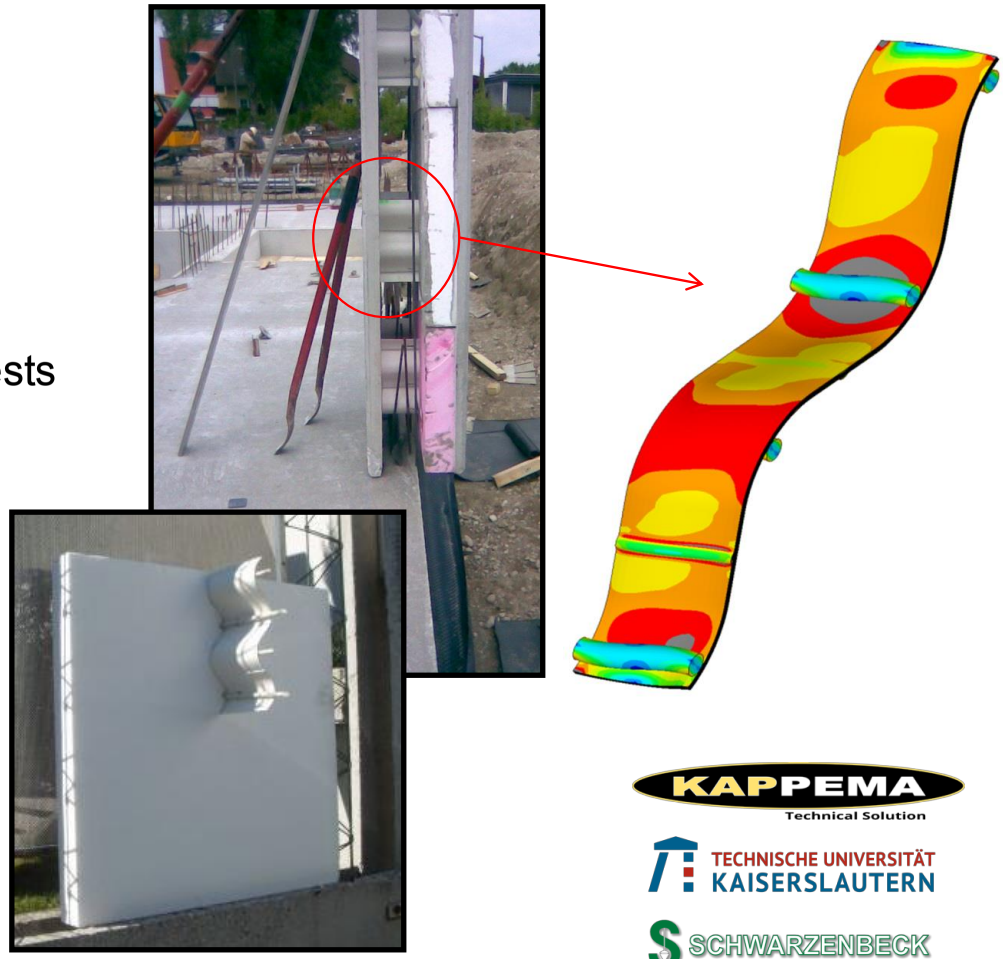
- Development of a glass fiber reinforced facade fixing element (GFRP – wave)
- Avoidance of thermal bridging

Approach:

- Design optimization by finite element simulation
- Validation of the design by means of structural tests

Results:

- Design validation successful



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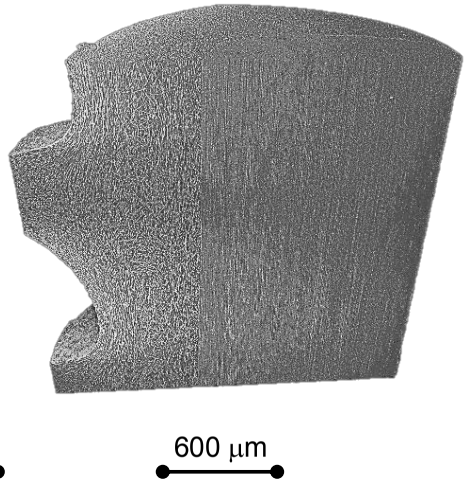
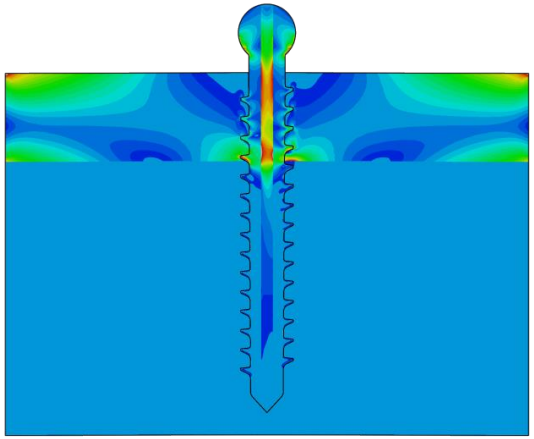
Eurostars/BMBF – HySpine: A non-metallic spinal Implant (2016-2020)



Targets

- ✓ X-ray transparency
- ✓ Biocompatibility
- ✓ Tailoring ability



Solution

- ✓ Combination of endless and discontinuous carbon fiber reinforcement

Y.N. Becker, N. Motsch, J. Hausmann: A new hybrid concept for CFRP pedicle screws: finite element analysis; *21st International Conference on Composite Materials (ICCM)*, Xi'an China, 20-25th August 2017

The Eurostars project "HySpine – Development of a non-metallic spinal implant based on a new composite manufacturing technology" (funding code: 01QE1633C) is funded by the German Federal Ministry of Education and Research.

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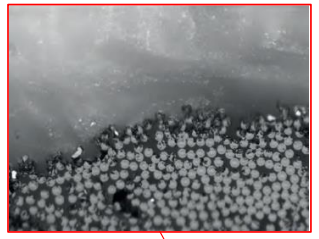
BMBF/KMU-Innovativ – 3DPrint2Fiber: Hybrid Manufacturing Process for Orthosis (2017-2019)

Objective:

Development of a combined 3D-print- and fiber placement process for in-situ manufacturing of personalized and optimized ankle foot orthosis



Approach:

- Development of manufacturing process: combination of CF-Tape placement and 3D-printed material (PA11)
- Manufacturing of fiber reinforced 3D-print material
- Conduction of material tests
- FE-analysis and topology optimization of orthosis
- Development of hybrid design

Status quo:

Development of thermoplastic tape-reinforced orthosis by hand-held device successful

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

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Thank you for your attention!

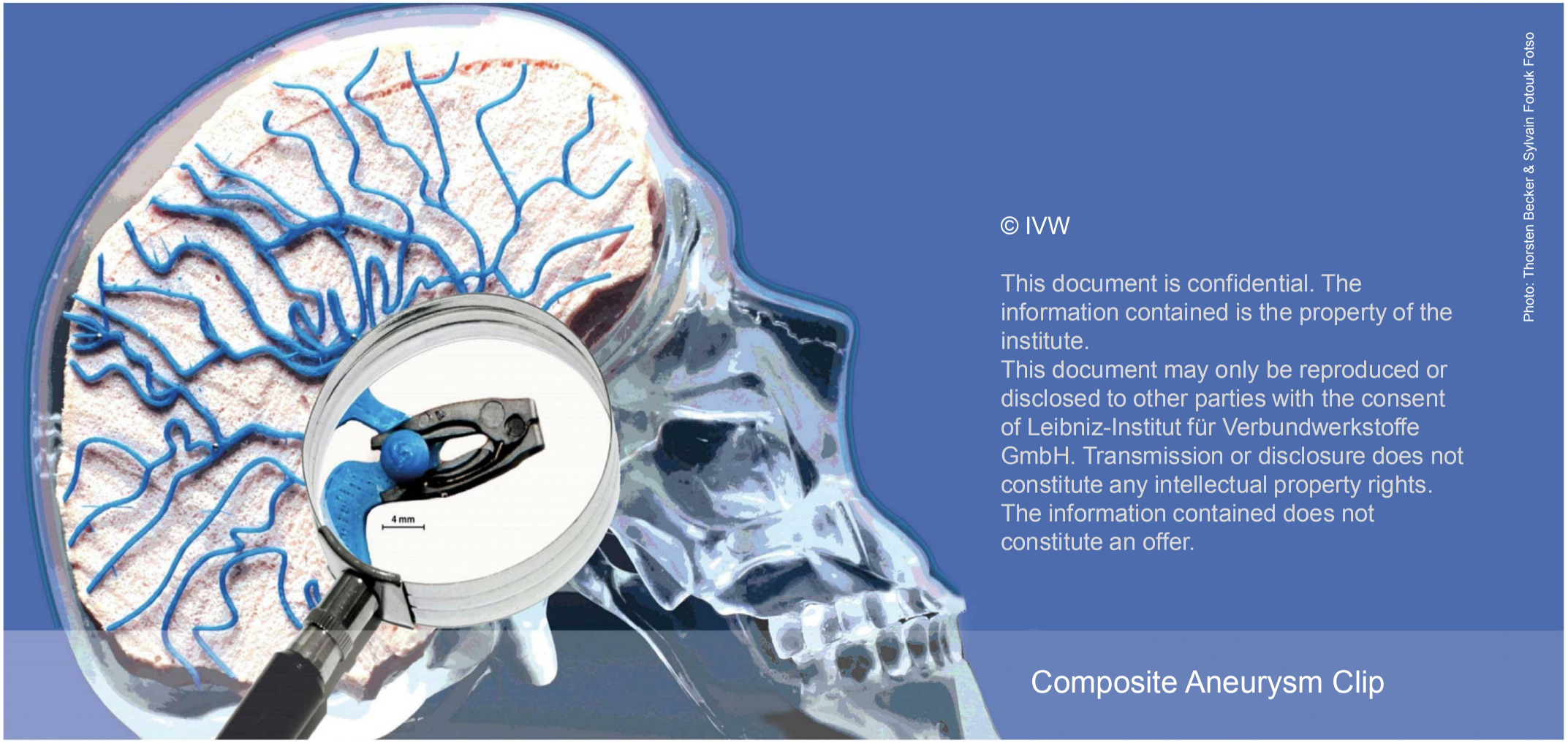

Photo: Thorsten Becker & Sylvain Fotouk Fotso

Composite Aneurysm Clip

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