B-UP1 – Optimal Design of the Cellular Structures for a Lightweight Car Body

INNOVATIONSCAMPUS Mobilität der Zukunft

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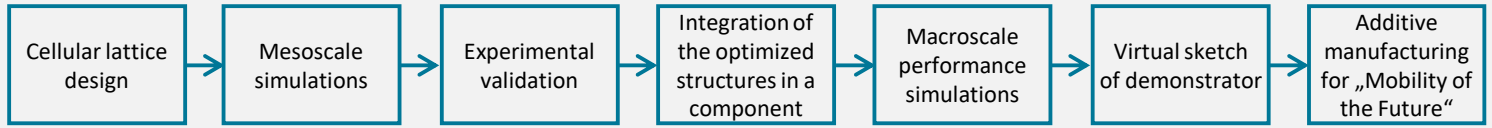
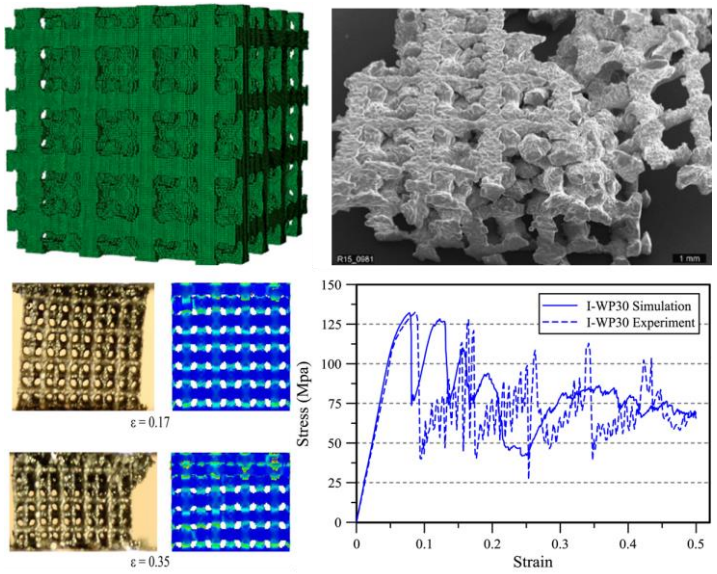
Abstract

Today's political objectives and social demands call for a significant reduction in energy consumption and greenhouse emission in the transport sector. Therefore, it is necessary to consider a reduction in vehicle weight. Cellular lattice structures with a repeating structure of a predefined unit cell can guarantee weight reduction whilst increase the impact energy absorption. This project aims to identify optimal cellular lattice structures for a lightweight car body through virtual design, numerical calculation as well as experimental testing and production via Laser Based Powder Bed Fusion Additive Manufacturing technology (PBF-LB).

Work plan:

- Virtual design of different types of cellular structures, e.g., strut, shell, and TPMS-based
- Mesoscale simulation in order to calculate stiffness, elastic anisotropy and energy absorption
- PBF-LB fabrication of aluminum alloy specimens and experimental validation through various mechanical tests
- Integration of the optimized structure in a bumper-mounting bracket component
- Macroscale performance simulation under the operational loading condition
- Final design optimization of the component and providing a virtual sketch





Schmauder et al., J. Mech. Behav. Biomed., 2017