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# Targeted Functional Volume Filling and Mechanical Optimization of Additively Manufactured Lattice Structures

Additive manufacturing with Laser Powder Bed Fusion (PBF-LB/M) has advanced the use of Triply Periodic Minimal Surface (TPMS) lattice structures, known for their lightweight and high surface-to-volume ratios. This study explores how residual stresses (RS) during PBF-LB/M impact the mechanical properties of these lattices. Focusing on targeted functional volume filling and optimization, we use Finite Element Analysis (FEA) and experiments to assess the effects of RS on Young's modulus, yield strength, and Specific Energy Absorption (SEA) in primitive and gyroid TPMS structures. The results highlight significant reductions in mechanical performance due to RS, underscoring the need for reliable qualification methods. The development of such methods for targeted functional volume filling and mechanical optimization of lattice structures is demonstrated, emphasizing their importance for practical applications.

## Speaker Country

Germany

**Primary author:** KRUSE, Henrik (RWTH Aachen University Chair Digital Additive Production DAP)

**Presenter:** KRUSE, Henrik (RWTH Aachen University Chair Digital Additive Production DAP)

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