High Rate Uniaxial and Cyclic Multiaxial Testing of Polymer Lattice Structures

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Abstract. A wide variety of lattice structures can be designed and fabricated by additive manufacturing of polymeric materials. Complex components with sufficient stiffness, strength and surface quality can be manufactured by selective laser sintering using PA12 and TPU grades. To cope with design challenges of polymeric lattice structures a comprehensive test program was developed and implemented in a Horizon research a project (MOAMMM, FET Open, 2021-2024). The main parts of this test program are sown in figure 1.

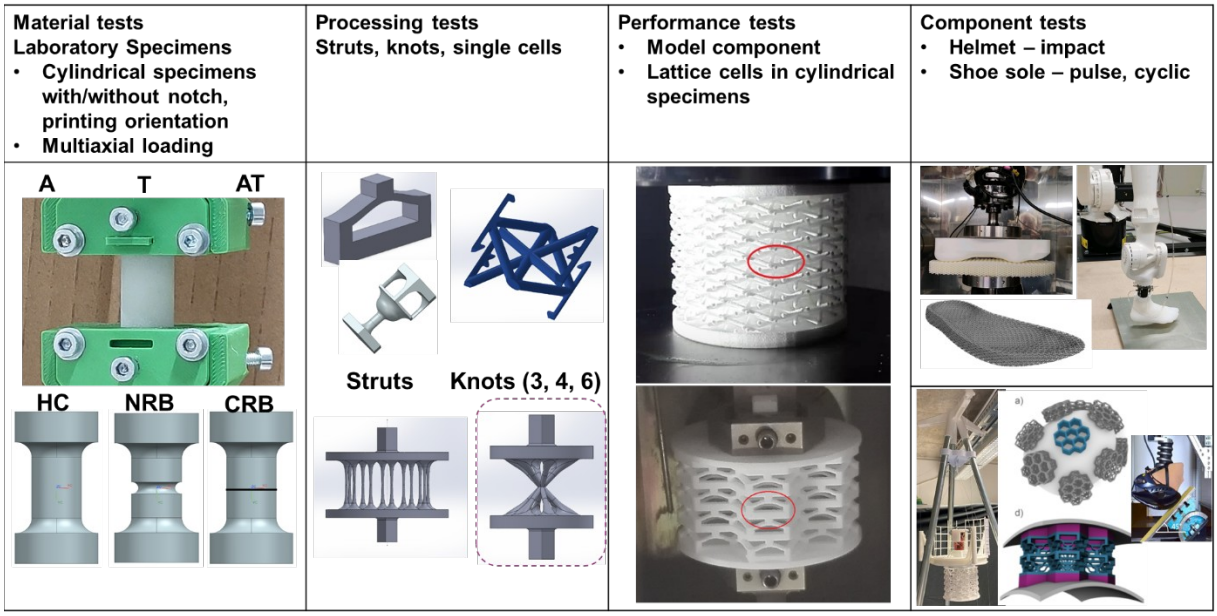

Fig. 1: Overview of the specimen configurations and test methods

The two main highlights of the material testing are:

- Uniaxial compression tests were performed over a wide loading rate range (up to about 30°m/s) to characterize the loading rate dependent yield and post-yield behavior .
- The combined effect of anisotropy and multiaxial loading (axial, torsional and combined axial/torsional) was characterized under both monotonic and cyclic loading conditions. A multiaxial strength/fatigue-map was designed and plotted for the materials investigated.

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References

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