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Optimization of the new testing machine for in-situ microstructural characterization under mechanical and thermal loading

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The goal of the BMBF funded project HiMat is the optimization of an innovative testing machine to perform deformation experiments at high temperatures at various instruments at the research neutron source Heinz Maier-Leibnitz. With diffraction, small-angle scattering and radiography (tomography) it is possible to investigate forming phases, their volume fractions as well as size and shape, dislocation densities, textures, recrystallization processes and crack propagation.

The field of possible loading cases of the testing machine is manifold: uniaxial tensile and compression experiments, creep experiments and cyclic loading or crack propagation tests. The testing temperatures can be varied from room temperature up to 1200 °C and the tests can be performed in vacuum or defined atmospheres. Furthermore, a contactless measurement tool was implemented, which enables a spatial resolved temperature and strain measurement. Thus, the optimized testing machine represents a unique sample environment for the investigation of high-performance materials. This is demonstrated exemplarily with the Co-based superalloy CoWAlloy, which was developed by the FAU, and the Ni-based superalloy VDM® Alloy 780 in the HiMat project.

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