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Development of new testing machine (load and temperature) for the investigation of superalloys

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Superalloys are widely used for high temperature applications like gas turbines. For this reason these kinds of alloys require specific optimized mechanical properties which they receive from solid solution strengthening, particularly precipitation strengthening. The strength strongly depends on type, shape and size of the respective precipitates. For the improvement of such materials it is crucial to deepen the knowledge of the precipitation kinetics during the whole thermomechanical process, especially during forging and heat treatment. Hence unique sample environment is needed for in situ neutron diffraction and small angle neutron scattering experiments.
Here we present the development of a new test rig which can provide tension and compression loading up to 100 kN at elevated temperatures. An attached vacuum furnace allows sample temperatures up to 1200 ℃. Furthermore the rig will be also used for quenching the sample. First test experiments of the load rig using a VDM Alloy 718 sample during neutron diffraction measurements at the instrument STRESS-SPEC (MLZ) have been performed.
After completion of this sample environment as part of a BMBF project (05K16W02), the MLZ will provide this testing machine to the user community. Experiments for the determination of e.g. lattice strain, residual stress and the microstructure in a creep-exposed sample under the influence of temperature will be the focus.

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