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Development of a unique testing machine for in-situ neutron measurements at elevated temperatures and mechanical loading

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To investigate superalloys under application conditions, which are often a combination of very high tensile loads, and temperatures in oxidizing environments, a new testing machine has been developed for use at several neutron instruments at the FRM II. The testing machine is designed to investigate the material behavior up to 100 kN. Different specimen grips were developed to perform tensile, compression, and fatigue tests to investigate the important material properties of newly developed alloys. The testing machine can be used for ex-situ experiments in the lab but is easily transferrable to different neutron instruments like STRESS-SPEC, SPODI, or SANS-1 at the MLZ. In-situ neutron diffraction experiments under tensile loading at different temperatures have already been performed at STRESS-SPEC and have demonstrated the functionality of this new, highly versatile sample environment.

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