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100 kN Testing Machine for In-Situ Neutron Scattering Experiments

Tuesday, 5 December 2023 14:00 (3 hours)

A testing machine with a load capacity of 100 kN has been developed to conduct comprehensive mechanical assessments encompassing tensile, compression, and fatigue testing on industrially pertinent high-temperature alloys used in aerospace. The machine is developed for in-situ microstructural and mechanical characterization of high-temperature alloys subjected to concurrent mechanical and thermal stresses. The machine is designed to serve as a novel sample environment for conducting in-situ experiments at the FRM II, particularly at the instruments Stress-Spec, Spodi, SANS-1, and Antares. Neutron Diffraction is can be employed to ascertain parameters, including lattice constants, lattice misfit, phase fractions, and strain within the alloy, while Small-Angle Neutron Scattering allows to determine the size and volume fraction of nano-sized precipitates. Neutron imaging allows to observe crack formation. By mechanically loading the alloy at elevated temperatures, mimicking real-world application conditions, the microstructure can be directly investigated. The testing machine can be used to perform tests at temperatures of up to 1200℃. Furthermore, ongoing developments for the machine include the incorporation of a laser heating system and an active cooling device, enhancing its capabilities for future research.

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