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In-situ neutron diffraction study of engineering materials under thermo-mechanical treatment at STRESS-SPEC

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The understanding of structure-property relationships is essential for the development and improvement of engineering materials. In-situ characterization of materials under external thermo-mechanical treatment is usually required. The materials science diffractometer STRESS-SPEC is designed to be applied equally to structure, texture and residual stress analyses by virtue of its very flexible configuration. In order to meet the needs of in-situ characterisation STRESS-SPEC has been dedicated with mechanical loading and dilatometry equipment.
First a unique load rig was designed for in-situ structure and lattice strain analysis both at ambient and high temperatures (~ 1000 ℃). This rig is also fully rotatable to emulate Eulerian cradle like sample positioning, which allows intensity and peak position pole figure measurements. Second is a quenching and deformation dilatometer has been recently adapted. It offers simultaneous high-precision measurements of length changes while heating/cooling or deforming the sample, and thus adding an additional measurement quantity that is sensitive to phase transformations. The combination of neutron and dilatometry measurements yields a unique view on the microstructural evolution during thermomechanical treatment. As examples the in-situ measurements of a high ductility Mg alloy, a shape memory Ni-Mn-Ga alloy, and newly selective laser beam manufactured Ti will be presented in this contribution.

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