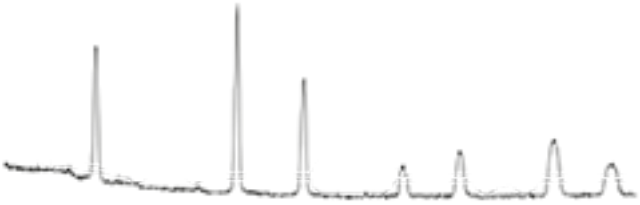

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Unique Materials' Characterization by In-Situ Neutron Diffraction and Small Angle Neutron Scattering and the new Quenching and Deformation Dilatometer

Wednesday 1 June 2022 17:00 (20 minutes)

A Quenching and Deformation Dilatometer (TA instruments DIL 805A/D/T) operates at the MLZ for performing in-situ neutron diffraction (phase, texture, stress/strain) at STRESS-SPEC and small-angle neutron scattering (nanostructure) at SANS-1. Imaging applications are under preparation at ANTARES. With this setup, the evolution of the sample length during heating or quenching can be accurately monitored while scattering data are being acquired. Thanks to induction heating and gas cooling very high rates are accessible. Forces up to 20 and 8 kN can be applied in compression and tension, respectively. Besides, special sample holders for powders will soon extend the range of applications.
The combination of the neutron scattering and dilatometry measurements yields a unique view on the microstructural evolution under thermomechanical treatment. In this work, we will present some results of different materials, i.e. high entropy alloy (HEA), light weight TiAl alloy and Cu - Ce0.8Gd0.2O2-𝛿 (CGO) composite. The combination of dilatometry and in-situ diffraction allows an accurate investigation of phase transformations (type and temperature) in AlCrFeNiTi HEA. TiAl alloy study will be focused on the bulk texture evolution induced by hot compression performed with the dilatometer. The aim is to investigate the mechanisms of hot compression and further to optimize the mechanical properties. Last example is the first results on Cu-CGO composites for high temperature green energy applications (solid oxide fuel cells, electrolyzers and catalytic membrane reactors). Here we studied the thermal expansion coefficient of the Cu-CGO cermets as a bulk at the same time as we obtain in-situ high temperature microstructural information on both Cu and CGO phases (diffraction measurements performed at the synchrotron Desy).

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