Poster Presentation

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Neutron diffraction on functional materials under electric field or mech. load

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In this contribution neutron diffraction studies on functional materials under special environmenal conditions will be presented. In particular, studies of ferroelectric ceramics under high electric fields as well as shape memory alloys under mechanical load will be highlighted. The investigations were carried out at the high-resolution neutron powder diffractometer SPODI (FRM II / Garching n. Munich) which offers special sample environmenal tools for electric fields, mechanical load etc. In-situ studies on ferroelectrics under the influence of high electric fields enable to establish correlations between the macroscopic poling behaviour and corresponding structural changes. The investigations were carried out on technologically applied lead zirconate titanate based samples and on a bismuth sodium titanate based system. A self-designed device allows the investigation of large bulk samples under different orientations of the electric field. This method allows to analyze the poling mechanisms in technical ferroelectrics, such as piezoelectric effect, domain reorientation and phase transformations. In the system $Bi_{0.5}Na_{0.5}TiO_3$ - $BaTiO_3$ – $K_{0.5}Na_{0.5}NbO_3$ the large recoverable field-induced strain could be attributed to a reversible field-induced phase transition from an almost non-polar, pseudocubic tetragonal phase to a distorted, ferroelectric active phase [1]. Polycristalline monoclinic nickel-titanium shape memory alloys have been investigated under mechanical load to analyze their stress-strain behaviour and to derive the elastic constants. A novel tensile rig allows to orient the load axis in a Eulerian cradle like manner. The elastic constants tensor could be calculated based on a series of diffraction patterns under different sample orientations in the initial state and under 0.6 % strain. Furthermore the contributions of elastic deformation (lattice dilatation) and inelastic deformation (orentation of twins) to the total strain could be separated.

[1] *Hinterstein et al., J. Appl. Cryst. 43 (2010) 1314-1321.*

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