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Hot Neutron Diffraction Experiments under Extreme Conditions on Single Crystals with HEiDi

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Diffraction with neutrons is one of the most versatile tools for detailed structure analysis on various hot topics related to physics, chemistry and mineralogy. The scd HEiDi at the Heinz Maier-Leibnitz Zentrum (MLZ) offers high flux, high resolution and large q range, low absorption and high sensitivity for light elements by using the Hot Source of FRM II.

At very high temperatures studies on Brownmillerite structures as Nd2NiO4+δ and Pr2NiO4+δ concerning their oxygen diffusion pathways reveal anharmonic diplacements of the apical oxygens pointing towards the interstitial vacancy sites which create a quasicontinuous shallow energy diffusion pathway between apical and interstitial oxygen sites [M. Ceretti et al., J. Mater. Chem. A 3, 21140-21148, 2015]. A new DFG project extends these studies including developments on a special mirror furnace to optimize experiments not only at temperatures > 1300K but also in atmospheres with various oxygen contents and different gas pressures are going to reveal more details on this topic.

A recently finished BMBF project shows that studys on tiny samples < 1 mm^3 and high pressure (HP) experiments with diamond anvil cells (DAC) can be performed at HEiDi [A. Grzechnik et al.; J. Appl. Cryst. 53 (2020), 1-6]. Also, they can be combined with low temperatures down to 3K. A new BMBF project has been launched in 2019 to improve efficient use of DAC on HEiDi and to build optimized HP cells for other instruments at MLZ (POLI, MIRA, DNS).

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