Recent Developments and Diffuse Scattering Studies at Beamline F1 (Hasylab/DESY)

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In order to enhance data collection possibilities at beamline F1 a new marresearch CCD-detector with an active area of 165 mm in diameter (2048² pixels in 2x2 binning) has been installed in February 2005 to replace an older CCD-system which was in operation since 1996. To increase the quantum efficiency for energies between 20 and 30 keV the detectors are fitted with 100 µm $Gd_2O_2S_2$:Tb phosphor instead of a standard 40 µm phosphor.

A previously developed software suite [1] for the reconstruction of diffuse scattering from CCD raw data has been adopted to the new data format and successfully applied in a composition- and temperature-dependent study of precursor-induced diffuse scattering in V-diluted lead-phosphates. Compared to pure lead-orthophosphate, the system $Pb_3(P_xV_{1-x}O_4)_2$ displays a complex sequence of phase transitions. The CCD-data show an overall rhombohedral symmetry (R-3m) of the paraelastic high-temperature phase, but broad diffuse intensities are clearly visible even 40 K above T_c. These maxima are centered around symmetry-allowed Bragg-reflections of the paraelastic HT-phase and must be indexed by half integers. The diffuse scattering shows a slight anisotropic spatial distribution in reciprocal space with an elongation along a*, indicating a higher degree of disorder along $[111]_{rh}$. This effect results from small (ca. 50 Å), dynamic precursor-clusters of the monoclinic ferroelastic LT-phase in an overall paraelastic matrix.

[1] Paulmann C., et al., *Nucl. Instr. Phys. Res. A*, 2001, **467**, 1293.

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