Synchrotron-based thermal diffuse scattering studies to understand structure-property relations of crystalline compounds

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A new diffractometer, operated as a side station to the existing high resolution inelastic spectrometer ID28@ESRF has been designed, built and commissioned in the last few years. The diffractometer (Fig. 1) is available to users and is optimised for rapid surveys of reciprocal space (Fig. 2). Specifically, its main purpose is to provide information on non-Bragg scattering, which can then be investigated by high resolution inelastic X-ray scattering on the main branch. X-rays with wave lengths between 0.52 - 0.98 Å are available. The flux is $\sim 10^{12}$ ph/s @ 17.8 keV and the x-ray beam can be focused down to 20 x 40 µm². Diffracted x-rays are detected with a PILATUS3 1M. The available sample environment includes a closed-cycle cryostat, nitrogen stream cooling, heat blower, diamond anvil cells, a uniaxial strain device in the closed-cycle cryostat and a high-temperature electric field setup.

In the talk, the application of x-ray diffuse scattering studies to understand properties and phase transitions in a variety of compounds, such as SrSO₄, BaVS₃, Bi₂SiO₅ and others will be discussed.

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Fig. 1. The new diffractometer is a side-station to beamline ID28@ESRF.

Fig. 2. Typical diffuse scattering maps obtained with the new diffractometer.