Abstract: In the present framework of coherent x-ray scattering, the use of hard x-rays has not been developed as far as its soft x-rays counterpart, in particular at large diffraction angles. The increase difficulty compared to soft x-rays arises mainly from a smaller coherence volume at higher energies and a rapid smearing of the contrast at large angles because of an optical path length difference that increases beyond the longitudinal coherence length. The special experimental setup of the ESRF ID20 beamline is described and a few presenting examples are shown of the application to disordered systems of interest in condensed matter physics.

Coherent Hard X-ray Scattering experiments at Large Diffraction Angles

The experimental setup on beamline ID20 at ESRF

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Coherence Energies: E=7.6 keV for structural studies
– adapted to sample elements absorption length
– close to nominal beamline energy of 8-9 keV

Manganese Charge and Orbital Domains


Antiferromagnetic Domain Fluctuations in UAs


Stability of magnetic order in MnO versus domain size

Phason Fluctuations in Quasicrystals


Conclusion:

A special setup was developed at the ID20 beamline of ESRF for coherent scattering experiments at large diffraction angles.

Intense monochromatic coherent beams can be obtained with a high degree of coherence in the 3-8 keV range.

This setup was exploited mainly for dynamic oriented studies on different disordered systems of hard condensed matter physics, on a timescale of minutes.

Further improvements in beam intensity and CCD reading time should open the way to studies of faster systems.