ESRF	Experiment title: Investigation of a small angle scattering filter for energy dispersive X-ray absorption spectroscopy	Experiment number: MI 64
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Report:

A strong noise pattern is frequently observed in X-ray absorption' spectra of powders acquired in the energy dispersive mode. Two consecutive measurements of the incident intensity and the absorbed intensity with the sample in the beam path have to be taken. Peaks and glitches in the 1_0 intensity may not normalize correctly, if the powder sample causes strong diffuse scattering. The intensity of white lines at the absorption edge may be damped due to diffuse scattering as well.

We have investigated the addition of a scattering filter into the beam path of an energy dispersive spectrometer.

The proposed geometry permits to acquire energy dispersive XAFS spectra hardly affected by small angle scattering. A similar set-up has been proposed in order to increase the flux of a neutron small angle scattering station [1].

The initially white beam, monochromatized by a bent monochromator, converges on the sample after reflection by a plane silicon crystal, the first crystal of a Bonse-Hart type camera (Fig. 1).

The second perfect crystal in the non-dispersive setting eliminates photons scattered by the sample if the momentum transfer in the scattering plane is larger than the acceptance of the crystal. The rocking curve widths of the employed reflections are narrower than one pixel of the detector so that the small angle scattering is effectively filtered.

The whole energy band from the bent monochromator (A E/E = 10%) must be transmitted by the two perfect crystals. The dispersions can be matched by inclining the scattering plane of the double crystal by an angle Y against the scattering plane of the bent crystal (Fig. 1).

XAS at the Pt L_{III} edge (E=l1.6 keV) were recorded for the first time in an initial experiment at ID24. A curved Si(111) Laue monochromator has been used as the dispersive element. A Si(220) double crystal has been used for the experiment on ID24. The dispersion of the double crystal and the bent monochromator was matched over the whole energy band. The energy resolution was strongly degraded adding BN sheets to a Pt metal foil when the double crystal was not used (Fig. 2). The double crystal clearly reduced the diffuse scattering.

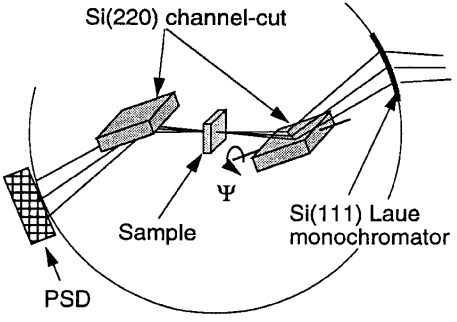

Fig. 1 Top view of the energy dispersive XAFS set-up using a filter for small angle scattering. The two Si(220) crystals arranged in the Bonse-Hart configuration are rotated by an angle Y in order to match the dispersion of the curved Laue monochromator.

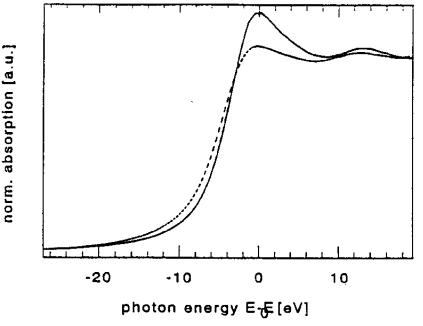

Fig. 2 Comparison of the XANES at the Pt L_3 edge with and without scattering filter. BN sheets were added to a Pt metal foil to enhance diffuse scattering.

References

[1] A. Freund, Nucl. Instrum. Meth, 216 (1983) 269 - 274