

Fundamental process of nuclear resonant scattering

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The monochromatic synchrotron radiation beam with the energy bandwidth of several meV to sub-meV can be used to suppress the background of electronic scattering (NRS) measurement, and also can be used as an important tool for the studies of inelastic X-ray scattering. Furthermore, as it provides longer coherence length, the intensity correlation experiment in X-ray range could be performed.

Several high energy-resolution monochromators for 14.4 keV X-rays with fixed energy bandwidth and another one with adjustable bandwidth from several meV to sub-meV have been built and tested. A nested channel-cut crystal monochromator as shown in Fig. 1 using the Si 511 and 975 reflections with the energy resolution of 2.4 meV and the acceptance of 16 μ rad has been shown to be suitable for this beamline to achieve high throughput of the beam. A higher energy resolution monochromator composed of two asymmetric Si 975 diffraction ins (+,+) arrangement with the energy resolution of 1.6 meV was proved to be in good performance. A bandwidth adjustable high energy-resolution monochromator was built first time.

The asymmetric factor b of an asymmetric-cut crystal could be adjusted by rotating the crystal along the reciprocal vector of a diffraction. The experimental results are shown in Fig. 2. It shows the possibilities to obtain varied energy-resolution by the same device.

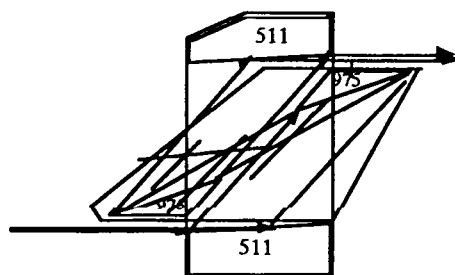


Fig. 1 A nested channel-cut high energy-resolution monochromator.

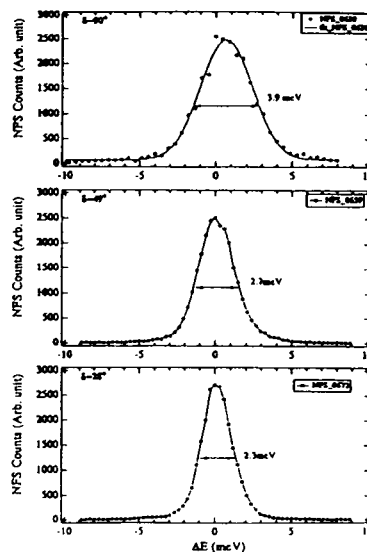


Fig. 2 The measured energy resolution of the ΔE adjustable monochromator.