

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 during the nuclear resonant 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.

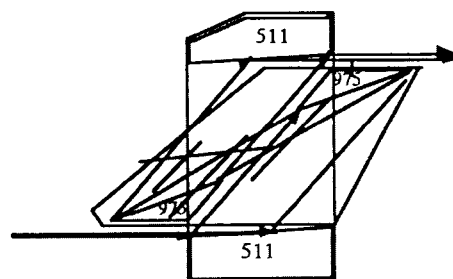


Fig. 1 A nested channel-cut high energy-resolution monochromator.

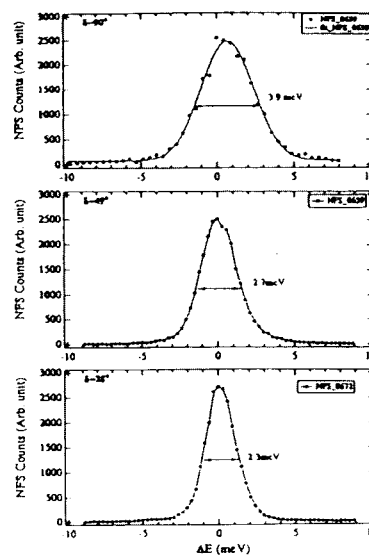


Fig. 2 The measured energy resolution of the ΔE adjustable monochromator.