Development of Nuclear Resonant Inelastic Scattering Technique

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For the measurements of nuclear resonant inelastic scattering, two high-resolution nested monochromators have been installed. One monochromator consisting of an asymmetric Si(4 2 2) and a symmetric Si(12 2 2) channel-cut crystals produced an incident beam with a 6.5 meV bandwidth at the 14.413 keV nuclear resonance in ^{57}Fe. Furthermore, an energy resolution of 2.5 meV was achieved with another monochromator consisting of an asymmetric Si(5 1 1) and an asymmetric Si(9 7 5) channel-cut crystals. We have developed APD detectors for high efficient detection of the inelastic scattering, and have evaluated the efficiency. In Fig.1, the experimental setup used is shown.

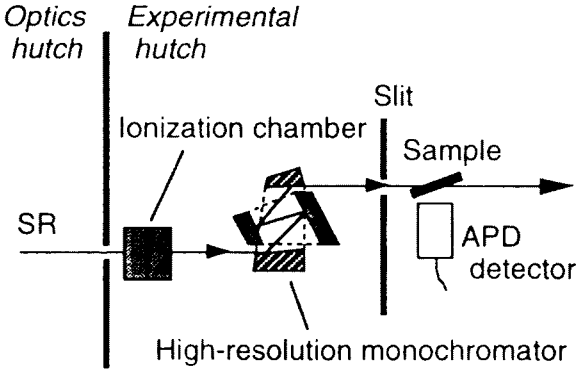

Fig. 1. Experimental setup.

We have measured the nuclear resonant inelastic scattering from ^{57}Fe in following samples;

- *Magnetic fluid*
- *Hydrated iron cations in nafion membranes*
- *Graphite single crystals intercalated with ferric chloride*

Figure 2 shows the energy spectrum of nuclear resonant inelastic scattering from the hydrated iron cations in nafion membranes measured using the high-resolution monochromator having a 6.5 meV bandwidth. The broadening of the line was observed. It is attributed to the diffusive motion of the confined iron ions in the nafion membranes.

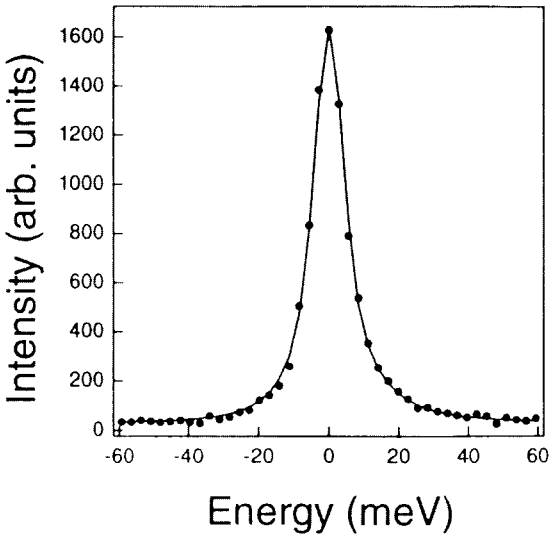

Fig. 2. Nuclear resonant inelastic scattering from hydrated iron cations in nafion membranes.