Development of Nuclear Resonant Inelastic Scattering Technique

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After the first observation of the phonon energy spectrum of iron, nuclear resonant inelastic scattering has been applied to the study of lattice dynamics. This method has the ability to obtain the vibrational character of the local environment of the resonant nucleus. However, the measuring technique seems not to be fully-developed, so far. We have developed a 32-element avalanche photodiode detector for the measurements of high efficient angle-resolved nuclear resonant scattering. Performance of the detection system was investigated, and the nuclear resonant scattering from iron foil was measured. The experimental setup is shown in Fig.1. An energy resolution of 2.5 meV was achieved with a monochromator consisting of an asymmetric Si(5 1 1) and an asymmetric Si(9 7 5) channel-cut crystals. The angle dependence of the nuclear resonance scattering was observed using the APD detector. The typical time spectrum and phonon energy spectrum are show in Figs. 2 and 3, respectively. Further analysis of the results is in progress.

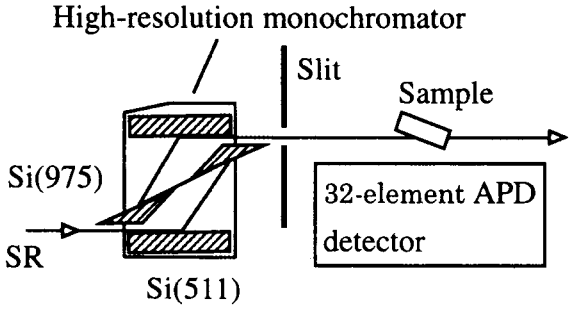

Fig. 1. Experimental setup.

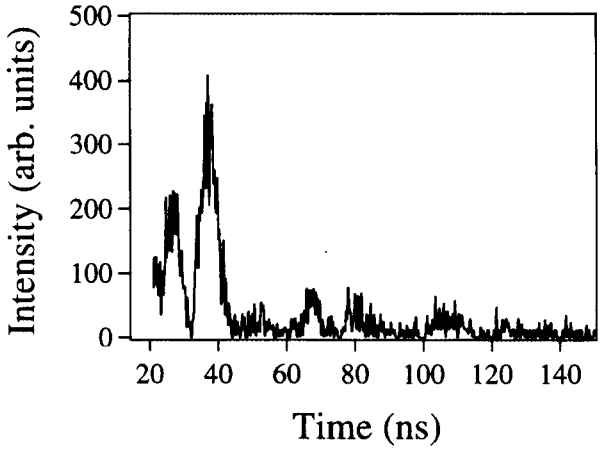

Fig. 2. Time spectrum of nuclear resonant scattering from Fe foil measured with a APD (No. 6) in a 32-element APD detector.

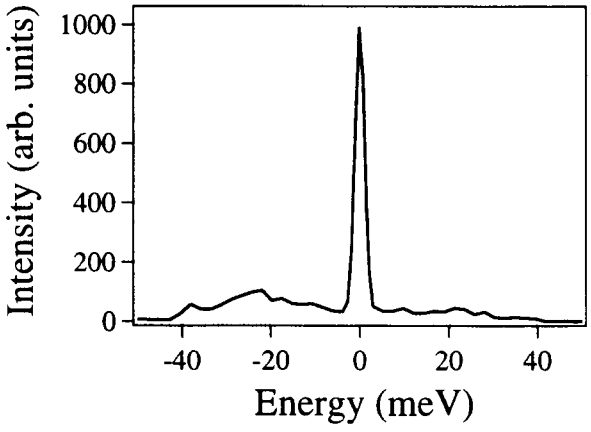

Fig. 3. Phonon energy spectrum of Fe foil measured with a APD (No. 6) in a 32-element APD detector.