The nuclear resonant scattering beam properties on the various rotation times of the hyper fine field in the magnetic material

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In the fluctuation system, especially, when the perturbations take place during the coherence time, the multiple resonant X-ray photon shows the novel scattering phenomenon. In present our experiments, the coherent nuclear resonant scattering in the spin fluctuation system was studied by using magnetically modulated $^{57}FeBO_3$ anti ferromagnetic single crystal. The experiment was performed at the BL09 undulator beamline of SPing-8. The storage ring was operated in 21-bunch mode at 20mA. A pulse emitted only in 228ns with typically 100ps width. The $^{57}FeBO_3$ crystal was excited magnetically by the external pulse magnetic field. The magnetic field was phase locked by the SR pulse signal. (Magnetic field parameters: strength 28Oe, pulse width 100ns, and fall off time 7ns, frequency ~219kHz) The Mössbauer time spectra were measured with and without the Si(840) polarization analyzer crystal. (This crystal reflects only the σ-polarization.) In this measurement system, at the same time, we could get 20 time spectra in the time range of about 4.6μs after the fall off. The measured time spectra are shown in Fig.1. Then, the magnetic relaxation accompanied with dissipation of magnetic energy is started form the time of 175ns (fall off time). The spectra showed the intensity reductions during the time range of 1.5μs clearly. We guess that it is the random phase modulation effect of photon induced by the magneto-elastic vibration. On the other hand, as is shown in Fig.2, the Mössbauer time spectra measured with the Si(840) showed the decay speed up in comparison with the one without Si(840). We guess that it is due to the rotation of the hyperfine field in the crystal.

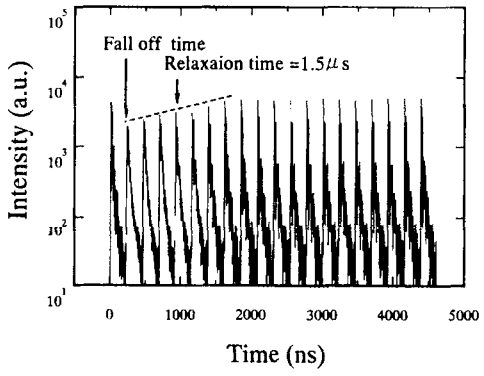

Fig.1. The measured mössbauer time spectra

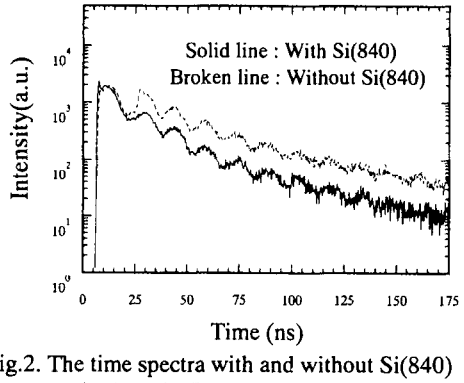

Fig.2. The time spectra with and without Si(840) in the spin fluctuation system.