Measurement of Internal Conversion Electron from Monoatomic Layers on Surfaces

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We have measured conversion electrons from ^{57}Fe foil and single crystals of Fe_2O_3 and $FeBO_3$at the BL-09XU beamline. We obtained energy distribution and time spectrum of the conversion electrons excited with 14.413keV nuclear resonant SR. The apparatus for the measurement consisted of a sample holder and an energy analyzer cotained in a UHV chamber. The energy analysis of the emited electrons was made by using a planer electrostatic quadrupole analyzer which deflected the electrons by 90°. The acceptance angle and the energy resolution was 0.04p and 4%, respectively. Electrons were detected by using an avalanche photodiode (Hamamatsu:SPL0142) which showed excellent time response (<1ns) and noise characteristics (<0.01cps). The SR was monochromatized to 2meV band-width with a Si premonochromator and a high-resolution monochromator. The count rate of the avalanche photodiode for the prompt emission of X-ray was 1.4 x 10^6. By the combined use of energy analysis and time discrimination in singnal processing, the prompt signals originated from the non-resonant component of electrons and photons were successfully suppressed. The enegy spectrum of the electrons excited with 14.413keV X-ray showed peaks of K- and L- shell conversion electrons KLL and Auger electrons as shown in Fig.1. The count rate for the peak of the K-shell conversion electrons was 0.51 cps. The time spectrum of the conversion electrons showed simple exponential decay with decay time constant of 131±17ns, which coincide with the decay time of isolated Fe nuclei, 141 ns. No significant speed-up of the decay process was observed.

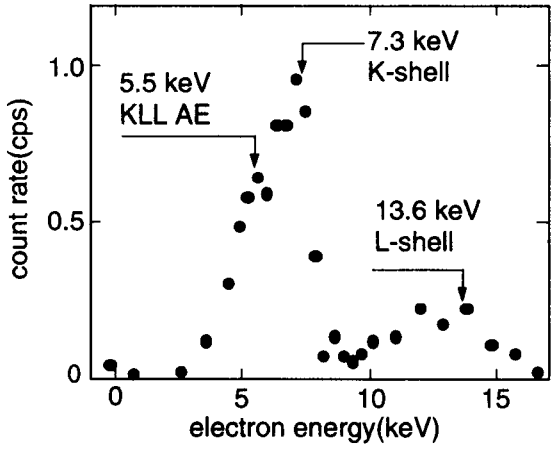

Fig.1. Energy distribution of electrons from 57Fe enriched foil excited with 14.413 keV photns.