Magnetic Moment of the Gd Layer at Room Temperature Induced by the Interlayer Magnetic Coupling through the Cu Layer in the Co/Cu/Gd/Cu Multilayer

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In the rare earth metal/ *3d* transition metal multilayers such as Fe/Gd and Co/Gd, the interface exchange coupling is known to be antiferromagnetic. Unlike the case of the interlayer exchange coupling in the Co/Cu multilayers, it decays rapidly when the nonmagnetic spacer layer is inserted between two ferromagnets. The influence of such decay behavior on the magnetic structures of the Co/Cu/Gd/Cu multilayers was investigated with changing the Cu layer thickness. The temperature dependence of the magnetization for a Co(3 nm)/Cu(1 nm)/Gd(3 nm)/Cu(1 nm) multilayer was measured with VSM. A compensation behavior was found around 150 K in the applied field of 2.5 kOe. The magnetization increases up to room temperature. This behavior suggests that the Cu layer of 1 nm thick mediates the antiferromagnetic exchange interaction between the Co and Gd layers. However since the Curie temperature of Gd sandwiched between the Cu layers is known to be below 150 K depending on the Gd layer thickness, it is rather strange to observe the compensation behavior in the Co/Cu/Gd/Cu multilayer. The magnetic structure of the Gd layer at room temperature was investigated in the applied field of 2.5 kOe by resonant X-ray

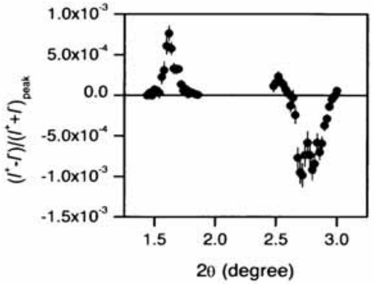

Fig.1 Resonant magnetic diffraction peaks of the Co/Cu/Gd/Cu multilayer at room temperature in the Co saturation state. The X-ray energy is 7242 eV (Gd L_3 edge).

magnetic diffraction around the Gd L_3 absorption edge (7242 eV). Figure 1 shows magnetic difference peak profiles of the multilayer. Different signs of the 1st and 2nd order Bragg peaks indicate a non-uniformly magnetized Gd layer. The peak intensities are about 1/10 of those expected for a magnetically saturated Gd layer. These facts suggest that the interface region of the Gd layer is weakly magnetized at room temperature by the indirect exchange interaction with the Co layer.

XMCD measurements for chiral molecule-based ferrimagnet.

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Construction of molecule-based magnetic materials, which possess additional properties such as conductivity, photo reactivity or optical properties, is currently a challenging target. The physical characteristic of current interest involves optical properties, particularly with respect to optical activity. When a magnet is characterized by optical transparency and chiral structure, there is a great possibility that the magnetic structure of the crystal becomes to be a chiral spin structure. These magnets display asymmetric magnetic anisotropy and magneto-chiral dichroism. This category of materials is not only of scientific interest; these materials also afford the possibility for use in new devices. Here we report on the XMCD measurements on BL39XU in Spring-8 of a 2D chiral ferrimagnet; $[Cr(CN)_6][Mn(R$ or $S)$-$pnH(H_2O)]$ (H_2O) (1); ((*S*)-pn = (*S*)-1,2-diaminopropane).

Ground fine powder sample was used for measurements. Fig. 1 and 2 shows the Temperature dependence of XMCD spectra of

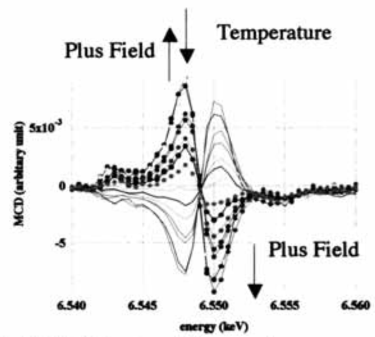

Fig. 1: XMCD Spectra of Mn K edge.

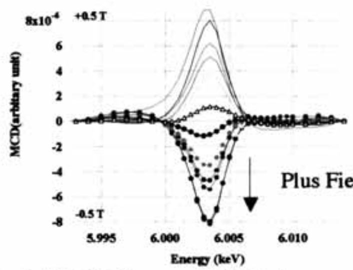

Fig. 2: XMCD Spectra of Cr K edge.

Mn and Cr K edge.The MCD spectra were increase by decreasing temperature and the spectra were symmetric by the sign of magnetic field. The temperature dependence of integrated signal intensity was followed with remnant magnetization curve of magnetization measurement.