Exchange Bias Effect Determined by Anisotropic Magnetoresistance in $Co_xNi_{1-x}O/Ni_{0.8}Fe_{0.2}$ Bilayer System

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Exchange bias effect is the unidirectional anisotropy induced by the interface between ferromagnetic (FM) and antiferromagnetic (AFM) layers below the Neél temperature of antiferromagnetic materials, leading to a shift of hysteresis loop. The effect of exchange bias has been studied for many years because of its possible application in spintronics, especially in spin valves for magnetic recording and sensor devices [1]. The essentials of exchange bias effect are not fully understood yet. It is generally accepted that the uncompensated moments in the AFM layer play an important role in pinning the spins at the interface and determine the strength of exchange bias field [3]. We prepared bilayer systems composed of the FM layer $Ni_{0.8}Fe_{0.2}$ and the AFM layer $Co_xNi_{1-x}O$ (x = 0.3, 0.4, 0.5, and 0.6) by using the DC/RF magnetron sputtering method. Exchange bias field H_{EB}, the shift field in hysteresis loop, was observed in all the $Ni_{0.8}Fe_{0.2}/Co_xNi_{1-x}O$ bilayer systems. The changes of H_{EB} were explicitly studied for various parameters such as the composition of AFM material *x*, the measured temperature T, and the angle θ of applied magnetic field. We measured anisotropic magnetoresistance (AMR) and analyzed the AMR data to extract the H_{EB}, since the peak structure in AMR is not exactly same to the coercive field H_C, unlike the magnetization data. We propose a new approach to analysis for AMR in determining H_{EB} and H_C along the field angle θ with respect to the field-cooling direction. The results were compared with the variations of H_{EB} and H_C simulated by Mauri model and spin-glass model [3].

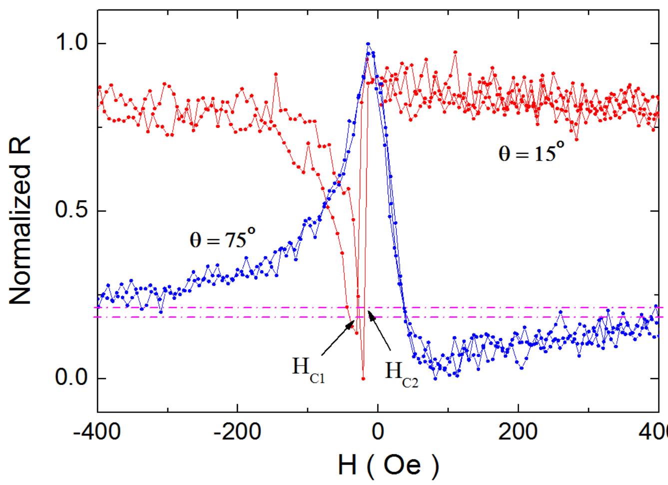

Fig. 1. AMR data for Θ = 15° and 75° to estimate $H_{EB} = (H_{C1} + H_{C2})/2$

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