

Perpendicular magnetic anisotropy induced by spin direction of antiferromagnet layers in a ferromagnetic-antiferromagnetic bi-layer system

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We investigated the influence of spin direction of an antiferromagnetic (AFM) layer on the perpendicular magnetic anisotropy (PMA) of a ferromagnetic (FM) layer in a FM-AFM bilayer system by using X-ray magnetic dichroism.

We grew single crystalline NiO wedge layers on two different substrate, MgO(001) and Ag(001), where NiO layers have two different spin directions, perpendicular and parallel to the surface, respectively. Then we grew FePd multilayers on NiO wedge layers and capped the whole layers with Pd for protection against oxidation. The magnetic properties of the samples were examined carefully in the magnetic spectroscopy beamline in the Pohang Light Source (PLS II), by using X-ray magnetic circular dichroism (XMCD) measurement at Fe L_2 edge and X-ray magnetic linear dichroism (XMLD) measurement at Ni L_3 edge. The hysteresis loops and XMCD asymmetry data clearly show the enhanced PMA for the FePd/NiO/Ag(001) sample with on-set of AFM ordering of underlying NiO layers, whereas for the FePd/NiO/MgO(001) sample no enhancement of PMA was observed. Considering XMLD signal of NiO, we temporarily conclude that the origin of the enhancement of PMA in FePd/NiO/Ag(001) is the 90-degree coupling between Fe magnetic moments of FePd layers and spins of NiO layers, similar to the spin coupling in Fe/NiO system.[1]

[1] Wondong Kim, E. Jin, J. Wu, J. Park, E. Arenholz, A. Scholl, Chanyong Hwang, and Z. Q. Qiu, Phys. Rev. B 81, 174416 (2010).

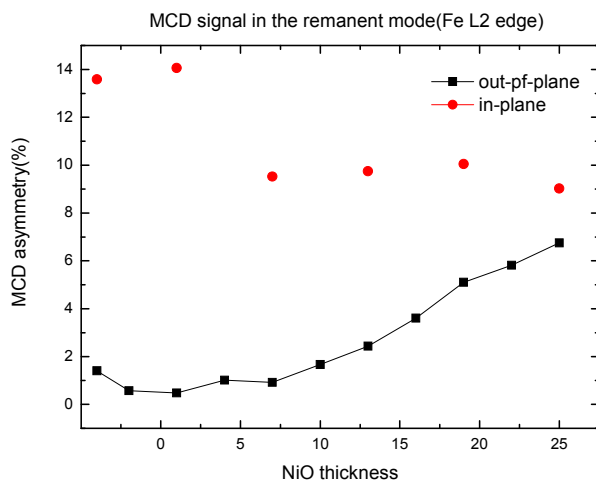


Fig 1. XMCD asymmetry measured at Fe L_2 absorption edge for FePd/NiO/Ag(001)