

[V-3]

Magnetic Circular Dichroism Study of Co Thin Films on Pd(111) Surface

Wookje Kim, Wondong Kim, Hyunjo Kim, Jae-Young Kim, Hoon Kho, J.-H. Park*, and S.-J. Oh
Department of Physics, Seoul National University
*NSLS, Brookhaven National Laboratory, U.S.A.

We studied magnetic properties of Co thin films deposited on Pd(111) surface, which attracted much attention recently due to the perpendicular magnetic anisotropy, using magnetic circular dichroism(MCD). Special attention was paid on the effect of Pd capping and interface roughness on the direction of magnetic easy axis, and for that purpose MCD signals for all Co thicknesses were measured with two different ways : in-plane and out-of-plane geometry.

In case of bare Co films deposited on smooth Pd(111) surface, no MCD signal was observed under 4Å Co thickness. At 4Å Co thickness, MCD signal at the out-of-plane geometry was observed, and for thicker Co films, only in-plane MCD signal was measured. This type of magnetic easy axis transition has been reported for other cases like Co/Pt system⁽¹⁾.

The effect of 5Å Pd capping on these bare Co films made an remarkable change on the transition of magnetic easy axis. Out-of-plane MCD signals exists up to 20Å Co thickness, and disappears at 24Å Co thickness. In-plane MCD signals first appears at 10Å Co thickness and gradually increases up to 24Å Co thickness. Between 10Å and 20Å Co thickness, in-plane and out-of-plane MCD signal coexist. The formation of multi-domain structure or the existence of tilted magnetic easy axis is an possible scenario for such an interesting coexistence.

The effect of interface roughness was also tested by measuring MCD signal on Co films deposited on un-annealed Pd(111) surface. Out-of-plane MCD signal was observed up to 8Å Co thickness and the anisotropy of MCD signal at 4Å Co thickness was very large with respect to that of Co film deposited on the smooth substrate. Above 8Å thickness, there exists only in-plane MCD signal.

From above results, it was concluded that both Pd capping and interface roughness induce and reenforce the perpendicular magnetic anisotropy. The large perpendicular magnetic anisotropy of Co/Pd multilayer system made by sputtering method can be well understood from our results.

[References]

1. J. Thiele, C. Boeglin, K. Hricovini, F. Chevrier, Phys. Rev. B **53**, R11934(1996)