

⁵⁹Co NMR STUDY OF Co/CoO MULTILAYERS: AN EXCHANGE BIAS SYSTEM

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It is generally accepted that the exchange bias created at the interface between a ferromagnetic (FM) and an antiferromagnetic (AFM) material strongly depends on the spin structure at the FM/AFM interface. To achieve a better understanding of the interface phenomena we have used ⁵⁹Co NMR to monitor the structural and magnetic properties of the Co/CoO exchange bias system. A ⁵⁹Co NMR study has been performed on a series of sputtered polycrystalline Co(t)/CoO (t = 10 - 18 nm) bilayers and [Co(t)/CoO]₁₀ (t = 5 - 10 nm) multilayers deposited on Si/SiO₂ wafers. The microstructure of a metallic Co layer covered with CoO was found to be essentially the same as that of a non-oxidized Co single layer. It consists of predominantly hcp Co stacking order. However, the presence of the oxidized Co layer results in a significant drop of the ⁵⁹Co NMR signal intensity. This suggests that the electronic state of Co at the interface is not metallic but similar to the Co²⁺ state of CoO. Despite the fact that the bilayers were in the unbiased state, i.e. the characteristic shift of the magnetization hysteresis loop is not present, a strong anisotropic exchange coupling between Co grains and the underlying AFM CoO grains can be inferred from an increase, by an order of magnitude, of the NMR restoring field.

9.7 cm

13.4 cm

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