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Positive Exchange Bias in Thin Film Multilayers Produced with Nano-oxide Layer

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We report a positive exchange bias (HE) in thin multilayered films containing nano-oxide layer. The positive HE, obtained for our system results from an antiferromagnetic coupling between the ferromagnetic (FM) CoFe and the antiferromagnetic (AFM) CoO layers, which spontaneously form on top of the nano-oxide layer (NOL). The shift in the hysteresis loop along the direction of the cooling field and the change in the sign of exchange bias are evidence of antiferromagnetic interfacial exchange coupling between the CoO and CoFe layers. Our calculation indicates that uncompensated oxygen moments in the NOL results in antiferromagnetic interfacial exchange coupling between the CoO and CoFe layers. One of the interesting features observed with our system is that it displays the positive HE even above the bulk Neel temperature (TN) of CoO. Although the positive HE system has a different AFM/FM interfacial spin structure compare to that of the negative HE one, the results of the angular dependence measurements show that the magnetization reversal mechanism can be considered within the framework of the coherent rotation model.

Keywords: Thin film multilayers, Positive exchange bias, Nano oxide layer

