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**Perpendicular Magnetic Anisotropy Driven by Antiferromagnetic Layers**

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We show a novel effect of an antiferromagnet (AFM) with the interfacial unpinned moments, which can form an intrinsic perpendicular anisotropy and switch the magnetization of adjacent ferromagnetic layer from in-plane into perpendicular orientation, providing a new feature of AFM. AFM has been known that its interfacial moments can lead to crucial effects of induced coercivity enhancement and exchange bias field on adjacent ferromagnet (FM), both of which are important for the design of state-of-the-art magnetic logic devices. In the study on the system of Fe/Mn bilayers, the unpinned moments of the Mn can form an intrinsic perpendicular anisotropy that drives the magnetization of an adjacent Fe layer from the in-plane into out-of-plane direction [1]. In the systematic measurements with variations of temperature and FM and AFM thickness, a phenomenological analysis shows that the perpendicular anisotropy is correlated to AFM/FM exchange coupling, and can be modulated according to the finite size effect of AFM ordering [2]. Our x-ray magnetic circular dichroism (XMCD) experiment [1] indicates further that the magnitude of perpendicular anisotropy of the system is enhanced proportionally to the out-of-plane oriented orbital moment of the unpinned Mn layer, rather than that from the Fe layer, providing evidence for the unpinned Mn moments as the origin of the established perpendicular magnetization. The result presented here shows functional characteristics other than the well-investigated phenomena of coercivity enhancement and exchange bias, and renews our knowledge on the role of the AFM layer [1-3], providing a new angle for the design of future perpendicular spintronic nanodevices.

[1] B. Y. Wang, J. Y. Hong, K. H. Ou Yang, Y. L. Chan, D. H. Wei, H. J. Lin, and Minn-Tsong Lin, Phys. Rev. Lett. 110, 117203 (2013).
[2] B. Y. Wang, N. Y. Jih, W. C. Lin, C. H. Chuang, P. J. Hsu, C. W. Peng, Y. C. Yeh, Y. L. Chan, D. H. Wei, W. C. Chiang, and Minn-Tsong Lin, Phys. Rev. B 83, 104417 (2011).
[3] B. Y. Wang, C. C. Chiu, W. C. Lin, and Minn-Tsong Lin, Appl. Phys. Lett. 103, 042407 (2013).