OT03

Comparison of Hf and W interlayer on the perpendicular magnetic anisotropy of the MgO/(Hf or W)/CoFeB structures

Kyoung-Min Lee[1,2,*], Taufik Bonaedy[1], Byoung-Chul Min[1], Junghyun Sok[2], and Jun Woo Choi[1]

[1]Center of Spintronics, Korea Institute of Science and Technology, Seoul 136-791, Republic of Korea

[2]Department of Nano Engineering, University of Seoul, Seoul 130-743, Republic of Korea

Investigations to tune the perpendicular magnetic anisotropy (PMA) of a MgO/CoFeB system have attracted great interest due to its potential application in various spintronics devices [1-4]. In this study, we have investigated the PMA of a CoFeB/Hf/MgO structure and a CoFeB/W/MgO structure. The full sample structures were Ta(20 Å)/MgO(16 Å)/Hf(0.0~2.0 Å)/CoFeB(12~30 Å)/W(10 Å)/ SiO_2/ Si and Ta(20 Å)/MgO(16 Å)/W(0.0~2.0 Å)/CoFeB(12~30 Å)/W(10 Å)/ SiO_2/ Si. The magnetic hysteresis loops were measured with a vibrating sample magnetometer and the elemental distribution were measured by energy dispersive spectroscopy (EDS). It was observed that the effective anisotropy increased with the inserted Hf and W thickness. The coercivity increased with insertion layer thickness in the Hf inserted samples, whereas the coercivity decreased with insertion layer thickness in the W inserted samples. The saturation magnetization, the magnetic dead layer and the interfacial anisotropy was calculated from CoFeB thickness dependent magnetic hysteresis loop measurements. The magnetic dead layer of CoFeB was increased with a W insertion, while the saturation magnetization and the dead layer of CoFeB was decreased with a Hf insertion. These results suggest that the mechanism of the increased PMA is different for samples with Hf and W insertion layer. Using EDS measurements, possible origins of the role of Hf and W will be discussed.

[1] Q. L. Ma, et, al. *Appl. Phys. Lett.* **101** (2012) pp.122414

[2] Xi Chen, Guang Hua Yu, et al. *Appl. Phys. Lett.* **105** (2014) pp.092402

[3] M. Yamanouchi, et al. *J. Appl. Phys.* **109** (2011) pp. 07C7712

[4] T. Liu, J. W. Cai, et al. *AIP Adv.* 2 (2012) pp. 032151