Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Thickness Dependent Magnetoelastic Effects and Perpendicular Magnetic Anisotropy in the Ta/CoFeB/MgO system GREGORY STIEHL, PRAVEEN GOWTHAM, DANIEL RALPH, ROBERT BUHRMAN, Cornell University, Ithaca, New York, 14853 — We report the observation of strong thickness-dependent in-plane magnetoelastic coupling in Ta/CoFeB(x=0.7-2 nm)/MgO multilayers. Measurements are made using a four-point bend test strain fixture, revealing the emergence of large effective surface and volume magnetoelastic couplings after post-deposition annealing. When such surface and volume magnetoelastic interactions are included in the standard Neel model of surface anisotropy, they provide a natural explanation for the nonmonotonic $K_{eff}t_{eff}$ vs t_{eff} curves measured for CoFeB films in the thickness range that yields perpendicular magnetic anisotropy (PMA). The large magnitude of the magnetoelastic coupling terms suggest that enhanced control of thin film strains could be used to beneficially manipulate the PMA in CoFeB/MgO magnetic tunnel junctions and other thin film multilayer nanostructures.

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Date submitted: 14 Nov 2014 Electronic form version 1.4