MAR10-2009-020253

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Ferromagnetic resonance linewidth and damping in perpendicular-anisotropy magnetic multilayers thin films

JEAN-MARC BEAUJOUR, Department of Physics, New York University

Transition metal ferromagnetic films with perpendicular magnetic anisotropy (PMA) have ferromagnetic resonance (FMR) linewidths that are one order of magnitude larger than soft magnetic materials, such as pure iron (Fe) and permalloy (NiFe) thin films. We have conducted systematic studies of a variety of thin film materials with perpendicular magnetic anisotropy to investigate the origin of the enhanced FMR linewidths, including Ni/Co and CoFeB/Co/Ni multilayers. In Ni/Co multilayers the PMA was systematically reduced by irradiation with Helium ions, leading to a transition from out-of-plane to in-plane easy axis with increasing He ion fluence [1,2]. The FMR linewidth depends linearly on frequency for perpendicular applied fields and increases significantly when the magnetization is rotated into the film plane with an applied in-plane magnetic field. Irradiation of the film with Helium ions decreases the PMA and the distribution of PMA parameters, leading to a large reduction in the FMR linewidth for in-plane magnetization. These results suggest that fluctuations in the PMA lead to a large two magnon scattering contribution to the linewidth for in-plane magnetization and establish that the Gilbert damping is enhanced in such materials ($\alpha \simeq 0.04$, compared to $\alpha \simeq 0.002$ for pure Fe) [2]. We compare these results to those on CoFeB/Co/Ni and published results on other thin film materials with PMA [e.g., Ref. 3].

[1] D. Stanescu *et al.*, J. Appl. Phys. **103**, 07B529 (2008).

[2] J-M. L. Beaujour, D. Ravelosona, I. Tudosa, E. Fullerton, and A. D. Kent, Phys. Rev. B RC **8**0, 180415 (2009).

[3] N. Mo, J. Hohlfeld, M. ulIslam, C. S. Brown, E. Girt, P. Krivosik, W. Tong, A. Rebel, and C. E. Patton, Appl. Phys. Lett. **92**, 022506 (2008).

*Research done in collaboration with: A. D. Kent, New York University, D. Ravelosona, Institut d'Electronique Fondamentale, UMR CNRS 8622, Université Paris Sud, E. E. Fullerton, Center for Magnetic Recording Research, UCSD, and supported by NSF-DMR-0706322.