Dynamics of asymmetric magnetization reversal in exchange-biased Co/Pt multilayers

M. Czapkiewicz[1], T. Stobiecki[1], R. Rak[1], M. Żołądź[1], P. Mietniowski[1], and S. van Dijken[2]

[1] *Department of Electronics, AGH University of Science and Technology Kraków 30-059, Poland*
[2] *SFI Trinity Nanoscience Laboratory, Physics Department, Trinity College Dublin 2, Ireland*

The magnetization dynamics of [2nm Pt/5nm Co]$_3$ multilayer, with perpendicular anisotropy and additional unidirectional anisotropy originated from the top 10nm IrMn layer separated by a thin Pt insertion of 0.1 nm to 1.2 nm thickness, has been investigated by Kerr magnetometry and Kerr microscopy. Such perpendicular exchange-biased structures manifest magnetization reversal loops with asymmetry of shape, dynamics and domain structure for forward and backward branches. The insertion of 0.1 nm thick Pt enhances the exchange bias field ($\mu_0 H_{eb}$) from 20 mT to 28 mT, above which it decreases exponentially with increasing Pt layer thickness (Fig. 1). Different thicknesses of the Pt insertion have strong influence on the mechanism of the magnetization process. We show, from relaxation measurements of the magnetization M(t) as well as by direct observation of magnetic domains, that the magnetization reversal at maximum H_{eb} takes place by the nucleation of isolated cylindrical domains with different nucleation density sites for the forward and backward branches of the hysteresis loop (Fig. 2). For a Pt layer thickness larger than 0.4 nm, magnetization reversal proceeds by domain wall movement, as well as for sample without IrMn exchange bias. All the results will be quantitatively analyzed using Fatuzzo [1] theory, adapted by Labrune *et al.* [2] for ferromagnetic thin films with perpendicular anisotropy.

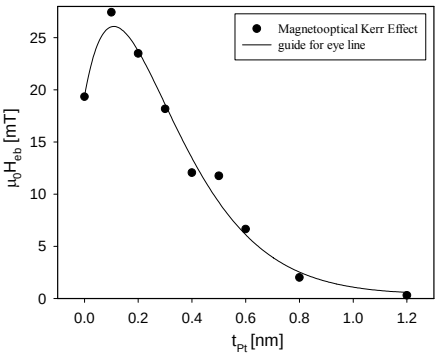

Fig. 1. Exchange bias field vs. interlayer thickness of Pt for the [Pt/Co]$_3$-Pt-IrMn samples

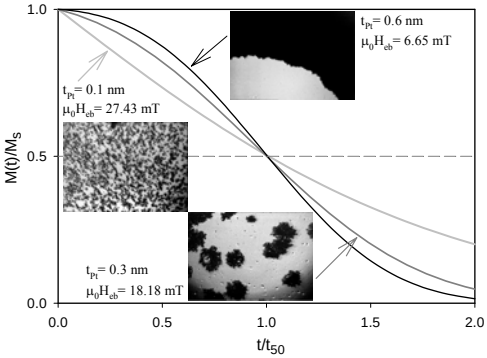

Fig. 2. Relaxation of magnetization vs. reduced time and corresponding domain image

[1] E. Fatuzzo, Phys. Rev. **127** (1962) 1999.
[2] M. Labrune, S. Andrieu, F. Rio, P. Bernstein, J. Magn. Magn. Mater. **80** (1989) 211.

Name of the presenting author (oral): Maciej Czapkiewicz
e-mail address: mczapkie@layer.uci.agh.edu.pl
url's: http://layer.uci.agh.edu.pl/M.Czapkiewicz