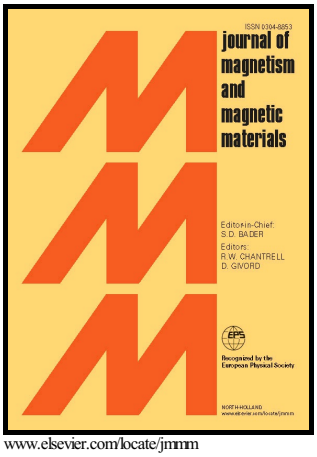

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Influence of domain structure induced coupling on magnetization reversal of Co/Pt/Co film with perpendicular anisotropy

Michał Matczak[1,2], Rudolf Schäfer[3], Maciej Urbaniak[1], Piotr Kuświk[1], Bogdan Szymański[1], Marek Schmidt[1], Jacek Aleksiejew[1], Feliks Stobiecki[1,2*]

[1]Institute of Molecular Physics, Polish Academy of Sciences, M. Smoluchowskiego 17, 60-179 Poznań, Poland

[2]NanoBioMedical Centre, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland

[3]Leibniz Institute for Solid State and Materials Research (IFW) Dresden, Institute for Metallic Materials, PO 270116, D-01171 Dresden, Germany and Dresden University of Technology, Institute for Materials Science, D-01062 Dresden, Germany

Feliks.Stobiecki@ifmpan.poznan.pl

[*]Corresponding author name : Feliks Stobiecki

***Abstract*—**

A magnetic multilayer of substrate/Pt-15nm/Co-0.8nm/Pt-wedge 0-7nm/Co-0.6nm/Pt-2nm structure is characterized by a perpendicular anisotropy of the Co layers and by graded interlayer coupling between them. Using magnetooptical Kerr microscopy we observed a distinct influence of magnetic domains in one Co layer on the nucleation field and positions of nucleation sites of reversed domains in the second Co layer. For sufficiently strong interlayer coupling a replication of magnetic domains from the magnetically harder layer to the magnetically softer layer is observed.

Keywords

Interlayer coupling, magnetic domains, magnetostatic interactions, perpendicular anisotropy,

Introduction

In pseudo spin valve structures (PSV), i.e., in layered films consisting of two ferromagnetic layers characterized by different coercive fields (H_C) and separated by a nonmagnetic spacer layer, the magnetization reversal is determined not only by the magnetic properties of ferromagnetic layers, but also by interactions between them. The interactions result from different mechanisms such as: direct coupling through pinholes, RKKY-like coupling and magnetostatic coupling. The magnetostatic coupling is attributed to interface roughness or stray fields generated by the domain structure. This coupling is characterized by a relatively wide interaction range. Thus the existence of a domain structure in the magnetically harder layer strongly influences the magnetization reversal of the magnetically softer layer, even in systems with a spacer thickness assuring negligible RKKY-like coupling. Investigations of this dipolar coupling were performed by different groups both for PSV structures with in-plane (e.g. [1], [2], [3]) and perpendicular anisotropy (e.g. [4], [5]). Possible applications are the main motivation for these studies. The dipolar coupling may, for example, hinder the proper functioning of multilevel magnetic recording systems [6, 7, 8]. On the other hand the dipolar interactions originating from the domain structure together with a RKKY-like coupling enable the replication of magnetic domains from the magnetically harder to the magnetically softer layer ([9] and references therein). This effect seems to be very promising for an efficient replication of information in magnetic memory systems [10].

In this paper the magnetization reversal (major and minor hysteresis loops) and corresponding changes in the magnetic structure of a Pt/Co^H/Pt-wedge/Co^S/Pt layered film will be discussed (Co^H and Co^S are magnetically harder and softer Co layers, respectively).

In contrast to our previous investigations [11], performed on the same structure, here particular attention will be paid to the influence of the domain structure in one layer on the magnetization reversal of the second layer. It should be noted that due to a gradient of interlayer coupling (wedge shaped Pt spacer) we were able to