REVERSIBLE PROPAGATION OF STRAIGHT DOMAIN WALL IN Co/Pt-wedge/Co FILM WITH PERPENDICULAR ANISOTROPY

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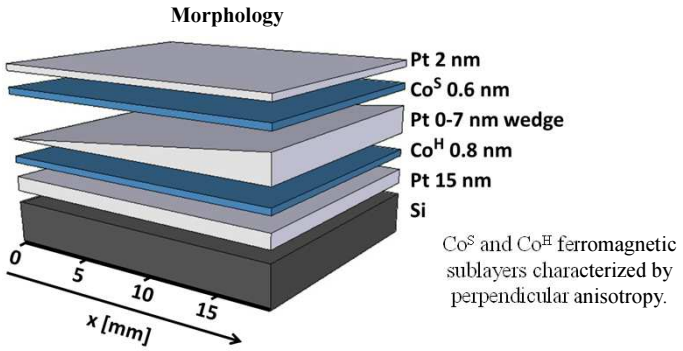
Introduction

In layered structures of the pseudo-spin-valve (PSV) type the magnetization reversal is determined not only by magnetic properties of ferromagnetic sublayers but also by interactions occurring between them. For applications important is not only reversal of the whole PSV structure represented by major loop but also reversal of magnetically soft layer (minor loop). It was previously demonstrated that the reversal of the soft layer depends on coupling between layers. In particular, for a specific range of t_{Pt} spacer thickness a reversible propagation of a single domain wall is observed.

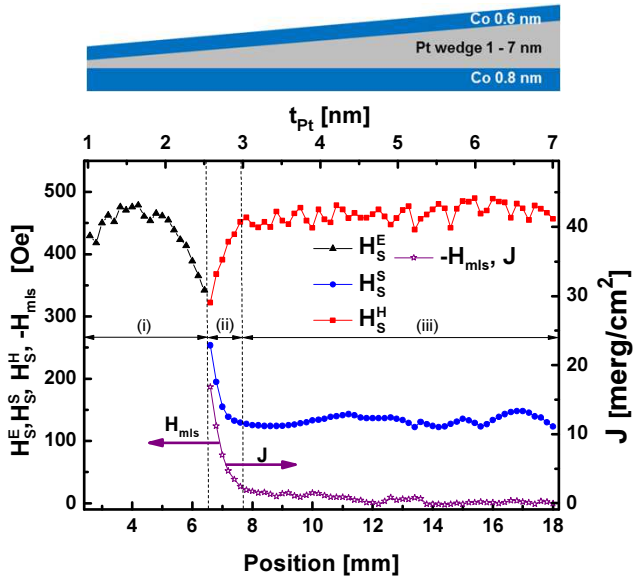
The sample - pseudo spin-valve (PSV) with perpendicular anisotropy



Co^S and Co^H ferromagnetic sublayers characterized by perpendicular anisotropy.

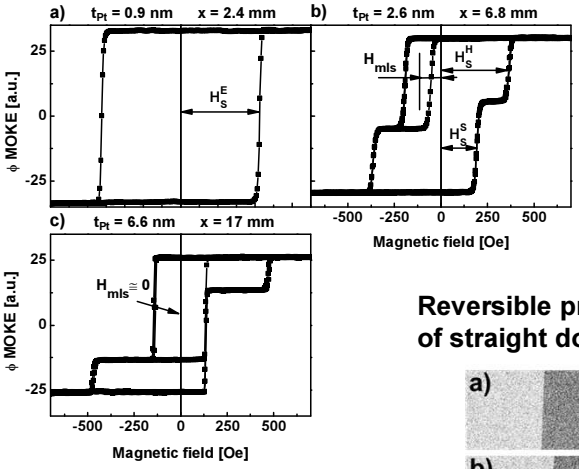
Wedge shaped Pt layer determine changes of coupling as a function of the thickness of nonmagnetic spacer ($0 \le t_{Pt} \le 7$ nm).

Changes of the interlayer coupling with Pt spacer thickness



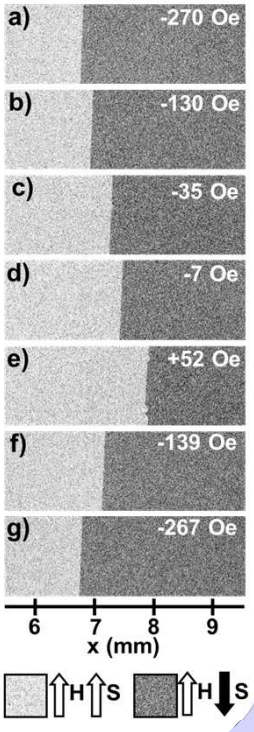
Spacer layer thickness (t_{Pt}) dependence of various magnetic parameters: switching fields of magnetically softer (H_S^S) and harder (H_S^H) Co layer, as well as field of cooperative reversal of both Co layers (H_S^E), field-position of minor loop center (H_{mls}), and interlayer coupling (J).

Magnetization reversal of Co^S layer for saturated Co^H layer



PMOKE major and minor loops. The following parameters are determined from these loops: the individual switching fields H_S^S and H_H^S of the Co^S and Co^H layers, respectively, a collective switching field H_E^S for the case of a cooperative reversal of both layers, the field-position of the center of the minor loop H_{mls}.

Reversible propagation of straight domain wall



Kerr images of Co^H/Pt-wedge/Co^S multilayer recorded at different values of magnetic field. Two different gray values correspond to different configurations of magnetization directions in the magnetically harder and softer Co layers. Co^H layer is in the monodomain state with magnetization ↑H.

Conclusions

It was shown that the magnetization reversal of the magnetically softer, 0.6 nm thick, Co^S layer under the conditions of a strong gradient of the ferromagnetic type coupling occurs through the propagation of a single straight DW. Such DW may have a length of several millimeters, and its propagation range may be of the same order. The direction of the DW propagation may be reversed by changing the direction of magnetic field changes.

Acknowledgements

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