MAGNETIZATION, HYSTERESYS ANOMALIES AND DOMAIN WALL DYNAMICS OF PY-LAYER IN HETEROSTRUCTURES

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The ferromagnetic layers are supposed to be used as control elements in new spintronic devices. This determines the importance of knowledge of dynamic characteristics of magnetization switching in ferromagnetic layer, of magnetization kinetics and mechanisms of limitation of switch velocity in heterostructures. The results concerning the magnetization kinetics of permalloy nano-layers in FM/AFM and FM/SC hybrid structures are presented in this report.

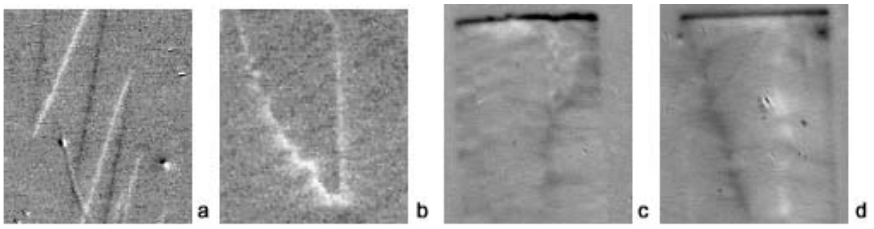
The magnetization process is studied in wide field and temperature range by magneto-optic (MO) visualization technique and the magnetization depth is qualitatively characterized by vibrating sample magnetometer, by measurements of both longitudinal and transverse components of magnetization simultaneously.

It is found that magnetization reversal process of permalloy in heterostructures is considerably different from the process in single layer material. Even in heterostructures grown under applied field, which provides induced unidirectional anisotropy and single domain state, more than bias appears and coercitivity growths, but magnetization switching rate decreases. The origin of these effect is demonstrated by direct observation of domain wall structure transformation at magnetization reversal by MO visualization.

Besides, at magnetization reversal by an in-plane field applied under some special angles anomalous asymmetry of the process is found, different mechanism of magnetization for fields of opposite polarities, which leads to an asymmetry of magnetization loops.

The time of domain wall nucleation and velocity of walls is found dependent upon field strength and direction, more over, both depend drastically upon field polarity. The highest wall velocity in heterostructures is found to be by orders of value lower than in single layer material.

Qualitative transformation of domain configuration and domain wall structure occur with temperature decrease, which looks naturally for FM/SC hybrid structures below $T_c^{Supercond}$, but unexpectedly takes place for FM/AFM heterostructures too. The origin of the effect is discussed.



Domain walls in 30nm single layer Py grown on Si substrate (a), and in heterostructures FeMn/Py/Si-(b), Py/Nb/Si-(c), Nb/Py/Si-(d) with the same thickness of permalloy layer at room temperature.

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