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SPIN-CURRENT INDUCED MAGNETIZATION STRUCTURES IN NANOMAGNETS

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Spin-polarized current is a convenient tool for accurate control of magnetization states in planar ferromagnetic nanostructures without applying an external magnetic field. That enables one to increase a density of nanoscale elements arrays in non-volatile magnetic memory.

Recently, we have studied an action of strong perpendicular spin-current o the ferromagnetic nanosamples with various forms via Slonczewski-Berger mechanism. We have founded that the influence of the spin-current, whose polarization was directed along the normal to the ferromagnetic plane, led to formation of various periodical magnetization patterns just below the saturation current. A square vortex-antivortex lattice was formed in two-dimensional films [1,2], a one–dimensional domain structure was formed in a wire [3] and various intermediate vortex-antivortex structures were formed in a stripe [4].

In current work we focus on the influence of Ørsted field induced by the electrical spin-polarized current on the periodical magnetization structures in ferromagnetic nanostripes and analyze the magnetization behavior for stripes with various widths and for all range of the applied current density [5].

We establish that Ørsted field does not destroy periodical magnetization structures induced by the spin-torque, e.g. vortex-antivortex crystal and cross-tie domain walls. However, the action of the Ørsted field disables the saturation state for the strong currents: a stationary state with a single longitudinal domain wall appears instead. It is shown both numerically and analytically that shape of this wall remains constant with the current increasing and it depends only on geometrical and material parameters of the sample. The micromagnetic simulations confirm our analytical results with high accuracy.

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