New spin configurations in nano-sized magnets near reorientation phase transition

A. Maziewski[a], M.Kisielewski[a] and V.Zablotskii[a,b]

[a]Institute of Experimental Physics, University of Białystok, Lipowa 41, 15-424 Białystok, Poland

[b]Institute of Physics ASCR, Na Slovance 2 , 18221 Prague 8, Czech Republic

9.7 cm

By micromagnetic simulations and analytically we study the ground and metastable magnetic states of ultrathin magnets (with thickness d) in the form of films and laterally size-limited samples: semi-infinite films, wires (width w) and disks (radius r). Nanostructures are discussed with low-perpendicular magnetic anisotropy determined by the quality factor Q - the ratio between magnetic anisotropy and demagnetization energies. Simulations are based on real material parameters, determined for ultrathin Co with defined Q(d) dependence. Domain structure existence decrease Q when the transition into in-plane phase undergoes down to $Q^* < 1$ [1]. Out-of-plane magnetization component exists at the edge of semi-infinite film when $Q > Q_{edge}$ ($Q_{edge} < Q^*$). Perpendicular magnetization states can be achieved by properly decreasing lateral nanostructure size in whole Co ultrathin thickness regime. Q dependent different scenarios of magnetization distribution changes decreasing parameters w or r are discussed for nanostructure with defined d. Novel nanometer-scale magnetization distributions are discussed such as: domain-like distribution with an oscillating out-of plane magnetization component and decaying amplitude; out-of plane component patterned vortex.

[1] M. Kisielewski et. al., Phys. Rev. B (2004) 69, 184419.

13.4 cm

Subject category :

2. Magnetic Films, Surfaces, Multilayers and Nanostructures

Presentation mode :
oral

Corresponding author :
A.Maziewski

Address for correspondence :
Institute of Experimental Physics
University of Białystok
Lipowa 41
15-424 Białystok
Poland

Email address :
magnet@uwb.edu.pl