Presented at MMM 2011, Scottsdale, USA (GP-14)

Micromagnetic study of magnetization processes in permalloy antidot arrays

L. Torres[1], D. Gonzalez[1], O. Alejos[1], K.J. Merazzo[2], M. Vázquez[2] and R. P. del Real[2]

[1] *Universidad de Salamanca, Plaza de la Merced s/n, E-37008, Salamanca, Spain*

[2] *Instituto de Ciencia de Materiales de Madrid (CSIC), Campus de Cantoblanco, 28049, Madrid, Spain*

Micromagnetic study of magnetization processes in permalloy antidot arrays previously studied experimentally [1] has been carried out in order to investigate the inner magnetization configurations and their dependence on thickness. The samples show hexagonal order, with a distance between centers of pores of 105 nm, a pore diameter of 63 nm and thickness of 5, 10, 20 and 47 nm. Static simulations have been performed using the parallel CUDA software GPmagnet running on Nvidia Graphic Processing Units [2]. A computational region of 1500x1500 nm has been used, the shape of the antidots was obtained from SEM images [1] and prismatic cells of 5x5xh nm3 where "h" is the thickness of the film were chosen. These preliminary simulations performed without considering thermal activation show how the coercivity increases with thickness when an external field is applies along x direction (Fig 1.). In Fig. 2 the states obtained at Hext = -100 mT are presented, it can be observed how the symmetry and the number of reluctant +Mx domains (red color) change with thickness. The increase of the coercivity is also observed in the experiments although quantitative agreement is not achieved. Further computations including temperature, larger antidot regions and several computational cells along thickness direction will be performed.

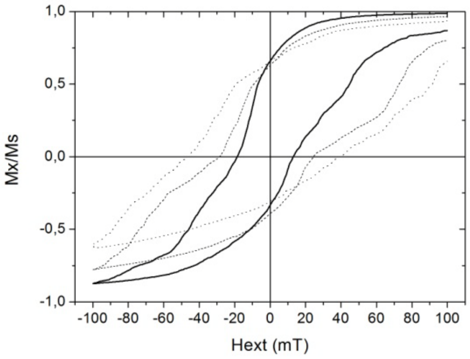

Fig. 1 Hysteresis loop beginning from a saturated +Mx state for thicknesses 5, 10 and 20 nm (solid, dash and dot lines)

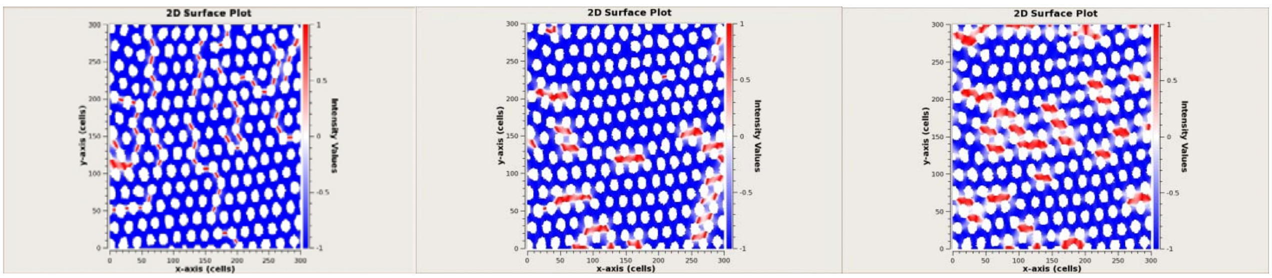

Fig. 2 Magnetization configuration at Hext = -100 mT for thicknesses 5, 10 and 20 nm (from left to right)

References

[1] J. Appl. Phys. 109, 07b906, 2011

[2] www.goparallel.net