

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Surface-patterned ferromagnetic thin films: an easy way to generate inverse hysteresis loops.¹ BEATRIZ MORA, NASTASSIA SORIANO, CAROLINA REDONDO, UPV/EHU, DAVID NAVAS, Universidade do Porto, RAFAEL MORALES, UPV/EHU IKERBASQUE — Inverted hysteresis loops (i.e., unusual magnetic behavior characterized by negative remanence and negative coercivity) have so far been reported in antiferromagnetically coupled multilayers or bilayers grown with orthogonal anisotropies. In this work we demonstrate that inverted hysteresis loops can be achieved by surface patterning of a single ferromagnetic material [1]. Trench-patterned Ni₈₀Fe₂₀ (Permalloy, Py) films were fabricated by interference lithography (IL). We started from Py thin films 100 nm thick. Then, line patterns of Ti hard masks were transferred onto the Py films by plasma etching. Different trench depths were obtained by varying the etching time. Surface patterned Py films with trench depths between 15%-25% of the total thickness exhibited inverted hysteresis loops for a wide range of applied magnetic field orientations. A theoretical approach based on the Stoner-Wohlfarth model was proposed to explain the physical origin of this unusual magnetic behavior in patterned nanostructures. The model accounts for the experimental results and predicts the conditions that magnetic and geometric parameters of trench-patterned films must satisfy to yield inverted hysteresis loops. [1] B. Mora et al. Nano Res. 9 (2016) 2347. DOI 10.1007/s12274-016-1121-y.

¹Work supported by Basque Country Government Nanoiker11, Spanish MINECO FIS2013-45469, FIS2016-76058 and EU FP7-IRSES-318901

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Date submitted: 11 Nov 2016

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