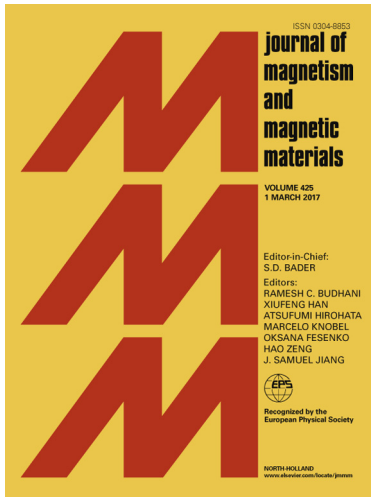

Research articles

Magnetization reversal of thin ferromagnetic elements with surface anisotropy

N.A. Usov, O.N. Serebryakova

PII: S0304-8853(17)32945-1
DOI: https://doi.org/10.1016/j.jmmm.2018.01.009
Reference: MAGMA 63587

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 19 September 2017
Revised Date: 20 December 2017
Accepted Date: 3 January 2018

Please cite this article as: N.A. Usov, O.N. Serebryakova, Magnetization reversal of thin ferromagnetic elements with surface anisotropy, *Journal of Magnetism and Magnetic Materials* (2018), doi: https://doi.org/10.1016/j.jmmm.2018.01.009

Magnetization reversal of thin ferromagnetic elements with surface anisotropy

N. A. Usov[1,2], O.N. Serebryakova[1,2]

[1]National University of Science and Technology «MISIS», 119049, Moscow, Russia

[2]Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, Russian Academy of Sciences, IZMIRAN, 108480, Troitsk, Moscow, Russia

Highlights

- Perpendicular and in-plane hysteresis loops of thin-film elements with surface anisotropy are calculated numerically.
- Buckling nucleation mode determines the nucleation field of elongated thin-film element.
- The nucleation field is proportional to the absolute value of the surface anisotropy constant.
- It is also inversely proportional to the element thickness.

Abstract. The magnetization reversal process in thin-film ferromagnetic elements with surface anisotropy of various shapes and sizes is investigated by means of numerical simulation. The dependencies of the perpendicular and in-plane hysteresis loops on the element thickness, and the value of the surface anisotropy constant are obtained. For sufficiently large values of the surface anisotropy constant the magnetization reversal of thin-film elements is shown to occur due to the nucleation of the buckling mode. For an elongated rectangular element the nucleation field of the buckling mode is proportional to the absolute value of the surface anisotropy constant, and inversely proportional to the element thickness.

Prime Novelty Statement

It is shown that analyzing the magnetization reversal process in thin-film ferromagnetic elements with surface anisotropy one can determine the actual value of the surface magnetic anisotropy by means of comparison of experimental and numerical simulation data. The properties of thin ferromagnetic films with surface anisotropy are promising for applications of such magnetic materials in modern thin-film electronics devices.

PACS: 75.50.Kj, 75.80.+q, 75.60.Ej, 75.60.Jk

Keywords: Thin ferromagnetic elements, Surface magnetic anisotropy, Buckling nucleation mode, Numerical simulation

Corresponding author: usov@obninsk.ru (N.A. Usov)