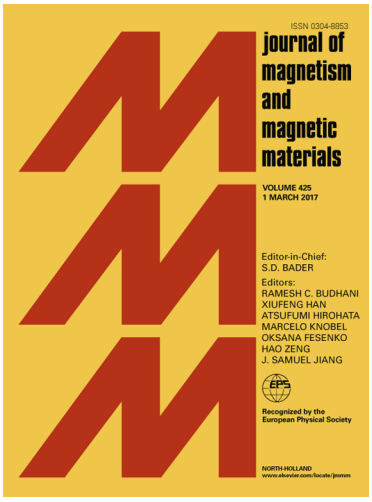

Micromagnetic study of equilibrium states in nano hemispheroidal shells

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Micromagnetic study of equilibrium states in nano hemispheroidal shells

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Abstract

We present results of micromagnetic simulations of thin ferromagnetic nano hemispheroidal shells with sizes ranging from 5 to 50 nm (inside dimensions). Depending on the geometrical and magnetic parameters of the hemispheroidal shell, there exist three different magnetic phases: easy axis, onion and vortex. The profile for the vortex magnetization distribution is analyzed and the limitations and applicability of different vortex ansatzes are discussed. In addition, we investigate the total energy density for each of the magnetic distributions as a function of the hemispheroidal shell dimensions.

Keywords: Micromagnetic simulations; Janus particles; Magnetic phases; Vortex

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1. Introduction

Synthesis and application of magnetic nanoparticles are a fast burgeoning field which has potential to bring significant advance in many fields, ranging from magnetic nanoparticles based cancer therapy to sensors [1]. The magnetic properties of a nanoparticle are important since they enable the manipulation of particle's behaviour remotely and therefore provide the means to direct a particles' orientation and translation. Janus particles (JPs) are particles with two dissimilar faces having unique material properties [2, 3]. JPs provide us with the ability to complete challenging tasks that would be impossible with isotropic particles. Magnetic JPs combine magnetic properties with anisotropy and thus are potential building blocks for complex structures that can be assembled from a particle suspension and can be directed easily by