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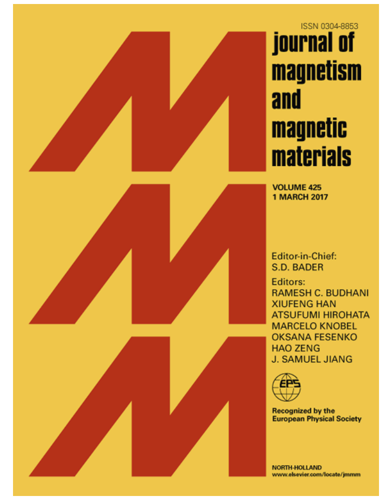

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Interface spins in polycrystalline FeMn/Fe bilayers with small exchange bias

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Abstract

The magnetic moments at the interface between ferromagnetic and antiferromagnetic layers play a central role in exchange biased systems, but their behavior is still not completely understood. In this work, the FeMn/Fe interface in polycrystalline thin films has been studied using conversion electron Mössbauer spectroscopy (CEMS), magneto-optic Kerr effect (MOKE) and micromagnetic simulations. Samples were prepared with ^{57}Fe layers at two distinct depths in order to probe the interface and bulk behaviors. At the equilibrium, the interface moments are randomly oriented while the bulk of the Fe layer has an in-plane magnetic anisotropy. Several models for the interface and anisotropies of the layers were used in the simulations of spin configurations and hysteresis loops. From the whole set of simulations, one can conclude the direct analysis of hysteresis curves is not enough to infer whether the interface has a configuration with spins tilted out of the film plane at equilibrium since different choices of parameters provide similar curves. The simulations have also shown the occurrence of spin clusters at the interface is compatible with CEMS and MOKE measurements.

Keywords: Micromagnetic simulations; Exchange bias; Interface spin coupling

1. Introduction

The effect of exchange bias occurring in some magnetic materials has been studied for long time and is the basic phenomenon for the operation of several kinds of spintronic devices. Despite of that, a comprehensive model able to explain the different aspects of this phenomenon is still not available. The effect is typically associated to multilayer structures or particles in which exist an interface between a ferromagnetic (FM) and an antiferromagnetic (AF) material, although it can also include ferrimagnetic materials. Its main useful consequence is the shift of the magnetic hysteresis loop respect to zero applied field, referred as exchange bias field (H_{EB}), followed by an increase in the coercivity. The behavior of these parameters as a function of temperature also presents specific aspects, as the occurrence of a

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