Simulations of magnetisation reversal in exchange-biased structures using Ising approach

T. Błachowicz

Department of Microelectronics, Institute of Physics, Silesian University of Technology
Krzywoustego 2, 44-100 Gliwice, Poland

Simulation of an exchange-bias phenomenon seems to be a great deal of intensive theoretical and experimental research, which has already been applied to magnetoelectronic devices and will soon be used in novel devices, where electron-spin plays an important role. One of the most important components of spintronic devices are exchange-biased magnetic thin layers. This effect, which exists at the ferromagnetic/antiferromagnetic (FM/AFM) interface, can be tailored by structural modification located in the AFM bulk [1, 2].

The exchange-bias was effectively described within the Domain State Model (DSM) [3, 4] and experimentally confirmed by crystal structure dilution or ion irradiation [5]. The DSM approach bases on Monte Carlo calculations using heat-bath algorithm [6]. Apart from the DSM other numerical methods can be applied here. One of them bases on Random Field Ising Model (RFIM) [7-10].

What is tested here, are phenomena related to the interface of the AFM or to the bulk parts of the FM. Thus, irreversible and reversible parts of the FM/AFM structure were calculated. Further, conclusions about influence of the structure disorder, dilution and atomic roughness, on the exchange-bias effect were obtained.

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Name of the presenting author (oral): Tomasz Błachowicz
e-mail address: Tomasz.Blachowicz@polsl.pl
url's: http://zeus.polsl.gliwice.pl/~tblachow/