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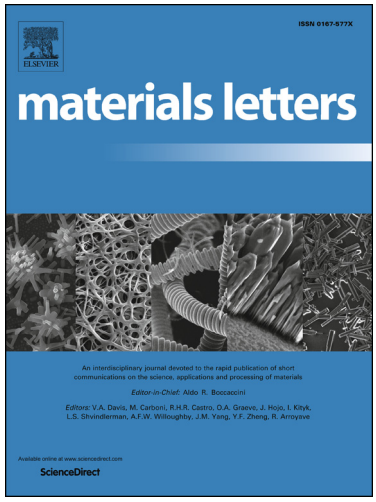

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Harish Sharma Akkera, Davinder Kaur

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Exchange bias effect in $Ni_{50}Mn_{35}In_{15}/BiFeO_3$ heterostructure thin film

Harish Sharma Akkera [a,b,*], Davinder Kaur [a]

[a]*Functional nanomaterials research lab, Department of physics, Indian Institute of Technology Roorkee, Uttarakhand - 247667, India*
[b]*Department of Physics, Indian Institute of Science, Bangalore, Karnataka-560062, India*

A B S T R A C T

In this study, we studied the exchange bias (EB) effect in $Ni_{50}Mn_{35}In_{15}$ and $Ni_{50}Mn_{35}In_{15}/BiFeO_3$ heterostructure thin films deposited onto $Pt/Ti/SiO_2/Si$ substrate using dc/rf magnetron sputtering. In pure $Ni_{50}Mn_{35}In_{15}$ film, the shift of the hysteresis loop from the origin up to 110 Oe was observed at 10 K due to coexistence of FM-AFM interface. On the other hand, the shift of the hysteresis loop was significantly enhanced (480 Oe) in $Ni_{50}Mn_{35}In_{15}/BiFeO_3$ heterostructure thin film at 10 K in field cooled. Further, a high exchange bias field of 80 Oe was found at room temperature in $Ni_{50}Mn_{35}In_{15}/BiFeO_3$ heterostructure thin film. The observed exchange bias field (H_E) in this heterostructure thin film was attributed to the presence of a pinned and uncompensated spins in the antiferromagnetic at the interface, and induced by the interface exchange coupling between $Ni_{50}Mn_{35}In_{15}$ and $BiFeO_3$. This behaviour is an additional property for the $Ni_{50}Mn_{35}In_{15}/BiFeO_3$ heterostructure thin film to be used in various other magnetic memory devise applications.

Keywords: Sputtering: Magnetic materials: Exchange bias

*email: ah.sharma75@gmail.com

1. Introduction

Exchange bias phenomenon (EB) was first discovered by Meiklejohn and Bean [1] in ferromagnetic/antiferromagnetic (FM/AFM) system in 1956 and has been extensively studied for their potential applications in spintronic devices [2], ultra-high density magnetic recording media [3], and many other magnetic materials [4] etc. The EB behaviour has been extensively studied in a several variety of composite materials such as the FM/AFM bilayer thin films [5-6], nanoparticles [7], and spin glass systems [8]. However, the likely EB effect in (FM) $Ni_{50}Mn_{35}In_{15}$/ antiferromagnetic (AFM) $BiFeO_3$ heterostructure thin film has not been reported yet. $BiFeO_3$ (BFO) is the only material whose ferroelectric Curie temperature (T_C = 1103 K) and antiferromagnetic Néel temperature (T_N = 643 K) are much higher than room