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Defect mediated exchange bias in oriented (111) Fe₃O₄/(100) GaAsShwetha G. Bhat^a and P. S. Anil Kumar^{a,*}^aDepartment of Physics, Indian Institute of Science, Bangalore-560012, INDIA.

Exchange bias (EB) in a single magnetic film has always been an intriguing subject to the researchers. But the quest for the origin of EB in Fe₃O₄ films at temperatures, $T < 200$ K is still contemplated. We report a thickness dependent observation of exchange bias at $T < 200$ K, with diminishing EB for higher thickness of oriented (111) Fe₃O₄ on (100) GaAs. Non-zero EB is observed to be retained even up to 55 nm of Fe₃O₄. Invariance of blocking temperature and the identical exponential nature of EB for different thickness of Fe₃O₄ suggests the origin of EB to be similar in all the films. Variation of coercivity with temperature in our case supports the disorder driven magnetic interactions in Fe₃O₄ films at $T < T_V$, which is the Verwey transition of Fe₃O₄. Hence, the exchange bias is thought to exist between the intra-grain ferrimagnetic Fe₃O₄ region and the antiferromagnetic grain boundary region. Reduced island sizes with lower defect area for higher thickness of Fe₃O₄ further supports the claim of defect mediated exchange pinning in a thin film of single magnetic material, Fe₃O₄. In addition, training of exchange bias in Fe₃O₄ films can be carried out similar to the films consisting of traditional ferromagnetic-antiferromagnetic layers.

Keywords

Exchange bias, Grain-boundaries, Oriented Fe₃O₄.

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