Exchange bias in $Sc_{0.8}Zr_{0.2}MnO_3$ induced by electron doping

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We report exchange bias phenomenon in electron-doped multiferroic compound $Sc_{0.8}Zr_{0.2}MnO_3$. Parent compound $ScMnO_3$ is a frustrated antiferromagnet and due to electron doping, antiferromagnetic ordering (T_N=90 K) is partially suppressed in $Sc_{0.8}Zr_{0.2}MnO_3$ [1]. Additionally, ferromagnetic interaction (T_C=60 K) develops in the system and it shows glassy nature below T_g=17 K. Field-cooled magnetic hysteresis loops exhibit shifts in both field axis and magnetization axis. Exchange bias field (H_E) decays exponentially with rise in temperature. These observations follow conventional exchange bias model of ferromagnetic (FM) clusters embedded in a spin glass (SG) or antiferromagnetic host material [2]. Nevertheless, here we find slight deviations: 1) H_E and remanence asymmetry (M_E) has non-zero value even after crossing T_g and vanishes completely only near T_C. 2) Both H_E and M_E increases sharply with increase in magnitude of cooling field (H_{FC}) up to 3 T beyond which the increment slow down but does not saturate even up to 9 T. Detailed investigation using training effect is carried out in order to elucidate the real nature of observed exchange bias.

References:

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