Structural and magneto-transport properties of thin films and devices based on spinel ferrites

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Abstract:

Heteroepitaxial spinel ferrites $NiFe_2O_4$ and $CoFe_2O_4$ films grown by the pulsed laser deposition (PLD) technique at various temperatures (175 - 690 °C) are shown to have atomically flat surfaces with bulk magnetization values [1]. Due to enhanced kinetic energy of ablated species at low pressure and enhanced oxidation power of ozone, epitaxy has been achieved at significantly lower temperatures than previously reported. Films grown at temperature below 550 °C show a novel growth mode, which we term "vertical step-flow" growth mode. Interestingly, the growth mode is independent of the nature of substrates (spinel $MgAl_2O_4$, perovskite $SrTiO_3$, and rock salt MgO) and film thicknesses. However, TEM anaylsis shows the presence of anti-phase boundaries (APBs) of approximately 20 nm grain size which has been attributed to the inequivalent nucleation sites during the out- of-equilibrium PLD growth [2]. The magneto-transport properties of spin-filter devices fabricated using NFO and CFO as the active spin-filter barrier and $(La,Sr)MnO_3$ (LSMO) as ferromagnetic electrode shows both positive (≈ 16%) and negative (≈ -1.4%) TMR values indicating the significant role played by the LSMO / STO interface.

References:

[1] J. X. Ma, D. Mazumdar, G. Kim, H. Sato, N. Z. Bao, and A. Gupta, *J. Appl. Phys.* **108**, 063917 (2010).

[2] R. Datta, S. Kanuri, S. V. Karthik, D. Mazumdar, J. X. Ma, and A. Gupta, *Appl. Phys. Lett.* **97**, 071907 (2010).