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Surprisingly high magneto-electric coupling in cubic $Co_{0.7}Fe_{2.3}O_4$-$SrTiO_3$ nano-composites

Anil S. Gaikwad [a], R. H. Kadam [b], Sagar E. Shirsath [c,*], Santosh R. Wadgane [b], Jyoti Shah [d], R. K. Kotnala [d], A.B. Kadam [e]

[a] *Department of Physics, Vivekanand College, Aurangabad 431001, MS, India*
[b] *Department of Physics, Materials Science Research Laboratory, Shrikrishna Mahavidyalaya, Gunjoti, Osmanabad 413613, MS, India*
[c] *School of Materials Science and Engineering, University of New South Wales, Kensington, Sydney, NSW 2052, Australia*
[d] *National Physical Laboratory (CSIR), Dr. K.S. Krishnan Road, New Delhi 110012, India*
[e] *Department of Physics, Jawahar Art Science and Commerce College, Andur, Osmanabad, MS, India*

Abstract

Magnetoelectric (ME) coupling of $(x)SrTiO_3$-$(1-x)Co_{0.7}Fe_{2.3}O_4$ synthesized by the sol-gel method is presented in this study. The presence of constituent phases of $Co_{0.7}Fe_{2.3}O_4$ (CFO) and $SrTiO_3$(STO), and their strain mechanism in the composites were studied by x-ray diffraction. The field emission scanning electron micrographs confirmed well-distributed CFO and STO phases in the composites. The dielectric constant (ε') and loss tangent ($\tan\delta$) of the composites were studied as a function of frequency. CFO and all the composites exhibit typical ferromagnetic hysteresis loops whereas their ferroelectric hysteresis loops show leaky behavior. CFO and STO lattices experiences compressive and tensile strain respectively that further promoting magnetostriction and electrostrictions in CFO and STO respectively. Strain mediated high magnetoelectric coefficient, α_{ME} = 9.1 mV/cm Oe is obtained for the composite having 50% STO and 50% CFO content. These results demonstrate that the lead free STO-CFO could be effective as magnetoelectric composite and may provide an alternative option over toxic lead contain materials for environmentally friendly ME device application.

Keywords: Sol-gel method, Magneto-electric Coefficient, Ferroelectric measurement; Magnetization

*Corresponding author: shirsathsagar@hotmail.com (SES)

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