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Studies on magnetoelectric coupling in lead-free [(0.5) BCT-(0.5) BZT]- NiFe₂O₄ laminated composites at low and EMR frequencies

N. Shara Sowmya^{a,b}, A. Srinivas^{a*}, P. Saravanan^a, K. Venu Gopal Reddy^b, S.V. Kamat^a,
J. Paul Praveen^{c,e}, Dibakar Das^c, G. Murugesan^e, S. Dinesh Kumar^d and V. Subramanian^d

^a Defence Metallurgical Research Laboratory, Kanchanbagh, Hyderabad, 500058, India

^b Department of Physics, National Institute of Technology Warangal, Warangal, 506004, India

^c School of Engineering Science and Technology, University of Hyderabad, Hyderabad, 500046, India

^d Department of Physics, Indian Institute of Technology Madras, Chennai, 600036, India

^e Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Chennai 600062, India

* Corresponding author: Adiraj Srinivas; Tel: 91-040-2458-6835. Email: adirajs@dmrl.drdo.in

ABSTRACT

The possibility of achieving significantly higher magnetoelectric (ME) coupling in lead-free [(0.5)BCT-(0.5)BZT]/NiFe₂O₄ and NiFe₂O₄/[(0.5)BCT-(0.5)BZT]/NiFe₂O₄ laminates, processed by epoxy bonding using 1 mm -thick [(0.5)BCT-(0.5)BZT] and NiFe₂O₄ layers was reported. The effect of coupling modes in these bi- and tri-layer laminates was investigated through evaluating transverse ($\alpha_{E,31}$) and longitudinal ($\alpha_{E,33}$) ME coefficients both at low (1 kHz) and at electromechanical resonance frequencies (300 - 380 kHz) under external bias field. Measurements on frequency dependence of ME coefficients revealed resonance enhancement due to bending and radial acoustic modes. A maximum ME response of 0.98 and 1.1 V/cm·Oe was obtained for the [(0.5)BCT-(0.5)BZT]/NiFe₂O₄ and NiFe₂O₄/[(0.5)BCT-(0.5)BZT]/ NiFe₂O₄ composites, respectively at the radial mode resonance, and these finding are explained on the basis of mechanical coupling exists at the interfaces of [(0.5)BCT-(0.5)BZT] and NiFe₂O₄ phases.

Keywords: Laminates; Composites; Multiferroics; Magnetoelectrics; Lead-free ceramics

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