Magnetoelectric effect in erbium doped $BaTiO_3$ -$CoFe_2O_4$ particulate multiferroic composites

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Abstract: Multiferroic particulate composites are a topic of intensive research, since they serve as potential candidates for magnetoelectric devices. Particulate multiferroic composites having general formula (1−*x*) $Ba_{0.98}Er_{0.02}TiO_3$ - *x* $CoEr_{0.1}Fe_{1.9}O_4$ (*x* = 0.04, 0.08 and 0.12) were prepared by using the conventional solid-state route. X-ray diffraction studies were done to ascertain the presence of constituent phases. An increase in density was observed with the increase of $CoEr_{0.1}Fe_{1.9}O_4$ ferrite content in the $Ba_{0.98}Er_{0.02}TiO_3$ ferroelectric matrix. Dielectric studies revealed two ferroelectric phase transitions from cubic to tetragonal and from tetragonal to orthorhombic phase. The dc conductivity followed Motts law, confirming variable range hopping mechanism. The unsaturated P-E loops were observed in all the composites and the coercivity increased with the increase in ferrite phase (Fig. 1). An increase in coupling was observed in composites with the increase in ferrite phase, confirmed by room temperature magneto-dielectric studies (Fig. 2). The magneto-electric coupling coefficients were evaluated by using Ginzburg-Landau theory. Improved coupling with low magnetic losses suggest the use of such particulate composites as magnetoelectric devices.

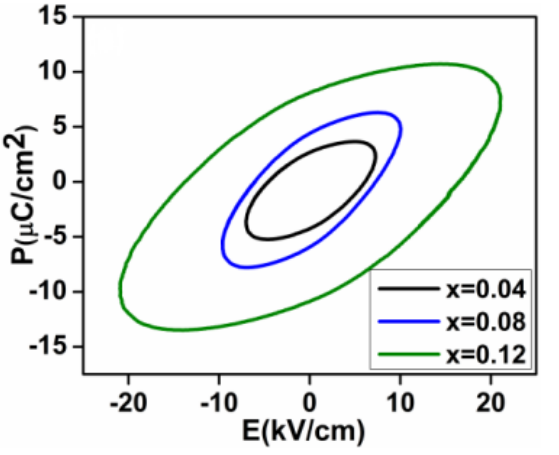

Figure 1: P-E loops of (1−*x*) $Ba_{0.98}Er_{0.02}TiO_3$ - *x* $CoEr_{0.1}Fe_{1.9}O_4$ (*x* = 0.04, 0.08 and 0.12) composites.

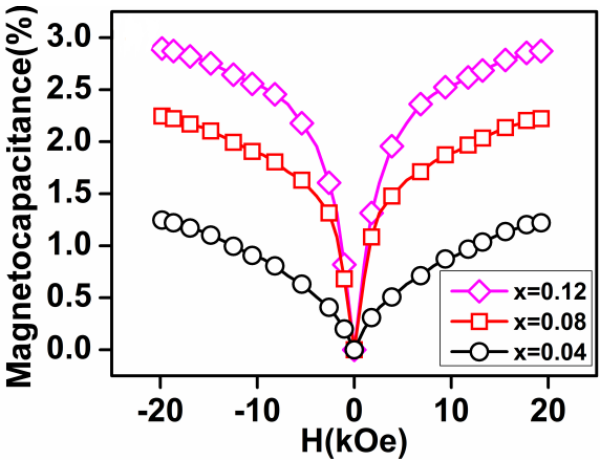

Figure 2: Variation of percentage magnetocapacitance with applied magnetic field for of (1−*x*) $Ba_{0.98}Er_{0.02}TiO_3$ - *x* $CoEr_{0.1}Fe_{1.9}O_4$ (*x* = 0.04, 0.08 and 0.12) composites

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