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MULTIFERROIC PROPERTIES OF $GDMnO_3$ & $GdFeO_3$ NANOPARTICLES

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Abstract:

In the present work, $GdMnO_3$, and $GdFeO_3$, nanoparticles have been synthesized by a chemical co-precipitation method in evaluating their multiferroic properties. In order to develop single phase materials, these two undertaken samples have been sintered at different temperatures in determining their optimized sintering temperatures. For these samples, we have carried out measurements on structural, magnetic and electrical properties, so as to investigate their multiferroic behaviors which eventually develop a strong coupling between magnetic and ferroelectric order, such a situation leads to the progress of newer and effective materials for their use in multifunctional devise applications.

Keywords: Nanoparticles; Multiferroic; Electric, Magnetic

Introduction:

In recent times, rare earth manganites in the compositional formula of RMnO, (where R = Gd, Eu, Sm, Tb & Dy) have been investigated as those possess significant importance due to the existence of strong magnetic interactions which could play a vital role in inducing magnetoelectric effect [1-4]. Especially $GdMnO_3$, reveals a strong magneto-dielectric coupling and as a consequence of that, different spin excitations could exist as electro active magnons, spin waves those could be excited by electric fields. Such materials are useful in tailoring the property of ferromagnetism by an external electric field or vice versa. [5].

Rare earth orthoferrites in the compositional formula of $RFeO_3$ (where R=Gd, Eu & Sm) are also another important set of multiferroic materials and $GdFeO_3$ material has a distorted perovskite structure; it is possibly because of the occurrence of tilting in rigid FeO_6 octahedral symmetry. It occurs when the A-site cation is too small for its 12-coordinate cavity in the cubic perovskite structure thereby result in lowering of the symmetry from a cubic (Pm3m) to an orthorhombic (Pnma). In such materials, ferroelectric polarization is generated by the striction through the exchange interaction between the Gd and Fe spins and antiferromagnetic ordering of material related to the size of the tilt angle, with larger values of a leading to higher Neel temperatures. Keeping this in view, we have undertaken the $GdFeO_3$ material to study their multiferroic behaviours. [6-9].

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