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Effect of structural,dielectric and optical properties of Gd modified $LaFeO_3$ pervoskite

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In the recent decades, perovskite material based on $LaFeO_3$ (LFO) has received a lot of attention due to its wide variety of applications in modern technology. Polycrystalline LFO compounds are excellent dielectric materials having uses in optoelectronics, electronics, and a variety of other disciplines.LFO is considered as p-type semiconductor and it has 2.65 eV band gap energy. Out of the all oxides it is considered as most prominent one with P_{bnm} space group. In general, it is represented as ABO_3 form, where A and B represent rare-earth elements and 3d transition metal, respectively. The 3d transition metal is a promising material for its abundance of functionalities. The LFO is created from FeO_6 octahedra units which constitute La^{3+} ions tucked between them. This material is useful as an electro-ceramic because of its attracting mixed conductivity, which is characterised by electronic and ionic defects corresponding to the existence of Fe^{2+}/Fe^{3+} valences and oxygen non-stoichiometry.

This paper tries to briefly explain structural, dielectric and optical effect of $\mathbf{(La_{0.75}\ Gd_{0.25})FeO_3}$ pervoskite. The traditional high temperature solid-state route method is used to synthesize the sample. The crystallographic phase of the sample is validated using the MAUD tool to analyse the X-ray diffraction pattern (XRD) recorded at room temperature (RT). The substitution of the Gd^{3+} ion at the A site causes a compressive lattice deformation, according to Rietveld studies. In addition, Fourier transformation Infrared (FTIR) Spectroscopy was used to examine the compound's stability and composition. The sample has an orthorhombic crystal symmetry that belongs to P_{bnm} space group .

UV –visible spectroscopy is utilized to investigate the optical sensitivity as well as band gap of the corresponding material. Optical bandgap has been determined from Kubelka-Munk function using Tauc's relation. The variation of dielectric parameters (dielectric constant and loss tangent) as a function of frequency(100Hz -5MHz) or temperature(25^{o}C -300^{o}C) is used to illustrate the material's dielectric characteristics.

Keywords : Perovskite, XRD, UV –visible spectroscopy, Dielectric spectroscopy

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