

## ABSTRACT

In order to study the structural, surface morphological and dielectric properties of  $\text{La}_{1-x}\text{Fe}_x\text{Mn}_{1-y}\text{Gd}_y\text{O}_3$  for  $x=0, 0.25$  and  $y=0, 0.04, 0.06, 0.08$ , Nano particles were synthesized by sol-gel auto combustion method. The X-ray diffraction (XRD) pattern revealed that structure of  $\text{LaMnO}_3$  compound crystallized in perovskite orthorhombic with the space group  $\text{pnma}$ . Crystallite size increases by increasing the Gd concentration. The unit cell volume decreased by the substitution of 25% Fe, while the unit cell volume increased by the substitution of Gd up to 8%. The Attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) spectra displayed the Mn-O-Mn bonds which is related to the  $\text{MnO}_6$  octahedron and confirms the  $\text{ABO}_3$  perovskite characteristic vibration. Field emission scanning electron microscope (FESEM) result shows that Fe and Gd influence the surface morphology of the samples and Gd 8% concentration causes the agglomeration of particles. Energy Dispersive X-ray (EDX) Spectroscopy plot shows the existence of all the elements and EDX plot of all the samples strongly matched with standard peak position of La, Fe, Mn, Cl and oxygen (O). LCR meter data tells that by increasing substitution of Gd in  $\text{LaMnO}_3$  dielectric constant and dielectric loss factor of samples increases. Impedance analysis reveals that total impedance of the material decreases with the doping of Gd. Complex impedance analysis is explored by cole-cole plot to examine the involvement of grain, grain boundary, and interfacial effects individually. Cole-cole plot indicated that Gd doping reduces the grain boundaries and form a large semicircle. Lanthanum-based manganites are of great concern for practical application due to the discovery of the colossal magneto resistance (CMR) effect. This material has become attractive for magnetic sensor, memory devices, catalyst electrodes and spintronics especially for read/write heads of hard disk.