ABSTRACT

This research work explores the properties of transition metal doped perovskite cobaltite from an experimental point of view which have great importance in spintronic devices. Origin of magnetism is the main out-come of Cobaltite materials for spintronics application in which Magnetic properties of diamagnetic doped $LaCoO_3$ can entirely determine by the magnetically active cobalt Co^{3+}, there may possibly exist the super exchange interaction between cobalt Co^{3+} to Co^{4+} state. Oxygen makes the octahedral symmetry by coordinating Cobalt in perovskite structure, this structure controls the delicate balance between Hund's rule coupling and crystal field splitting energy for d electron of cobalt ion. Our purpose of research is to analyze the effect of Sn ions to alter the magnetic properties of Cobaltite as well as its dielectric properties.

Experimentally, we investigate the structural, magnetic and dielectric properties of $LaCo_{1-x}Sn_xO_3$ for x=0, 0.03, 0.06, 0.09 and x=0.12 using XRD, FESEM, FTIR, EDX, VSM and Impedance Analyzer, nanoparticles in the range of 0.36μm to 0.49μm were synthesized by the sol-gel auto-combustion method. The XRD pattern revealed that the structure of $LaCoO_3$ compound crystallized in rhombohedral with the space group Pbnm. Crystallite size decreased by the addition of Sn from 15nm to 10nm. The unit cell volume was found to be increased by the substitution of Sn x=0, 0.03, 0.06, 0.09 and x=0.12. SEM results showed that with the addition of Sn microstructures of prepared nanoparticles display a bit agglomeration of very fine particles with smooth and round edges and somewhere a pours structure. The FTIR spectra displayed the O-Co-O bonds which are related to the CoO_6 octahedron and confirm the ABO_3 perovskite characteristic vibration. EDX plot confirmed the existence of all the elements. VSM result showed that by increasing the doping of Sn at x=0, 0.03, 0.06, 0.09 and x=0.12 in $LaCoO_3$, enhance its ferromagnetic behavior from 0.004emu/g, 0.009emu/g, 0.017emu/g, 0.018emu/g and 0.016emu/g respectively and material is a soft magnet. Dielectric properties showed that the Dielectric constant decreases by increasing the Sn doping.