ABSTRACT

Perovskite-type oxides are a class of compounds with the general formula ABO_3. They are a very important family of materials and exhibit properties suitable for numerous applications. In this research work, the preparation, characterization, and application of La doped $BaZrO_3$ have been described. Five samples having formula $Ba_{1-x}La_xZrO_3$(X= 0.0, 0.04, 0.08, 0.12 and 0.16) have been synthesized by solid-state reaction method. The prepared samples were sintered at temperature 1600°C for 7 hours. The structure was examined by the X-ray diffraction (XRD). XRD peaks started at (110), (111), (200), (211), (220), (013), (311) and (222) *hkl* planes with a most preferred peak at (110). XRD patterns verify the formation of cubic perovskite structure with space group Pm3m which is in agreement with standard data. The lattice parameters were calculated through Rietveld refinement and structural parameters show the decrease in cell volume for all the samples. This is due to the replacement of A-site cation with La. . The Average crystallite size of pure $BaZrO_3$ was found almost 57.02nm and it observed that size was increasing by increasing La content, and at higher La content, it graduallly decrease. Surface morphology of the samples was examined by field emission scanning electron microscope (FESEM). The average grain size of the samples lies in the range of 0.2 to 0.8 μm. Fourier Transform Infrared (FTIR) spectroscopy shows the formation of functional bonding in all samples at 500-600cm^{-1}. The small peaks between 1400-1500 cm^{-1} can be attributed to the Ba-O stretching vibrations. Dielectric and impedance studies were also carried out as a function of frequency to explore the electrical properties of La-doped $BaZrO_3$ using electrical impedance spectroscopy (EIS) in the microwave range. The dielectric constant, dielectric loss, dielectric tangent loss and complex impedance of the samples were calculated. The dielectric constant was found to be in the range of 9-69 with nearly similar dielectric loss of the order of 0.12 to 20. At higher La content, it was observed that the dielectric constant has a maximum value at a lower frequency. The resonance at almost 2.5 GHz shows that it is strong enough to disperse the electrical part of the microwaves. The impedance decreases linearly with an increase in frequency at room temperature.