Microstructure and Electrical Properties of $Ba_{1-x}La_xTi_{1-x/4}O_3$ ceramics Synthesized by sol-gel Technique

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Barium titanate ($BaTiO_3$ or BT) is one of the most studied perovskite material, since its discovery in 1940s. $BaTiO_3$–based electroceramics have been used in electronic industry in the form bulk ceramics and thin films, for applications like multilayer ceramic capacitors (MLCCs), thermistors, gas sensitive sensors and field effect transistors due to its mechanical stability and excellent dielectric, piezoelectric and ferroelectric properties. Here we investigated lanthanum-doped Polycrystalline $Ba_{1-x}La_xTi_{1-x/4}O_3$ (x = 0.00, 0.015, 0.025, 0.035, 0.045 and 0.055) ceramics synthesized by sol-gel method and sintered at 1300 ^oC for 6 h in air. Effect of La on the microstructure, dielectric properties, and impedance of $BaTiO_3$ was investigated. XRD and Raman studies showed that La^{3+} doping influenced $BaTiO_3$ crystal structure and particle morphology. The permittivity and dielectric loss of the $Ba_{1-x}La_xTi_{1-x/4}O_3$ ceramics were investigated in the frequency range from 10 KHz to 1 MHz. The Currie temperature (T_c) was observed to be shifted to lower temperature with increase in La content. The impedance spectroscopic studies were used to analyze the electrical resistance, which was observed to decrease with the rise in temperature, showing a typical ceramic behavior.

Keywords: Ceramics, Sol-gel, XRD, $BaTiO_3$, Electrical resistance.