

Ac conductivity of $\text{Ca}_{1-x}\text{A}_x\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (A= Sr or Ba) with $x=0.0$ and 0.2 ceramics

ABSTRACT

Colossal dielectric constant materials such $\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ (CCTO) have recently received an enormous of attention because of their potential in technological applications due to the formation of internal barrier layer capacitor (IBLC) contains semiconducting grains with insulating grain boundaries. $\text{Ca}_{1-x}\text{Sr}_x\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (CSCTO) and $\text{Ca}_{1-x}\text{Ba}_x\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (CBCTO) with $x = 0.0$ and 0.2 ceramics has been doped on Ca site with strontium or barium was prepared using solid state reaction technique. X-ray diffraction pattern shows single phase with cubic structure. In complex impedance plot for both the ceramics show three semicircular arcs re present the grain, the grain boundary and electrode effect responses and modeled using series network of three parallel RC circuits. Two regions were found in conductivity plot due to the grain boundary at low frequencies and the grain at high frequencies. The n value obtained from the fitting at the grain region at high frequency dependent are above 0.6 indicates of electron hopping conduction mechanism among Ti^{3+} and Ti^{4+} . The activation energy values for CCTO are 0.28 eV and 0.74 eV for grain and grain boundary regions, respectively while for CSCTO the energies is 0.27 eV and 0.71 and for CBCTO is 0.31 eV and 0.59 eV for the grain and grain boundary regions respectively.

Keyword: Colossal dielectric constant material; Ceramic; Technological application