

High temperature impedance spectroscopy study of non-stoichiometric bismuth zinc niobate pyrochlore.

Abstract

Single phase non-stoichiometric bismuth zinc niobate, $\text{Bi}_3\text{Zn}_{1.84}\text{Nb}_3\text{O}_{13.84}$, was fabricated by a conventional solid state method. The sample was refined and fully indexed on the cubic system, space group $Fd\bar{3}m$ (No. 227), $Z = 4$ with $a = 10.5579(4) \text{ \AA}$. Electrical characterisation was performed using an ac impedance analyser over the temperature range of 25-850 $^{\circ}\text{C}$ and frequency range of 5 Hz-13 MHz. Typical dielectric response is observed in $\text{Bi}_3\text{Zn}_{1.84}\text{Nb}_3\text{O}_{13.84}$ with a high relative permittivity, low dielectric loss and a negative temperature coefficient of capacitance, with the values of 147, 0.002 and $-396 \text{ ppm}/^{\circ}\text{C}$, at 100 kHz at ambient temperature, respectively. This material is highly resistive, with a conductivity of $10^{-21} \text{ O}^{-1}\text{cm}^{-1}$ and a high activation energy of ca. 1.59 eV.

Keyword: Activation energy; Bismuth zinc niobate; Dielectric response; Impedance spectroscopy; Pyrochlore.