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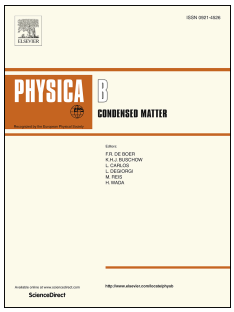

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Temperature dependent dielectric relaxation and ac–conductivity of alkali niobate ceramics studied by impedance spectroscopy

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Abstract

Sodium niobate ($NaNbO_3$) ceramics is prepared by conventional solid state reaction method at sintering temperature 1150 °C for 4 hr. The structural information of the material has been investigated by X-ray diffraction (XRD) and Field emission scanning electron microscopy (FE-SEM). The XRD analysis of $NaNbO_3$ ceramics shows an orthorhombic structure. The FE-SEM micrograph of $NaNbO_3$ ceramics exhibit grains with grain sizes ranging between 1 μm to 5 μm. The surface coverage and average grain size of $NaNbO_3$ ceramics are found to be 97.6 % and 2.5 μm, respectively. Frequency dependent electrical properties of $NaNbO_3$ is investigated from room temperature to 500 °C in wide frequency range (100 Hz – 5 MHz). Dielectric constant, ac–conductivity, impedance, modulus and Nyquist analysis are performed. The observed dielectric constant (1 kHz) at transition temperature (400 °C) are 975. From conductivity analysis, the estimated activation energy of $NaNbO_3$ ceramics is 0.58 eV at 10 kHz. The result of Nyquist plot shows that the electrical behavior of $NaNbO_3$ ceramics is contributed by grain and grain boundary responses. The impedance and modulus spectrum asserts that the negative temperature coefficient of resistance (NTCR) behavior and non-Debye type relaxation in $NaNbO_3$.

Keywords : Electroceramics, Dielectric relaxation, Electrical conductivity, Impedance spectroscopy.

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