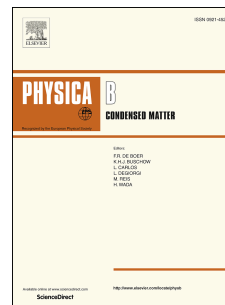


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Temperature dependent dielectric relaxation and ac-conductivity of alkali niobate ceramics studied by impedance spectroscopy

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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 $1\ \mu\text{m}$ to $5\ \mu\text{m}$. The surface coverage and average grain size of NaNbO_3 ceramics are found to be 97.6 % and $2.5\ \mu\text{m}$, 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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