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Electrical microstructure properties of $0.9(\text{KNbO}_3) - 0.1\left(\text{BaNi}_{\frac{1}{2}}\text{Nb}_{\frac{1}{2}}\text{O}_{3-\delta}\right)$ electroceramic

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Abstract

The electroceramic of $0.9(\text{KNbO}_3) - 0.1(\text{BaNi}_{\frac{1}{2}}\text{Nb}_{\frac{1}{2}}\text{O}_{3-\delta})$ (KBNNO) is synthesized using solid state reaction and its electrical microstructure properties are investigated using impedance spectroscopy. KBNNO exhibits negative temperature coefficient of resistance of $-0.283\text{ }^{\circ}\text{C}^{-1}$ at 400°C and the grain boundaries dominate its electrical properties. The conductivity is found to increase with the onset of ferroelectric to paraelectric phase transition. The possible underlying mechanism responsible for increase of conductivity with the onset of phase transition is discussed. The activation energy of conductivity is calculated to be 0.61 eV , indicating proton ion conduction in this electroceramic and the conduction mechanism can be described by using large polaron model. Present study suggests that KBNNO could be a prospective material for many noble applications such as solid oxide fuel cell, hydrogen sensing, and negative temperature coefficient thermistor for temperature compensation and temperature sensor etc.

Introduction

Perovskites electroceramics are advanced functional materials whose properties and hence, applications depend on the close control of structure, composition, ceramic texture, dopants, and defect distribution etc. [1]. The electrical properties of these electroceramics may be contributed by the different regions such as bulk or grain, grain boundary, electrode/electrolyte interface, surface layer etc. [1, 2]. Impedance spectroscopy (IS) is a powerful method for characterizing the electrical properties of the systems in which the overall system behavior is determined by a number of strongly coupled factors [3].

In the recent research, Grinberg *et al.* [4] reported a record high solar energy absorption and low optical band gap in Ba/Ni co-doped KNbO_3 . Of the reported compounds, the composition

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