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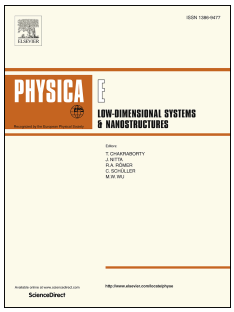

Phase transition, impedance spectroscopy and conduction mechanism of $Li_{0.5}Na_{1.5}WO_4$ material

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Phase transition, impedance spectroscopy and conduction mechanism of $Li_{0.5}Na_{1.5}WO_4$ material

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Abstract

In order to better characterize the tungsten-based samples, and to get better inside into this field, we synthesized the $Li_{0.5}Na_{1.5}WO_4$ compound and identified its purity by X-ray diffraction which showed that it crystallizes in the orthorhombic system with the Pmmm space group. Accordingly we used Raman spectroscopy, differential scanning calorimetry and impedance spectroscopy as to distinguish its properties. All WO_4^{2-} tetrahedral vibration modes appear in the Raman spectra. The calorimetric study displays two phase transitions at 498 K and 567K. Impedance spectroscopy reveals the contribution of two electrically active regions corresponding to the bulk mechanism and distribution of grain boundaries which allows us to use two cells mounted in series each one of them is composed of the combination in parallel of a resistance R and a fractal capacitance CPE. The variation σ_{dc} as a function of the inverse of temperature confirms the presence of three phases for each one of them the conductivity is ensured by a specific conduction mechanism. It has been pointed out that the first phase is described by the correlated barrier hopping model (CBH), the second one by the over loping polaron tunneling model (OLPT) and the third one by the non small polaron tunneling model (SPT). A comparison with the compound of $Li_{1.5}Na_{0.5}WO_4$ confirms that the transport is dominated by the motion of the monovalent cations (Li^+ and Na^+) in the investigated material.

Keywords*: X-Ray, scanning electron microscopy, phase transitions, electrical properties.*

1-Introduction

In recent years, researchers have focused their works to find new more stable materials endowed with characteristic properties that allow them to be used in several domains. Tungsten is among the material considered as very hard metal possessing enormous resistance to heat since its melting point is about 3380°C (the highest melting point of all metals) and its