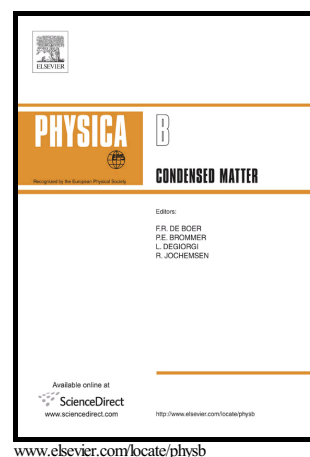


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AC conduction of $\text{Ba}_{1-x}\text{Ca}_x\text{TiO}_3$ and BZT-BCTx

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Abstract

$\text{Ba}_{1-x}\text{Ca}_x\text{TiO}_3$ (BCTx), ($x = 0.0-0.3$) and $\text{Ba}_{0.8}\text{Zr}_{0.2}\text{TiO}_3\text{-Ba}_{1-x}\text{Ca}_x\text{TiO}_3$ (BZT-BCTx), ($x = 0.15-0.35$) were fabricated by the solid state reaction method. Phase structure of the material samples was identified by X-ray diffraction. The impedance versus frequency in a range of 100 Hz – 2.5 MHz was measured for all the samples at room temperature. AC conductivity versus frequency of the BCTx and BZT-BCTx was evaluated and fitted by using the extended Universal Dielectric Response (UDR) equations. The fitting results were discussed in detail and shown that the localized reorientation polarization-based mechanism is most contributed in BCTx material samples. Basically both two the hopping polaron and polarization mechanisms play roles in BZT-BCTx material samples. In contrary the short-range polaron hopping is dominated in ac conductivity of BZT-BCTx material samples in low frequency range.

Keywords: *Ferroelectrics, Dielectrics, Substitution effect, XRD, AC conduction.*

Introduction

BaTiO_3 (BTO) has been widely investigated due to its promising piezoelectric properties, such as the large polarizations, large permittivity and the large induced strains [1]. However, the pure BaTiO_3 has limited applications because of its low paraelectric-ferroelectric phase transition temperature ($T_c \sim 130^\circ\text{C}$), relatively low piezoelectric constant. R. Kazaki et al. reported a value of the piezoelectric constant d_{33} of 149 pC/N for BaTiO_3 with single crystalline domain [2]. T. Karaki et al. reported a little bit higher d_{33} value of 190 pC/N for BaTiO_3 doped with $\text{Bi}_2\text{O}_3\text{-Li}_2\text{O}$ [3]. Various synthesis methods for the enhancement of ferroelectric properties have been developed [4-7]. Recently BZT-BCTx have attracted a lot of attention after a high piezoelectric coefficient ($d_{33} \sim 620$ pC/N) was reported in 2009 for this composition [4]. In aim to understand the influence of Ca substitution on structure and electrical properties of the BTO-based materials we have carried out experiments focused on $\text{Ba}_{1-x}\text{Ca}_x\text{TiO}_3$ (BCT) and $\text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3\text{-BCTx}$

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