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www.elsevier.com/locate/ceri

PII: S0272-8842(17)31463-3
DOI: <http://dx.doi.org/10.1016/j.ceramint.2017.07.032>
Reference: CERI15752

To appear in: *Ceramics International*

Received date: 15 May 2017
Revised date: 24 June 2017
Accepted date: 4 July 2017

Cite this article as: Poonam Yadav, Shivani Sharma and N.P. Lalla, Effect of magnetic ion (Mn) doping on structural, ferroelectric and magnetic properties of $\text{Ba}_{0.90}\text{Mn}_{0.10}\text{TiO}_3$, *Ceramics International*, <http://dx.doi.org/10.1016/j.ceramint.2017.07.032>

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Effect of magnetic ion (Mn) doping on structural, ferroelectric and magnetic properties of $\text{Ba}_{0.90}\text{Mn}_{0.10}\text{TiO}_3$

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Abstract

Synthesis, formation, structural phase transition, dielectric and magnetic properties of polycrystalline $\text{Ba}_{0.90}\text{Mn}_{0.10}\text{TiO}_3$ (BMTO) ceramic have been investigated to study the effect of magnetic ion (Mn) doping at Ba-site in the well-known ferroelectric (FE) material BaTiO_3 (BTO). The polycrystalline ceramic BMTO has been prepared via solid state reaction route. The Wyckoff-site occupancy of the substituted Mn has been determined through x-ray diffraction (XRD) and soft X-ray absorption measurement via confirmation of its oxidation state to be 2+ and that of Ti to be 4+. The temperature dependent XRD, dielectric and pyroelectric studies show all the known transitions similar to the pristine BTO. However, the transition temperatures (T_c) were found shifted towards lower temperatures as compare to the pristine BTO. The shifts in T_c corresponding to cubic-tetragonal and tetragonal-orthorhombic transitions are significant as compared to that of orthorhombic-rhombohedral transition. Frequency dependent dielectric measurements show the space-charge related dielectric relaxation. The dc-magnetization measurements show antiferromagnetic interactions in BMTO. Our results also address the role of Ba site on the ferroelectric properties of BTO.

Keywords: Magneto-Electrics; Multi-ferroics; Ferroelectrics; Dielectric relaxation; BaTiO_3

Introduction:

In recent years, multiferroic materials typified by the coexistence of two ferroic orders, ferroelectricity and magnetism have attracted much attention because of its potential application in high density data storage [1]. There are very few materials which possess such multiferroic and magneto-electric properties [2,3,4,5]. In ABO_3 perovskite based materials the BaTiO_3 (BTO) is well known due to its interesting properties like ferroelectricity, large dielectric constant,

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