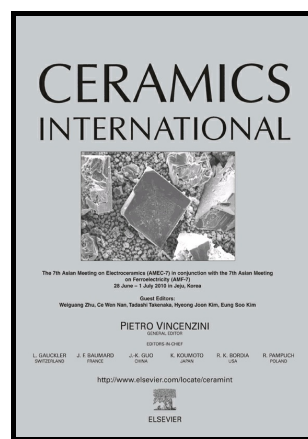


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PII: S0272-8842(18)30585-6  
DOI: <https://doi.org/10.1016/j.ceramint.2018.03.039>  
Reference: CER117676

To appear in: *Ceramics International*

Received date: 1 January 2018  
Revised date: 17 February 2018  
Accepted date: 5 March 2018

Cite this article as: Kanta Maan Sangwan, N. Ahlawat, Sunita Rani, Suman Rani and R.S. Kundu, Influence of Mn doping on electrical conductivity of lead free BaZrTiO<sub>3</sub> perovskite ceramic, *Ceramics International*, <https://doi.org/10.1016/j.ceramint.2018.03.039>

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# Influence of Mn doping on electrical conductivity of lead free

## BaZrTiO<sub>3</sub> perovskite ceramic

Kanta Maan Sangwan<sup>1</sup>, N. Ahlawat<sup>1</sup>, Sunita Rani<sup>1</sup>,  
Suman Rani<sup>1</sup>, R.S. Kundu<sup>1</sup>

<sup>1</sup>Department of Physics, Guru Jambheshwar University of Science & Technology,  
Hisar125001, India

### Abstract

Mn doped barium zirconate titanate lead free ceramic with formula BaZr<sub>0.045</sub>(Mn<sub>x</sub>Ti<sub>1-x</sub>)<sub>0.955</sub>O<sub>3</sub> for  $x = 0.00, 0.01, 0.02$  and  $0.03$  has been prepared by solid-state reaction method. The single phase tetragonal structure was confirmed by X-ray diffraction (XRD) pattern using Rietveld refinement. Scanning electron microscopy (SEM) shows an inhomogeneous distribution of randomly oriented grains with some voids. Electrical conductivity of Mn doped BZT ceramics was studied using impedance analyzer in the temperature range 493K-673K over wide frequency window. The dispersion behavior in electrical conductivity obeys Jonscher's double power law for Mn free compound, while it follows single power law for Mn doped compositions. Various parameters viz. dc conductivity ( $\sigma_{dc}$ ), pre-exponential factor ( $A$ ), frequency exponent ( $s$ ) and activation energy ( $E_a$ ) have been estimated by the theoretical fitting of experimental data. The reciprocal temperature dependence of dc conductivity follows the Arrhenius law and specifies thermally activated conduction mechanism. The obtained value of activation energy ( $E_a$ ) evidences the conduction mechanism is induced by the migration of oxygen vacancies and oxide ions. All samples shows Negative temperature coefficient of resistance (NTCR) and hence exhibit semiconducting behavior. The environmental friendly lead free ceramic can be exploit to design advanced materials and suitable for the fuel cell electrolyte/electrode applications.

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