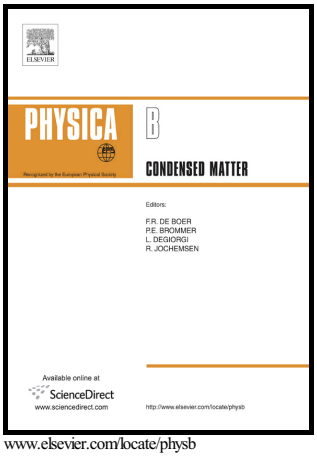
Electric field induced strain, switching and energy storage behaviour of lead free Barium Zirconium Titanate ceramic

T. Badapanda, S. Chaterjee, Anupam Mishra, Rajeev Ranjan, S. Anwar



www.elsevier.com/locate/physb

PII: S0921-4526(17)30402-7
DOI: http://dx.doi.org/10.1016/j.physb.2017.07.013
Reference: PHYSB310080

To appear in: *Physica B: Physics of Condensed Matter*

Received date: 10 May 2017
Revised date: 5 July 2017
Accepted date: 6 July 2017

Cite this article as: T. Badapanda, S. Chaterjee, Anupam Mishra, Rajeev Ranjan and S. Anwar, Electric field induced strain, switching and energy storage behaviour of lead free Barium Zirconium Titanate ceramic, *Physica B: Physics of Condensed Matter,* http://dx.doi.org/10.1016/j.physb.2017.07.013

Electric field induced strain, switching and energy storage behaviour of lead free Barium Zirconium Titanate ceramic

T.Badapanda[1*], S. Chaterjee[2*], Anupam Mishra[3], Rajeev Ranjan[3], S.Anwar[4]

[1]*Department of Physics, C.V. Raman College of Engineering, Bhubaneswar, Odisha 752054, India*

[2]*Department of Mechanical Engineering, C.V. Raman College of Engineering, Bhubaneswar, Odisha 752054, India*

[3]*Department of Materials Engineering, Indian Institute of Science, Bangalore 560012, India*

[4]*Colloids & Materials Chemistry, Institute of Minerals and Materials Technology, Bhubaneswar, Odisha, India-751013*

badapanda.tanmaya@gmail.com

jeesaikat@gmail.com

[*]Corresponding author's. Tel: +91-9437306100 Fax: +91-674 2113593

Abstract

There is a huge demand of lead-free high performance ceramics with large strain, low hysteresis loss and high-energy storage ability at room temperature. In this context, we investigated the large electric field induced strain, switching behaviour and energy storage properties of $BaZr_{0.05}Ti_{0.95}O_3$ ceramic (BZT) prepared by high energy ball milling technique, reportedly exhibiting a triple point transition near the room temperature. The X-ray diffraction of the BZT ceramic confirms orthorhombic symmetry with space group Amm2 at room temperature. The room temperature dielectric study reveals that there is a negligible variation of dielectric constant and dielectric loss with frequency. The polarization behaviour at various applied electric fields was studied and the energy storage densities were obtained from the integral area of P-E loops. Electric field induced strain behaviour has been studied with due emphasis on the electrostrictive response at room temperature. The ferroelectric and electromechanical properties derived from the P-E and S-E loops suggest that the present ceramic encompass the properties of actuation and energy storage simultaneously.

Keywords: Piezoelectric ceramic; High energy ball milling; Electric field induced strain; Electrostriction; Energy storage efficiency.

1. Introduction:

Piezoelectric ceramics are widely used in applications, such as actuators, energy storage devices, sensors, resonators and ultrasonic transducers. Lead based perovskite oxides have