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Effect of dc bias effect on the dielectric properties and nonlinear electrical behaviors of Bi1-xBaxFeO3 ceramics

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In this work we report the dc bias effect on dielectric properties and nonlinear current-voltage behaviors of Bi1-xBaxFeO3 (where x = 0, 0.05, 0.1, 0.2, and 0.3) ceramics synthesized by a co-precipitate process. Structural studies using X-ray diffraction (XRD) show the formation of small amount of second phase (Bi2Fe4O9). Ba-doped samples show the Rhombohedral (R3c) and Orthorhombic (Pbam) distorted structure mixed phase. SEM images indicate the average grain size decreases with the increase of Ba content and the average grain size of Ba-doped samples is about 6.48-3.28 . The dielectric constant and loss tangent of the Ba-doped pellets were measured between 100 Hz –1 MHz under an applied dc bias voltage. Interestingly, it is observed that the dielectric constant gradually increases with increasing dc bias voltage for all of Ba-doped samples at low frequency region (<104 Hz). The grain boundary activation energy has been investigated using impedance microscopy. The leakage current density behavior is significantly enhanced with increase of Ba doping concentration. The relationship between J-E reveal that all of samples exhibits nonlinear characteristic, which is similar to that reported in Ba-doped CCTO ceramics [1]. The non-Ohmic property is described by the existence of Schottky-type barrier in the samples.
Keywords: Bismuth ferrite; Dielectric property; Nonlinear behavior; Impedance analysis
[1]. P. Thongbai,S. Vangchangyia,E. Swatsitang,V. Amornkitbamrung,T. Yamwong, & S. Maensiri. 2013. Non-Ohmic and dielectric properties of Ba-doped CaCu3Ti4O12 ceramics. Journal of Materials Science: Materials in Electronics, 24, 875-883.

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