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PII: S0955-2219(18)30025-6
DOI: https://doi.org/10.1016/j.jeurceramsoc.2018.01.011
Reference: JECS 11679

To appear in: *Journal of the European Ceramic Society*

Received date: 4-12-2017
Revised date: 9-1-2018
Accepted date: 9-1-2018

Please cite this article as: Zhang H, Ke H, Lu H, Guo P, Yan B, Jia D, Zhou Y, Effects of spark plasma sintering on ferroelectricity of $0.8Bi_{3.15}Nd_{0.85}Ti_3O_{12}$-$0.2CoFe_2O_4$ composite ceramic, *Journal of The European Ceramic Society* (2010), https://doi.org/10.1016/j.jeurceramsoc.2018.01.011

Effects of spark plasma sintering on ferroelectricity of $0.8Bi_{3.15}Nd_{0.85}Ti_3O_{12}$-$0.2CoFe_2O_4$ composite ceramic

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Abstract

The $0.8Bi_{3.15}Nd_{0.85}Ti_3O_{12}$ (BNdT)-$0.2CoFe_2O_4$ (CFO) composite multiferroic ceramics have been fabricated by spark plasma sintering (SPS) at 850 °C. The relative density of as-sintered SPS ceramic reaches 97.4 (±0.3)%. The composites are composed of pure BNdT and CFO phases without any preferred *c*-orientation. The *a*-orientation preference is more obvious perpendicular to the pressure direction. The average grain-sizes of BNdT and CFO are 163 and 146 nm, respectively. The BNdT phase has more grains below 100 nm (~20%). The super energy-dispersive X-ray analyses suggest no serious reaction between BNdT and CFO. The Raman spectrum verifies the nano-structure of the SPS ceramic via the broadening bands and peak shifts. The Curie temperature of the SPS ceramic declines to 560 °C with stabilized dielectric loss. The grain boundary resistance plays a dominant role on impedance above 700 °C. The remanent polarization approaches to 15.2 μC/cm^2 (300 kV/cm) with lower coercive fields (-89/+95 kV/cm).

1. Introduction

The composite magnetoelectric (ME) ceramics [1-3] with ferromagnetic and ferroelectric properties have attracted tremendous researches due to their wide application in information storages, transducers and energy conversion fields [4-6]. The simple processes and low-cost characteristics of ME ceramics make them more practical compared with composite ME thin films [7-9]. Given the actual situation, some disadvantages in ME ceramics, such as the increased charge carriers density caused by defects and the higher electroconductivity arising from the introduction of the magnetic phases [10], usually diminish their ferroelectric performances. To surmount the

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