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PII: S0167-577X(16)31896-1
DOI: http://dx.doi.org/10.1016/j.matlet.2016.12.020
Reference: MLBLUE21832

To appear in: *Materials Letters*

Received date: 1 November 2016
Revised date: 28 November 2016
Accepted date: 7 December 2016

Cite this article as: Yongping Pu, Lei Zhang, Mouteng Yao, Wanyin Ge and Min Chen, Improved Energy Storage Properties of Microwave Sintered 0.475BNT-0.525BCTZ-xwt%MgO ceramics, *Materials Letters* http://dx.doi.org/10.1016/j.matlet.2016.12.020

Improved Energy Storage Properties of Microwave Sintered 0.475BNT-0.525BCTZ-*x*wt%MgO ceramics

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Abstract:

0.475BNT-0.525BCTZ-*x*wt%MgO ceramics were densified by microwave sintering method and their phase compositions and dielectric properties were investigated. The XRD results reveal that all samples possess a perovskite structure and the secondary phase of MgO can be observed in the MgO-doped samples. The maximum polarization of the MgO-doped samples sintered by microwave sintering are higher than that of the samples sintered by traditional sintering, thus a higher energy storage density can be achieved. The dielectric breakdown strength of the samples are greatly improved with the increasing content of MgO. The *x*=5 sample exhibits a high dielectric breakdown strength of 17.91 kV/mm and a high energy storage density of 1.37 J/cm^3.

Keywords:

Microwave sintering, Energy storage and conversion, Dielectric breakdown strength, Ferroelectrics

1 Introduction

Capacitors are indispensable components for passive parts in contemporary electronic devices. Compared to batteries, capacitors usually possess higher power density (10^8 W/kg for dielectric capacitor), which are eagerly desired for the potential application in advanced pulsed capacitors [1]. However, the low energy density of capacitor limits its practical application. Interest in high energy storage density dielectric materials has surged recently, which is mainly driven by the ever-increasing demands for the miniaturization of electronic devices [2,3]. Lately, $Bi_{0.5}Na_{0.5}TiO_3$-based relaxor ferroelectrics were widely investigated for energy storage due to their high maximum polarization. A high a high energy storage density of 0.7 J/cm^3, 0.598 J/cm^3 and 1.2 J/cm^3 were reported in BNT-BT-CZ [4], BNT-BT-KNN [5] and BNT-KNN [6] ceramics, respectively. Furthermore, MgO is generally added