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Low dielectric loss of Bi-doped BaZr_{0.15}Ti_{0.85}O₃ ceramics for high-voltage capacitor applications

Yan Zhang^{1,2}, Yaoyao Li^{1,2}, Haikui Zhu^{1,2}, Zhenxiao Fu³, Qitu Zhang^{1,2*}

Abstract

BaZr_{0.15}Ti_{0.85}O₃ ceramics are prepared via the conventional solid state reaction method. The effects of Bi₂O₃·3TiO₂ doped on dielectric properties and breakdown strength of BaZr_{0.15}Ti_{0.85}O₃ ceramics are systematically discussed. Doping of Bi₂O₃·3TiO₂ can obviously improve the breakdown strength and reduce the dielectric loss of the material. It is attributed to the Bi³⁺ substituted Ba²⁺ is an unequal ion substitution, and two Bi³⁺ substitute three Ba²⁺ to produce an A vacancy, thereby increasing the lattice energy and promoting the diffusion and migration of the particles during the sintering process, promoting the sintering and reducing the sintering temperature. However, the dielectric constant of the material is decreased. When the amount of Bi₂O₃·3TiO₂ is 12 mol%, the minimum dielectric loss $\tan\delta = 0.0009$, the maximum breakdown strength is $E_b = 15.09$ kv/mm, the insulation resistivity is $3.52 \times 10^{11} \Omega \cdot \text{cm}$. The energy storage density of the BaZr_{0.15}Ti_{0.85}O₃ ceramic samples doped with Bi₂O₃·3TiO₂ varies from 0.008 J/cm³ to 0.012 J/cm³.

Keywords: Dielectric properties; Bi₂O₃·3TiO₂ doped; Breakdown strength; High-voltage capacitor; Low $\tan\delta$

1. Introduction

In recent years, BaZr_xTi_{1-x}O₃ (BZT) ceramics have gotten much attention from the

¹ College of Materials Science and Engineering, Nanjing Tech University, Nanjing 210009, China

² Jiangsu Collaborative Innovation Center for Advanced Inorganic Function Composites, 210009, Jiangsu, China

³ Guangdong Fenghua Advanced Technology Company Limited, Zhaoqing 526020, Guangdong, China

* Corresponding author

E-mail address: ngdzqt@163.com

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