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Effects of TiO₂ addition on dielectric and energy storage properties ofBaO-K₂O-Nb₂O₅-SiO₂ glass ceramicsKe Yang, Jingran Liu, Bo Shen^{*}, Jiwei Zhai^{*}, Shujian Wang, Jia Tian

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Abstract

In this work, 25.6BaO-6.4K₂O-32Nb₂O₅-36SiO₂-xTiO₂ (0 ≤ x ≤ 10 mol.%) (BKNST) glass ceramics were synthesized by conventional melts and controllable crystallization method. The effects of different TiO₂ addition on the phase composition, dielectric and energy storage properties of BKNS glass ceramics were systematically evaluated. With the TiO₂ concentration increasing, a growing content of Ba₂TiO₄ phase was observed in the glass ceramics. The microstructures appeared to be homogenous and uniform with very low porosity through the addition of TiO₂, for which the maximal breakdown strength of 2112 kV/cm and the corresponding energy storage density of 9.48 J/cm³ were obtained with x = 7.5. The extremely low dielectric loss of less than 1‰ (25 °C, 100 kHz) and the obviously improved microstructure contributed to the increased breakdown strength. In addition, the discharge power density of the glass-ceramic capacitor (x = 7.5) was investigated using the RLC charge-discharge circuit and a relatively high value of 16 MW/cm³ at 300 kV/cm was obtained.

Key words: Glass ceramics, Breakdown strength, Energy-storage density, Discharge

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