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Temperature-stable Dielectric and Piezoelectric Properties of $(\text{K}_{0.5}\text{Na}_{0.5})\text{NbO}_3\text{-Bi}(\text{Cu}_{0.75}\text{W}_{0.25})\text{O}_3$ Solid Solutions

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Abstract

$(1-x)(\text{K}_{0.5}\text{Na}_{0.5})\text{NbO}_3\text{-}x\text{Bi}(\text{Cu}_{0.75}\text{W}_{0.25})\text{O}_3$ (abbreviated as KNN-BCW) [$x = 0, 0.005, 0.01, 0.015, 0.02, 0.025$] lead-free ceramics were fabricated by a solid state reaction method. The XRD analysis confirmed that $\text{Bi}(\text{Cu}_{0.75}\text{W}_{0.25})\text{O}_3$ has diffused into $(\text{K}_{0.5}\text{Na}_{0.5})\text{NbO}_3$ to fabricate a new solid solution with perovskite structure. As $x = 0.01$, the ceramics exhibited high relative permittivity ($\epsilon \sim 1121$), low dielectric loss ($\tan\delta < 2.8\%$). Especially, good thermal stability ($\Delta\epsilon/\epsilon_{150^\circ\text{C}} \leq \pm 15\%$) was obtained in a broad temperature range from 150°C to 500°C as $x = 0.025$. The results indicated that the addition of $\text{Bi}(\text{Cu}_{0.75}\text{W}_{0.25})\text{O}_3$ could enhance the dielectric properties of ceramics. The thermal aging behavior represented that the d_{33} was decreased gradually with increasing the measured temperatures.

Key words: Ceramics; Crystal structure; Dielectrics

1. Introduction

High temperature multilayer ceramic capacitors (HTMLCC) have been widely

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