

عنوان مقاله:

Enhancing the Electrical Properties of Bismuth Titanate Ceramics Using Zinc Oxide Nanoparticles as Sintering Aid

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خلاصه مقاله:

In this study, bismuth titanate (BIT) powder was synthesized using the solid-state synthesis method. The effect of zinc oxide (ZnO) nanoparticles as a sintering aid on the electrical properties of BIT ceramic was then investigated. The weight percentages of ZnO used were 0.3, 0.6, and 1.2. Disc-shaped samples were prepared using the uniaxial pressing method and sintered at temperatures of 1025, 1075, and 1125 °C for durations of 1, 2, and 5 h, and with heating rates of 3, 5, and 10 °C/min. The highest density values were achieved under the optimal sintering conditions of 1075 °C, 2 h, and a heating rate of 5 °C/min. The addition of ZnO nanoparticles improved the densification of BIT ceramic. In the sample containing 1.2 wt.% of ZnO, a secondary phase of Zn₂TiO₄ was identified. The inclusion of ZnO nanoparticles resulted in an increase in the dielectric constant, a reduction in dielectric loss, and improvements in the piezoelectric and ferroelectric properties of BIT ceramics. These enhancements contributed to increased density and reduced electrical conductivity. The best results were obtained with the sample containing 0.6 wt.% of nano ZnO, which exhibited a high dielectric constant (312), low dielectric loss ($\tan\delta = 0.01$), high piezoelectric coefficient ($d_{33} = 21$ pC/N), and high remnant polarization ($4.25 \mu\text{C}/\text{cm}^2$).

کلمات کلیدی:

Bismuth titanate, Zinc oxide nanoparticles, Sintering, Dielectric properties, Microstructure

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