

THE INFLUENCE OF MILLING ON THE GRAIN SIZE OF LEAD-FREE SOLID SOLUTIONS $0.8\text{Na}_{0.5}\text{Bi}_{0.5}\text{TiO}_3 - 0.2\text{BaTiO}_3$.

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Piezoelectric ceramics play an important role in electronics as actuators, sensors, resonators and ultrasonic transducers. However, most conventional piezoelectrics contain lead, posing environmental and health hazards. Increasing interest in lead-free alternatives is driven by the Restriction of Hazardous Substances (RoHS) directive, which limits the use of lead-based materials. Among the most promising lead-free ferroelectric ceramics is the $(1-x)(\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3) - x(\text{BaTiO}_3)$ family. This research aims to synthesize the $0.8\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3 - 0.2\text{BaTiO}_3$ via the solid-state reaction method and to investigate the effect of varying milling durations on the mean grain size of powders, in order to optimize its microstructural and functional properties.

Commercially available Na_2CO_3 , Bi_2O_3 , TiO_2 , and BaCO_3 (Sigma-Aldrich) were weighed and milled with the planetary mill in isopropyl alcohol for 24 hours. The mixture was then calcined at 900°C for 4 h, milled again, pressed into 8 mm diameter pellets, and sintered at 1200°C for 4 hours. X-ray diffraction analysis confirmed the formation of the perovskite phase and its purity. Dielectric measurements exhibited a characteristic sharp peak (see Figure 1) at a temperature of 537K, while piezoelectric and ferroelectric properties are promising in comparison to those presented in the literature.

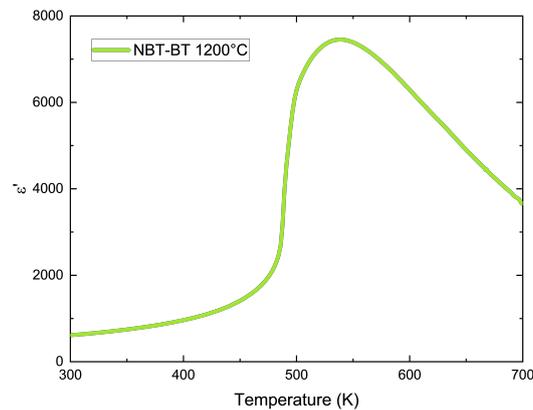


Fig. 1. Dielectric constant dependence on temperature.