

Characterization of Lead-Free Piezo-Ceramics

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Lead zirconate titanate (PZT) has been the most commonly used piezoelectric material due to its high piezoelectric performance under varied operating conditions. However, it has been noticed that the lead component is toxic, causing some environmental issues and a lead free substitute material was introduced. The substituted environmental friendly piezoelectric material, $\text{Ba}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3-x(\text{Ba}_{0.7}\text{Ca}_{0.3})\text{TiO}_3$ (BZT-xBCT) system that can fulfill the need of high piezoelectricity has been developed. The research was conducted to characterize the BZT-xBCT system with five different compositions ($x=0.06, 0.08, 0.1, 0.12$ and 0.14). XRD was applied to examine the crystal structure of the samples before and after poling and polarization measurement was conducted. The results from the experiments allow us to find out the piezoelectricity performance of BZT-xBCT system of different compositions that have distinct crystal structures on microscopic scale. It is found that after poling, the intensity peaks do not shift, compared with that before poling, but the ratio between two peaks at the same 2θ degree increases, which means the domain structure changes. Polarization curves for 0.08, 0.1, 0.12 and 0.14 are as expected but the 0.06 one is not. This research will contribute to ongoing research on BZT-xBCT system, and better understanding of piezoelectric materials.