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A novel lead-free ceramic with layered structure for high energy storage applications

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Abstract

In recent years, ceramic capacitors have attracted much attention due to their high energy storage properties and fast charge-discharge capability. The $(\text{SrTiO}_3+0.5 \text{ wt\% Li}_2\text{CO}_3)/((0.93\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3-0.07\text{Ba}_{0.94}\text{La}_{0.04}\text{Zr}_{0.02}\text{Ti}_{0.98}\text{O}_3)$ (STL/(BNT-BLZT)) lead-free ceramic with layered structure was designed and fabricated via the tape-casting and subsequently laminating technique, and sintered by the conventional solid state sintering method in this study. The results reveal that the STL/(BNT-BLZT) multilayer ceramic sintered at 1175 °C with an excellent charge energy density of 3.67 J/cm³ and discharge energy density of 2.72 J/cm³ under 294 kV/cm. In addition, the energy storage properties of STL/(BNT-BLZT) multilayer ceramic also displays good thermal stability from 25 to 100 °C at the electric field of 100 kV/cm. These results indicate that the STL/(BNT-BLZT) multilayer ceramic may be a promising lead-free material for high energy storage applications.

Keywords: Energy storage, Lead-free ceramics, Layered structure, Capacitors.

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