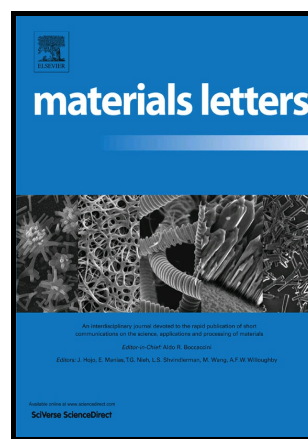


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Electocaloric Effect in Lead-free Relaxor (1-x)
(Sr_{0.7}Bi_{0.2})TiO₃+x(Na_{0.5}Bi_{0.5})TiO₃ Material
System

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Electrocaloric Effect in Lead-free Relaxor $(1-x)(\text{Sr}_{0.7}\text{Bi}_{0.2})\text{TiO}_3+x(\text{Na}_{0.5}\text{Bi}_{0.5})\text{TiO}_3$ Material SystemJinglei Li^{1,2}, Xiaobo Zhao¹, Zhuo Xu², Tian Zhang¹, Xiaoshi Qian¹, Ying Hou¹, Lu Yang¹, Shujun Zhang^{3*}

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Abstract

The relationship between electrocaloric effect (ECE) and electrostrictive strain over a broad electric field was studied in $(1-x)(\text{Sr}_{0.7}\text{Bi}_{0.2})\text{TiO}_3+x(\text{Na}_{0.5}\text{Bi}_{0.5})\text{TiO}_3$ relaxor based lead-free ceramics, where the electric field induced strain can reach the level of 0.28% at 12 MV/m. The experimental data revealed that the composition with highest strain response also generated the largest ECE near room temperature, e.g., $\Delta S=3.6 \text{ J kg}^{-1} \text{ K}^{-1}$ and an adiabatic temperature change $\Delta T=2.4 \text{ K}$ at 13 MV/m. This research provides an effective approach for designing new ECE materials.

Keywords: Electrocaloric; Electrostrictive Strain; Relaxor; Lead-Free Ceramics.

1. Introduction

The electrocaloric effect (ECE) is the temperature/entropy change of a dielectric material caused by electric field induced polarization change, which has the promise of realizing solid-state cooling devices for a broad range of applications, such as on chip cooling and temperature regulation for sensors and electronic devices. Dielectrics with large ECE provide an alternative approach to the century-old vapor compression based refrigeration technologies, due to the advantages of miniaturization, high efficiency, and environmental friendly[1]. There are currently numerous candidates for ECE materials, but being restricted for practical applications due to the low ECE effect, as given in Table I.

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