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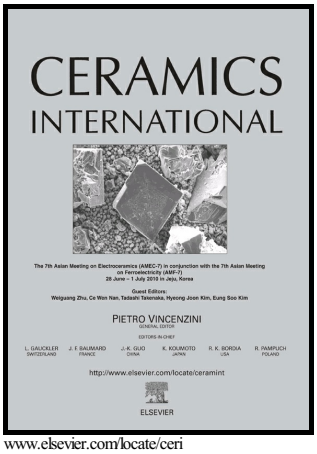

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Enhanced electromechanical properties of $CaZrO_3$-modified $(K_{0.5}Na_{0.5})NbO_3$-based lead-free ceramics

Zhe Kong[1], Wangfeng Bai[1*], Peng Zheng[1], Jingji Zhang[2],Fei wen[1], Daqin Chen[1*], Bo Shen[3], Jiwei Zhai[3]

[1]College of Materials and Environmental Engineering, Hangzhou Dianzi University, Hangzhou, 310018, China

[2]College of Materials Science and Engineering, China Jiliang University, Hangzhou, 310018, China

[3]Functional Materials Research Laboratory, School of Materials Science & Engineering, Tongji University, No. 4800 Caoan Highway, Shanghai 201804, China

bwfcxj@126.com
dqchen@hdu.edu.cn.
[*]Corresponding author.

Abstract

Pairing of large strain response and high d_{33} with high T_c in $(K_{0.5}Na_{0.5})NbO_3$-based materials is of high significance in practical applications for piezoelectric actuators. Here, we report remarkable enhancement in the electromechanical properties for $(1-x)(K_{0.52}Na_{0.48})(Nb_{0.95}Sb_{0.05})O_3$-$xCaZrO_3$ (KNNS-xCZ) lead-free ceramics through the construction of a rhombohedral (*R*)-tetragonal (*T*) phase boundary. We investigated the correlation between the composition-driven phase boundary and resulting ferroelectric, piezoelectric, and strain properties in KNNS-xCZ ceramics. The KNNS-xCZ ceramics with x=0.02 exhibited a large strain response of 0.23% while keeping a relatively large d_{33} of 237pC/N, which was mainly ascribed to the coexistence of *R* and *T* phases confirmed by the XRD and dielectric results. It was found that pairing of large strain response and high d_{33} in KNN-based materials was achieved. As a consequence, we believe that this study opens the possibility to achieve high-performance lead-free electromechanical compounds for piezoelectric actuators applications.

Keywords: Potassium-sodium niobate; Electromechanical properties; Multiphase coexistence; Lead-free ceramics; Strain response.