Title: Mechanism of significantly enhanced piezoelectric performance and stability in textured potassium-sodium niobate piezoelectric ceramics

Authors: Peng Li, Baihui Liu, Bo Shen, Jiwei Zhai, Yang Zhang, Feng Li, Xing Liu

PII: S0955-2219(17)30503-4
DOI: http://dx.doi.org/doi:10.1016/j.jeurceramsoc.2017.07.017
Reference: JECS 11374

To appear in: *Journal of the European Ceramic Society*

Received date: 15-5-2017
Revised date: 19-7-2017
Accepted date: 19-7-2017

Please cite this article as: Li Peng, Liu Baihui, Shen Bo, Zhai Jiwei, Zhang Yang, Li Feng, Liu Xing.Mechanism of significantly enhanced piezoelectric performance and stability in textured potassium-sodium niobate piezoelectric ceramics.*Journal of The European Ceramic Society* http://dx.doi.org/10.1016/j.jeurceramsoc.2017.07.017

Mechanism of significantly enhanced piezoelectric performance and stability in textured potassium-sodium niobate piezoelectric ceramics

Peng Li, Baihui Liu, Bo Shen,* Jiwei Zhai,* Yang Zhang, Feng Li, Xing Liu

Key Laboratory of Advanced Civil Engineering Materials of Ministry of Education, Functional Materials Research Laboratory, School of Materials Science and Engineering, Tongji University, Shanghai 201804, China

* Corresponding author. Tel.: + 021-69584759; fax: + 021-69584759.
E-mail address: shenbo@tongji.edu.cn (Bo Shen) and apzhai@tongji.edu.cn (Jiwei Zhai)

Abstract

In this study, the piezoelectric coefficient d_{33} and planar electromechanical coupling coefficient k_p were enhanced 145% and 71%, respectively for the <001>-textured $(K_{0.5}Na_{0.5})_{0.95}Li_{0.05}Nb_{0.93}Sb_{0.07}O_3$ piezoelectric ceramics compared with their randomly oriented counterpart. Significantly enhanced piezoelectric response in textured ceramics is originated from a combined effect of the intrinsic high piezoelectric activity of <001>-oriented grains in the tetragonal-orthorhombic phases, and easy polarization rotation of fine domains. Furthermore, a comparative analysis suggests that <001>-textured ceramics exhibit good thermal stability, benefiting from the weakened depolarization behavior via crystal orientation. The superior fatigue resistance in textured ceramics can be attributed to the reduced clamping effect as low defect density. These results show that high-performance textured ceramics reported in this work will be promising candidates in the field of lead-free piezoelectric materials.

Keywords: Potassium-Sodium Niobate; Texture; Piezoelectric response; Stability

1. Introduction

Piezoelectrics with the interconversion function between electrical and mechanical energy have been widely used in transducers, actuators, and sensors, etc[1-5]. Lead-based piezoelectric materials, especially PZT have always firmly occupied the dominant position in the piezoelectric market due to their excellent electromechanical performance[6]. However, the dumped electronic devices containing Pb are harmful to