

Accepted Manuscript

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PII: S0925-8388(17)34470-5

DOI: [10.1016/j.jallcom.2017.12.274](https://doi.org/10.1016/j.jallcom.2017.12.274)

Reference: JALCOM 44360

To appear in: *Journal of Alloys and Compounds*

Received Date: 25 August 2017

Revised Date: 8 November 2017

Accepted Date: 23 December 2017

Please cite this article as: X. Jia, J. Zhang, H. Xing, J. Wang, P. Zheng, F. Wen, Large electrostrain response in binary $\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3\text{-Ba}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ solid solution ceramics, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2017.12.274.

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Large electrostrain response in binary $\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3\text{-Ba}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ solid solution ceramicsXuanrui Jia¹, Jingji Zhang^{1,*}, Hongjie Xing¹, Jiangying Wang^{1,*}, Peng Zheng², Fei Wen²¹College of Materials Science and Engineering, China Jiliang University, Hangzhou 310018, China²College of Electronics and Information, Hangzhou Dianzi University, Hangzhou 310018, China

Abstract: A binary solid solution $(1-x)\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3\text{-}x\text{Ba}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ ($(1-x)\text{BNT-}x\text{BMN}$) was fabricated by the conventional solid state reaction, and compositionally dependent micro-structure and macro-electrical properties were systematically investigated. The BMN substitution was found to induce a transition from dominant ferroelectric to ergodic relaxor phase, resulting in the ferroelectric-to-relaxor phase transition temperature decreasing from 102°C to below room temperature. Accordingly, the optimal piezoelectric property of $d_{33}=122$ pC/N and the maximum strain of 0.35% with normalized strain of 493 pm/V were achieved at ambient temperature for the compositions with $x=0.044$ and 0.052, respectively. The piezoelectric and strain properties are dominated by the contributions from the irreversible domain switching and the recoverable ergodic-ferroelectric phase transition, respectively.

Keywords: $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$; phase transition; piezoelectric properties; electrostrain

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