



The 3rd China-Russia Workshop on Dielectric and Ferroelectric Materials



Hubei University
Wuhan, Hubei, China



The 3rd China-Russia Workshop on Dielectric and Ferroelectric Materials

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Sponsored by State Key Laboratory of Advanced Technology for Materials Synthesis and Processing (Wuhan University of Technology, China), International School of Materials Science and Engineering (Wuhan University of Technology, China), and Key Lab of Ferro & Piezoelectric Materials and Devices of Hubei Province (Hubei University, China), the 3rd China-Russia Workshop on Dielectric and Ferroelectric Materials will be held on Oct. 12-14, 2017 in Wuhan.

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Processing and characterization of lead-free ceramics on the base of sodium-bismuth titanate and sodium-potassium niobate

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Lead-free piezoelectric materials are among the most intensively studied in order to replace widely used Pb-based ones. In this work, effects of modification of compositions by various donor and acceptor dopants in the A- and B-sites of perovskite lattice and influence of nonstoichiometry on structure, dielectric and ferroelectric properties of ceramics from Morphotropic Phase Boundaries (MPB) in the $(\text{Na}_{1/2}\text{Bi}_{1/2})\text{TiO}_3$ - BaTiO_3 (NBT-BT) and $(\text{K}_{0.5}\text{Na}_{0.5})\text{NbO}_3$ - BaTiO_3 (KNN-BT) systems have been studied.

Ceramic samples were prepared by the two-step solid-state reaction method at high temperatures of 920 – 1500 K. The samples NBT-BT and KNN-BT were additionally modified by Ni^{2+} , Fe^{3+} , and Mn^{4+} cations. The samples were characterized by the X-ray Diffraction, Scanning Electron Microscopy, Second Harmonic Generation (SHG), Dielectric Spectroscopy and Piezoresponse Force Microscopy (PFM) methods.

Changes in the unit cell volume of the KNN- and NBT-based ceramics were observed depending on the A- and B-cation substitutions. Ferroelectric phase transitions marked by steps at ~ 300 - 400 K (NBT) and by peaks at ~ 550 K (NBT) and at ~700 K (KNN) were revealed in the dielectric permittivity versus temperature curves of the

compositions studied. Ferroelectric phase transitions near 300–400 K revealed typical relaxor-type behavior attributed to the presence of polar nanoregions in a nonpolar matrix.

Increase in the spontaneous polarization value was proved for modified ceramics using the SHG method. At the room temperature, non-monotonous changes of the dielectric parameters ε_{α} and $\tan\delta_{\alpha}$ and maximum effective d_{33} values were observed in modified BNT- and KNN-based compositions, thus confirming their prospects for new lead-free materials development.

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