BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE 21.-24. APRIL 2013 TARTU, ESTONIA

FUNCTIONAL MATERIALS AND NANOTECHNOLOGIES

UNIVERSITY OF TARTU
Institute of Physics
1632

FM&NT

Tartu 2013

Edited by: Toomas Plank, Rainer Pärna
Design: Vivian Klimušev

ISBN 978-9985-4-0744-8
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Tartu, 2013

Oral presentations

Dielectric relaxation in bismuth-containing ceramics

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Modification of composition is widely used for development of ceramic oxide materials with improved functional properties. However, effects of dielectric relaxation are often observed in compositionally disordered complex oxides. In this work dielectric properties of Bi -containing solid solutions on the base of perovskite-like compounds promising for the development of piezoelectric ceramics for high-temperature applications were studied.

Layered structure $Ca(Bi,Nd)_4(Ti,B)_4O_{15}$ (B - Cr, Ta – 10 at. %) and perovskite structure solid solutions $(Bi,Pb,A)(Sc,M)O_3$ (A – Nd – 10 at. %; M – Ti, Ga, Lu, Yb, Er, Y – 10 at. %) were prepared by the conventional solid state reaction method. The compositions were additionally modified by additives (Bi_2O_3, MnO_2, Ni_2O_3, Cr_2O_3, and LiF) in amounts less than 5 w. % in order to improve density of ceramics and their dielectric properties. Ceramics on the base of composition $0.36BiScO_3$ - $0.64PbTiO_3$ (BSPT) were modified by the powdered $Bi_4Ti_3O_{12}$ and $Bi_{0.75}Sr_{0.25}O_{1.36}$ single crystals additives (5 - 10 w. %) to stimulate the texture formation.

Structure parameters, phase transitions, dielectric and ferroelectric properties of ceramics were studied using the X-Ray diffraction and dielectric spectroscopy method, piezoelectric coefficients of some ceramics were measured as well.

The 1st order ferroelectric-paraelectric phase transitions were observed for all samples at temperatures 700 – 1000 K. Besides the dielectric anomalies corresponding to phase transitions, broad dielectric anomalies of relaxation nature were also revealed, with temperature position of peaks in dielectric permittivity curves depending on measuring frequency. These effects are pronounced in the samples obtained at higher sintering temperatures, so a microscopic mechanism of the relaxor behaviour may be related to the motion of dipoles formed by oxygen vacancies. Decrease of the total conductivity value to more than one order in modified samples sintered at lower temperatures supports this conclusion.

High values of piezoelectric coefficients d_{33} ~500 pC/N and of electromechanical coupling coefficient k_t ~0.50 were measured for some BSPT ceramics. The improvement of properties observed is obviously related to the optimization of crystal structure parameters and decrease of concentration of oxygen vacancies favoring to the enhancement of the domain walls movement and to improvement of piezoelectric properties.

The work was supported by the Russian Fund for Basic Research (Grant 12-03-00388).