TIP-INDUCED DOMAIN AND PHASE STRUCTURE TRANSFORMATION IN LEAD FREE BISMUTH FERRITE CERAMICS

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Searching of lead-free materials with the electromechanical characteristics comparable to lead zirconate titanate (PZT) is an actual topic during recent decades due to the increasing demands of ecology in production and recycling. One of the most promising materials is a lead-free multiferroic bismuth ferrite (BFO) possessing both high electromechanical performance and magneto-electric coupling [1]. BFO thin films doped by rare-earth elements (Sm, La, Pr) demonstrate enormously high piezoelectric coefficients near the morphotropic phase boundary (MPB) [2]. The local studies of domain and phase structure gives an understanding of the macroscopic ceramics properties.

We focus on Sm doped BFO ceramics with composition near the MPB synthesized by solid phase synthesis and with additional mechanochemical activation [2]. Analysis by X-ray diffraction and piezoresponse force microscopy showed that the ratio of the structural phases and its distribution depend on doping level. Ceramics synthesized by different methods had different phase distributions. Mechanochemical activation results to better phase mixing and the formation of complicated structural states, as well as to the motion of domain walls through the grain boundaries during polarization switching (Fig. 1) [3]. Local polarization switching experiments within individual grains were conducted by applying rectangular pulses with amplitude from 5 to 60 V, and duration from 10 ms to 100 s.

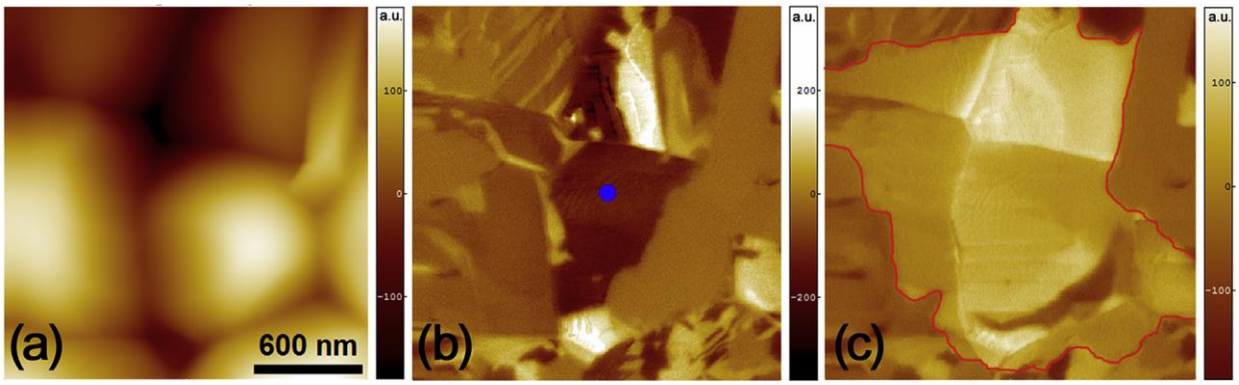

Fig. 1. Sm doped BFO ceramic with mechanochemical activation: a) topography; b) initial domain structure; c) domain structure after voltage pulse 40V, 60 s.

Local transformation to polar phase under the action of electric field applied by conductive tip was demonstrated. The induced phase relaxed partially in few minutes after the voltage switch-off and remained unchanged for more than 24 hours.

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КВАЗИРАСПРЕДЕЛЕННЫЙ ОПТОВОЛОКОННЫЙ ДАТЧИК С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ СПЕКТРАЛЬНОГО МУЛЬТИПЛЕКСИРОВАНИЯ

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THE WAVELENGHT-DIVISION MULTIPLEXING QUASIDISTRIBUTED FIBER-OPTIC SENSOR

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Annotation. The quasidistributed fiber-optic system using wavelength division multiplexing technology is developed. The sensing element is a segment of a multimode silica fiber coated with metal, separated spectrally selective elements, which are mainly offered to use dichroic mirrors. These studies determined: number of measuring sections (8), the maximal measured temperature (500°C), the measurement error (±0,2°C), and the optimum beginning time measurement after starting circulation (15 min), and counting time of the frequency meter (1 s).

Распределенные и квазираспределенные волоконно-оптические датчики (ВОД) температуры находят в настоящее время широкое применение в различных областях промышленности. В частности, такие датчики могут использоваться в нефтяной и газовой промышленности при добыче нефти как при стандартных условиях, так и при добыче высоковязкой нефти и плотного газа. ВОД используются для температурного контроля и мониторинга технологических процессов в скважинах, наблюдению за распределением перегретого пара (в случае добычи высоковязкой нефти), притока нефти и т. д. по всей длине добываю-