EVOLUTION OF THE POLARIZED STATE IN RHOMBOEDRICAL $0.74Pb(Mg_{1/3}Nb_{1/3})O_3–0.26PbTiO_3$ SINGLE CRYSTAL AT ELEVATED TEMPERATURE

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Single crystalline $0,74Pb(Mg_{1/3}Nb_{1/3})O_3–0,26PbTiO_3$ (PMN-xPT) exhibits classical ferroelectric behavior with PT content higher 30 % and typical relaxor behavior with PT below 30% [1]. At present, the use of relaxors in optoelectronics, nonlinear optics and piezoelectricity is of special interest, therefore, attempts are being made to create regular micron and submicron domain structures, as well as to search for methods of these structures stabilization [2]. The main advantage of PMN-xPT is the extremely high piezoelectric, electro-optical and non-linear optical coefficients. The main issue is that the relaxor behavior hampered significantly creation of single domain state which could maximize the dielectric and piezoelectric response and make possible realizing of the domain engineering in the material.

This research is devoted to study of the polarized state temporal and temperature evolution in PMN-26PT single crystals at the nanoscale. We used piezoresponse force microscopy (PFM) approach for the local polarization of the area by scanning probe microscopy tip and visualization of the created domain pattern degradation coupled with relaxation of the surface potential localized at the domain walls. Surprisingly we found essentially stable macroscopic response in whole temperature range up to Curie temperature while local studies revealed rapid relaxation (Figure 1). The change of the surface potential with temperature we attributed to the rhomboedrical-tetragonal phase transition corresponding to the appearance of the relaxor state with character non-polar regions. We observed the relaxation of the surface potential at different temperatures and found that the rate of surface charge relaxation depends on the temperature, namely, the higher temperature leads to the faster the relaxation of the potential. The surface potential relaxation is discussed in

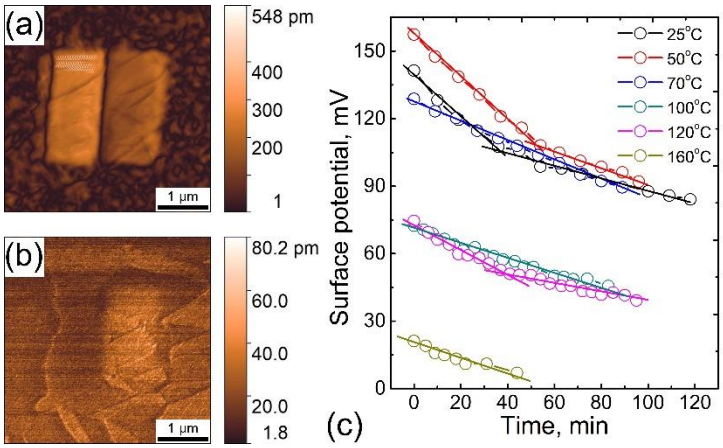

Fig. 1. Polarized state produced in PMN-26PT by local bipolar poling of a sqare region (-20 V / 20 V) at the (a) room temperature (25 °C) and b) elevated temperature (160 °C), c) surface potential temporal evolution at different temperature.

terms of residual depolarization field screening while PFM pattern degradation we explained as back switching. Obtained results give further insight in stabilization of polarized states in relaxor ferroelectrics.

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ТЕМПЕРАТУРНОЕ ТУШЕНИЕ ФОТОЛЮМИЕСЦЕНЦИИ УГЛЕРОД-КИСЛОРОДНЫХ КОМПЛЕКСОВ В ГЕКСАГОНАЛЬНОМ НИТРИДЕ БОРА

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PHOTOLUMESCENCE THERMAL QUENCHING OF CARBON-OXYGEN COMPLEXES IN HEXAGONAL BORON NITRIDE

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Photoluminescence quenching curves were measured in 3.9 eV band and 7 – 1100 K range under inter-band and direct excitation of carbon-oxygen complexes in h-BN micropowder. It is shown that sample under study is synthesized under the conditions of nitrogen lack, and total concentration of C and O impurities is < 3.5 at. %. Quenching activation energies are determined in the frame of the Mott ratio. Band diagram is proposed for carbon-oxygen defects in h-BN.

Гексагональный нитрид бора (h-BN) или белый графит обладает уникальным набором электрофизических свойств, что делает его перспективным материалом для создания Ван-дер-Вальсовых гетероструктур для целей оптоэлектроники и нанофотоники. Известно, что энергетическая щель h-BN варьируется в диапазоне 3.6 – 7.1 эВ и зависит от способа синтеза, примесного состава и др. При наличии неконтролируемых примесей углерода и кислорода возникает яркое однофотонное УФ излучение точечных дефектов по донорно-акцепторному механизму. Указанное свечение имеет бесфононную линию ≈ 4.1 эВ с кинетикой затухания ≈ 1 нс и характеризуется вибронной структурой с энергией фононов 0.17 – 0.18 эВ. В то же время имеется недостаточно данных о температурных зависимостях данной люминесценции. В этой связи цель работы заключалась в исследовании особенностей процессов температурного тушения флуо-