

Repolarization of ferroelectric superlattices BaZrO₃/BaTiO₃

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Using the modified Sawyer-Tower scheme and the Mertz technique the repolarization properties of ferroelectric barium zirconate/barium titanate superlattices BaZrO₃/BaTiO₃ on a single-crystal magnesium oxide MgO substrate were investigated.

Experimental studies of switching currents have shown that switching processes in synthesized superlattices are carried out in two stages - activation motion ("creep" mode) and nonactivation (slip mode). The presence of an activation switching stage means that with high probability switching processes in the investigated superlattice are realized by the motion of domain walls. The threshold field separating creep and slip stages decreases with increasing temperature when approaching the Curie point of the superlattice similar to the coercive field. The activation mode of motion revealed in the work that does not obeying the strictly exponential dependence on the field strength was modeled by the dependence with a critical exponent for the applied electric field. The angle of slope in the field dependence of the switching current in the linear region decreases with increasing of the temperature, which may be due to a decrease in the polarization as the phase transition temperature approaches the nonpolar state in the lattice. Both used methods show that the investigated superlattices have a small internal bias field directed from the superlattice to the substrate. To explain the direction of the internal biasing field obtained in the researched structures, one can use the representations of the flexoelectric effect.

To use superlattices in dynamic memory devices, it is necessary to know the characteristics of switching in strong fields, which is determined by the velocity or mobility of the domain walls. For the region of strong fields, the mobility of the domain walls at various temperatures was calculated on the basis of the switching time. As the temperature increases, the switching time grows, which means a decrease in the mobility of the domain walls associated with a critical deceleration of the polarization relaxation near the Curie point.

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