

Field Induced Evolution of Nanoscale Structures in Relaxor (5-12)/65/35 PLZT Ceramics

Vladimir Shur, Gennady Lomakin, Oksana Yakutova, Andris Sternberg, Andris Krumins,
Marija Kosec

Jozef Stefan Institute - SLOVENIA

Abstract

The field-induced reconstruction of the nanoscale domain structures and hetero-phase structure composed of multi-domain micro-clusters in nonpolar matrix were studied by original analysis of the switching current data recorded during application of the sequence of field pulses in X/65/35 PLZT ceramics. The parameters characterizing the evolution of the nano-scale structures have been extracted in wide temperature range. The significant role of the charged domain walls (CDW) in the frequency dependence of the dielectric properties has been revealed.

We investigated the plates of coarse-grained hot-pressed (5-12)/65/35 PLZT ceramics with ITO electrodes. The switching current data were recorded under application of the sequence of rectangular and triangular unipolar and bipolar field pulses in wide range of temperature and field amplitude.

We studied in details the anomalous behavior of the switching characteristics observed for all compositions under investigation within the temperature range in vicinity of the freezing temperature T_f of between T_m and, so as slightly below T_f .

The original approach used for mathematical treatment of the switching current data recorded in increasing field allows us to extract the distribution function of the local threshold fields. The temperature dependence of the distribution function parameters has been revealed. Analysis of the switching current data recorded in relaxor phase allows us to determine the activation field for switching of the nano-scale multi-domain structure.

The dependence of T_f and the maximum of dielectric permittivity T_m on the La concentration allows to reveal $T_m - T_f$, which is proportional to the temperature range of relaxor phase existence for all investigated compositions thus specifying the phase diagram for X/65/35 PLZT.

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