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Field induced metastable ferroelectric phase in $Pb_{0.97}La_{0.03}(Zr_{0.90}Ti_{0.10})_{0.9925}O_3$ ceramics

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Abstract

$Pb_{0.97}La_{0.03}(Zr_{0.9}Ti_{0.1})_{0.9925}O_3$ (PLZT 3/90/10) ceramics prepared by solid-state reaction with the compositions near the antiferroelectric/ferroelectric (FE/AFE) phase boundary were studied. From the polarization–electric field *P(E)* dependence and *ex situ* X-ray study, an irreversible electric field induced AFE-to-FE phase transition is verified at room temperature. Dielectric and *in situ* temperature dependent X-ray analysis evidence that the phase transition sequence in PLZT 3/90/10-based ceramics can be readily altered by poling. A first order antiferroelectric-paraelectric (AFE-PE) transition occurred at~190°C in virgin sample and at~180°C in poled sample. In addition, a FE-to-AFE transition occurs in the poled ceramic at much lower temperatures (~120°C) with respect to the Curie range (~190°C). The temperature-induced FE-to-AFE transition is diffuse and takes place in a broad temperature range of 72-135°C. The recovery of AFE is accompanied by an enhancement in the piezoelectric properties.