Dielectric Glassy Behaviour of Cd2Nb2O7 Based Electroceramics under a Weak Bias Electric Field

Nadezda N. Kolpakova, Piotr Czarnecki, Pavel P. Syrnikov, Andrei O. Lebedev, Ludoslawa Szczepanska

Institute of Molecular Physics PAS - Poland

Abstract

The cadmium niobate, Cd2Nb2O7 (CN), pyrochlore electroceramics is the first example of the materials that exhibit simultaneously the normal and relaxor ferroelectric (FE) behaviour [1,2]. Understanding the nature of disordered relaxor state as well as the mechanism of the transition from a relaxor to a glassy or ferroelectric state are the basic questions for physics of relaxor FE and for application of the electroceramics. We report on the dielectric dispersion (100 Hz to 13 MHz) and spontaneous polarization study both of pure CN and that modified with V, Mn, Fe, Ni, Cu or Zn on the Cd-site (at x= 0.1, 0.2 or 0.5) in a weak bias electric field over the range of 10 to 300 K. In addition to the conventional FE relaxation at Tcurie=196 K, non-Arrhenius and non-Debye dielectric relaxation around 190 K is typical of a relaxor FE with glassy behaviour, with Tfreez=183 K. Below 150 K, the features are typical of the dipolar glass-forming systems in the ergodic state far above Tglass=20 K. Parameter q(T) characterizing a deviation of ε(T) from Curie-Weiss behaviour in relaxors and δε(T)= [εhis – εZFC] are estimated for various thermal and electrical histories and analyzed in view of glassy behaviour of the relaxor CN. A mechanism explaining the developing of a sequence of disordered states in the system is proposed. Characteristic features in dielectric relaxation of the RF with pyrochlore (Oh7-Fd3m) and perovskite (Oh1-Pm3m) structure are briefly reviewed. The financial support from RFFI (Russia), Grant 0402-16126 and KBN (Poland), Project 2P03B04722 is acknowledged. 1. N.N.Kolpakova, P.Czarnecki et al., J. Exper. Theor. Phys. 94, 395 (2002). 2. N.N.Kolpakova, P.P.Syrnikov et al., J. Appl. Phys. 90, 6332 (2001).