Ferroelectric - Antiferroelectric Phase Transition in LiO.12NaO.88TayNb1-yO3 Ceramics

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Abstract

FERROELECTRIC - ANTIFERROELECTRIC PHASE TRANSITION IN Li0.12Na0.88TayNb1-yO3 CERAMICS N. Sidorov1, K. Bormanis2, A. Sternberg2, M. Palatnikov1, N. Golubjatnik1, and I. Birjukova1 1 Institute of Chemistry, Kola Science Centre RAS, Apatity, Murmansk Region, Russia 2 Institute of Solid State Physics, University of Latvia, Riga, Latvia

The Li0.12Na0.88TayNb1-yO3 system of solid solutions is for the first time shown to be characterized by the ferroelectric type of dipole ordering in the concentration range у=00.8, and to act as an antiferroelectric at y ¿ 0.8. Raman studies of the ferroelectric to antiferroelectric phase transition in sodium niobate perovskite solid solutions Li0.12Na0.88Ta0.4Nb0.6O3 and Li0.12Na0.88Ta0.2Nb0.8O3 are presented. As the temperature is increased, essential broadening of the 0-400 cm-1 Raman bands related to cation vibrations within ВО6 octahedrons and АО12 polyhedrons is observed along with broadening of the 550-900 cm-1 bands related to vibrations of oxygen octahedrons ВО6 (A=Li,Na; В=Nb,Ta). The changes suggest of a considerable structural disordering taking place. The change of vibration frequencies is monotonous over the whole range of temperatures and does not show any phase transition discontinuity. Frequency of the 875 cm-1 B-O-B stretching band of the octahedral ВО6 anions remains practically constant as the temperature raises. The ferroelectric - antiferroelectric phase transition is manifested in the Raman spectrum by decrease to zero of the intensity of this band forbidden in Raman scattering of centro-symmetric anion octahedrons ВО6. An anomaly consisting of a very broad explicit maximum on the intensity vs. temperature curve of the oxygen stretch band and vibration bands of the ВО6 octahedrons is revealed in Li0.12Na0.88Ta0.4Nb0.6O3 solid solutions in the 60-100 С range. Similar but essentially narrower maximums are observed in Li0.12Na0.88Ta0.2Nb0.8O3 solid solutions within the same range of temperatures.