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Terahertz and infrared studies of antiferroelectric phase transition in multiferroic Bi(0.85)Nd(0.15)FeO(3)

Source

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Abstract

High-frequency dielectric studies of Bi(0.85)Nd(0.15)FeO(3) ceramics performed betweeen 100 and 900 K reveal hardening of most polar phonons on cooling below antiferroelectric phase transition, which occurs near 600 K. Moreover, a strong THz dielectric relaxation is seen in paraelectric phase. Its relaxation frequency softens on cooling towards T(C) approximate to 600 K, its dielectric strength simultaneously decreases, and finally the relaxation disappears from the spectra below 450 K. Both phonon and dielectric relaxation behavior are responsible for a decrease in the dielectric permittivity at the antiferroelectric phase transition. Origin of unusual strong THz dielectric relaxation in paraelectric phase is discussed. Bi(0.85)Nd(0.15)FeO(3) structure lies on the phase boundary between polar rhombohedral and non-polar orthorhombic phase and owing to this, the polarization rotation and polarization extension can enhance the piezoelectric response of this system. Similarities and discrepancies with lead-based piezoelectric perovskites, exhibiting morphotrophic phase boundary between two ferroelectric phases, are discussed. (C) 2011 American Institute of Physics.