

Experimental researches of phase transitions in ceramics on the basis of titanat-barium-strontium

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Application of piezoelectric crystal in acoustics demands special attention to their nonlinear properties. In these crystals besides elastic nonlinearity it is necessary to consider piezoelectric nonlinearity and electrostriction. Nonlinear acoustics effects in piezoelectric crystals are very interesting, in particular near temperature of phase transition. In a vicinity of phase transition the crystal lattice is labile, strong anharmonicity of a phonon-phonon and a photon-phonon interactions are observed [1, 2]. In some solid state and liquid substances at certain external influences the phase transformations without change of a physical state take place. For example, following phase transformations: from a ferroelectric material to a paraelectric, from a dielectric to a metal, from a paramagnetic to a ferromagnetic. In vicinities of phase transformations the structure of substance appears extremely pliable to external influences: thermal, electric, magnetic or mechanical, and even small changes of their values near to phase transition, cause considerable changes of electric, optical, structural and other properties of substances. Phase transitions in a same dielectric and semiconductors are accompanied by their essential restructuring of electronic, phonon, dipole and magnon subsystems. Researches of nonlinear interaction of volume acoustic waves and rotating electric field carried out by us [3,4] are related with the same problems, one of which is phase transitions in a ferroelectric material. For example, widely used in acoustoelectronics barium titanate is centrosymmetric state (class $m3m$) at a temperature above the Curie temperature. If the temperature is below the transition temperature, the crystal structure corresponds to the class $4mm$ with a tetragonal symmetry [5]. Thus, on the basis of described method and with various samples piezoelectric ceramics it is possible to investigate the acoustic anisotropy formed by rotating electric field at the temperatures below the 50°C .

References

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