Dielectric, piezoelectric and elastic properties of quasione-dimensional $Cs(H_{1-x}D_x)_2PO_4$ ferroelectrics

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Within the framework of the proposed modified proton ordering model for quasione-dimentional CsH_2PO_4 type ferroelectrics with hydrogen bonds, that takes into account linear over strains ε_6 and ε_4 contributions to the proton subsystem energy, and using a four-particle cluster approximation with taking into account short-range and long-range interactions between protons on short hydrogen bonds we have calculated and studied spontaneous polarization, longitudinal static dielectric permittivities of mechanically free and clamped crystals, coefficients and constants of piezoelectric strain and stress, and also elastic constants of these crystals.

Dynamic characteristics of the crystals are explored within a nonequilibrium statistical operator method with taking into account dynamics of strains via Newtonian equations of motion. In the case of frequency-independent kinetic parameters these results are shown to be agreement with those obtained by us in the frames of Glauber method.

A thorough numerical analysis of the obtained results is performed. Phenomena of piezoelectric resonance in some frequency region in the low-temperature phase is described. It is shown, that at proper set of the model parameters it is proper description of experimental data for thermodynamic and dynamic characteristics of $Cs(H_{1-x}D_x)_2PO_4$ ferroelectrics.