Effect of hydrostatic pressure and longitudinal electric field on dielectric properties of CDP ferroelectric

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The phase transition in the CsH_2PO_4 (CDP) crystal is caused by proton ordering on the hydrogen bonds. To study its dielectric properties we use the proton ordering model, which takes into account piezoelectric coupling of the proton subsystem with lattice strains ε_1, ε_2, ε_3 and ε_5. Within the two-particle cluster approximation we have calculated the dielectric characteristics of CDP under hydrostatic pressure and longitudinal electric field E_y.

Application of the hydrostatic pressure in the absence of the field leads to decreasing of the phase transition temperature T_c from the paraelectric to the ferroelectric phase. At the pressures higher than some critical one p_k there appears the phase transition from the paraelectric to the antiferroelectric phase at the temperature T_N, which also decreases with pressure. A satisfactory quantitative description of the experimental data is obtained.

The electric field E_y, which is applied additionally to the hydrostatic pressure, smears the ferroelectric phase transition, decreases the temperature T_N, increases the critical pressure p_k and longitudinal dielectric permittivity ε_{yy} in the antiferroelectric phase.