Two Sub-lattice Model of Ferroelectric Phase Transitions

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Dielectric properties of two non-equivalent sublattice polarizations are studied. This model offers two qualitatively new features of ferroelectric transitions:

1) If the coupling between sublattices is strong, then the Curie-Weiss constant is drastically reduced and simultaneously the change of sign of the spontaneous polarizations P_s can be easily acheived by a small variation of crystal parameters with temperature. In general, the model is useful for explaining very small value of the Curie-Weiss constant in several ferroelectrics with no doubling of the unit cell volume, i. e., it has the same advantage as the Kobayashi theory. The model of two sublattices, however, has at present a better physical background (at least in ammonium sulfate) and moreover it is able in a simple way to explain the tendency of changing the sign of P_s observed also in dicalsium strontium and lead propionate. (DSP, DLP).

2) The model contains also a possibility for an isomorphous phase transition (with no change of symmetry) between two ferroelectric phases. Such transitions were observed both in DSP and DLP. Interesting dielectric anomaly under critical pressure at which the difference between two ferroelectric phases disappears was experimentally and theoretically studied first by Gesi. We shall improve his theory but obtain essentially the same classical critical index for dielectric constant under critical pressure, $-2/3$. The similarity with the dielectric behavior at the first order ferroelectric phase transition under static electric field is discussed.