The non-isotropic character of electric and dielectric properties of ammonium zinc chloride crystal

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Abstract:

The dielectric constant, $\varepsilon$, and the d.c. conductivity, $\sigma$, were measured along the a-, b- and c-axes of (NH$_4$)$_2$ZnCl$_4$ (AZC) crystal in the 300–450 K temperature range. Crystals of AZC grown from aqueous solutions containing excess of ZnCl$_2$ were used. The value of the dielectric permittivity of AZC is extremely small compared to other ferroelectric crystals. Pronounced broad or step-like peaks at the phase transition temperatures were detected along the a- and b-axes, while along the c-axis is temperature independent up to the end of the measuring range. Reciprocal of the dielectric permittivity in the range of the commensurate to incommensurate phase transition obeys a relation similar to the Curie–Weiss law that is valid for second order ferroelectric/paraelectric phase transitions. The constants of the proposed relationship applied to the cooling run are given. The J–E characteristics along the three crystallographic axes were measured in the normal, commensurate and antiferroelectric phases. Hence, the type of conduction mechanism has been estimated. Parameters of Poole–Frenkel and Richardson–Schottky types of conduction mechanism have been determined. The effect of applied electric field on the conductivity measurement was also tested. Conductivity anomalies with different character were observed at the phase transition temperatures. The ln $\sigma$ vs 1000/T dependence revealed thermal activation energy of conduction along the a-, b- and c-axes with different values in different phases of AZC.

Keywords:

D. Electrical properties; D. Dielectric properties

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