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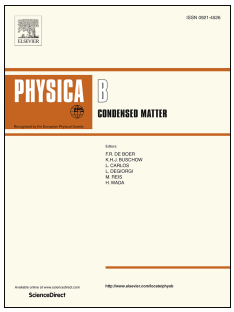

Synergic nature of dielectric relaxation process in the layered perovskite halide salts: The case of 1,3- diammoniumpropylenetetrabromocadmate compound

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Synergic nature of dielectric relaxation process in the layered perovskite halide salts: the case of 1,3- diammoniumpropylenetetrabromocadmate compound

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Abstract

The negative thermal expansion (NTE) property was a prototype to discuss the origin of difference between classical Debye relaxation process and the non-Debye behavior in the layered perovskite halide salt of chemical formula $NH_3(CH_2)_3NH_3CdBr_4$. The analysis has been taken by dielectric relaxation spectroscopy measurements in almost six decades in frequency $5\times10^2 \leq f(\omega) \leq 1.2\times10^8$ and in the temperature range $315 \leq T(\mathrm{K}) \leq 390$. It was shown that the investigated sample exhibit an antiferrodistortive nature of phase transition between two orthorhombic structural modifications *i.e. Pnma* (phase I) and *Ima2* (phase II) at $T_{c_1(I\rightarrow II)}$ = 326 K, leading from an antiferroelectric to a paraelectric phase. The involvement of an odd number of carbon atoms in the alkylammonium chains in dielectric properties of examined sample is proved. Higher structural modifications, *i.e. Ima2* (phase II) and $P2_1/m$ (phase III), have shown significant deviations from a regular circle on the Cole-Cole diagram. Presented experimental observations are essentially important for the theoretical explanation of relaxation processes in analyzed organic – inorganic compound crystallizing in a perovskite-like topology and may provide new perspective on the fundamental aspect of relaxation response in "diammonium" series.

Keywords: Organic – inorganic compounds; Perovskite halide salts; Dielectric spectroscopy; Negative thermal expansion (NTE) property; An antiferrodistortive phase transitions.

1. Introduction

At the forefront of research in perovskite-like materials is the empirical search for their new unusual physical properties and functionalities. An exceptional diversity dictated by their structural (chemical) flexibility and synergic nature of organic – inorganic compounds crystallizing in a perovskite-like topology allows one to create different crystal structures and thus optimizes their physical properties [1-3].

In this paper we pay a great attention to the member of one of families of compounds crystallizing in the perovskite architecture, i.e. "diammonium" series forming two-dimensional (2D) or equivalently bidimensional,