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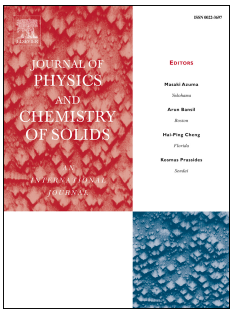

Structure, thermal, and impedance study of a new organic–inorganic hybrid $[(CH_2)_7(NH_3)_2]CoCl_4$

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Structure, thermal, and impedance study of a new organic–inorganic hybrid $[(CH_2)_7(NH_3)_2]CoCl_4$

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Abstract

$[(CH_2)_7(NH_3)_2]CoCl_4$ crystallizes in the triclinic system, space group P-1 with two molecules per asymmetric unit cell (Z = 2). The unit cell dimensions are a = 7.3107 (2) Å, b = 10.1841 (3) Å, c = 11.2690 (4) Å, α = 66.81(2), β = 78.85 (12), and γ= 87.66(2). The unit cell volume and the calculated density are 756.11 (4) $Å^3$ and 1.463 Mg m^{-3}, respectively. The structure of the hybrid is characterized by alternating layers of inorganic $[CoCl_4]^{2-}$ anion and heptane diammonium cation. The organic hydrocarbon layers are packed in a stacked herring-bone manner with hydrogen bonds to the halide ions. The lattice potential energy U_{pot} and the cation molecular volume V^+ are 1856.2 kJ/mol and 0.37 nm^3, respectively. DSC showed a compound (broad) peak at T_1 =331 K, T_2 =328 K with total entropy ΔS = 36.2 J/K. mol, and a λ-like endothermic peak at T_3 = 296 K (ΔS = 24.9 J/K. mol). Dielectric properties are investigated at different temperatures and frequencies [260 K < T < 360 K and 0.06 kHz < f < 60 kHz, respectively]. Super-linear power law is observed for the AC conductivity, which is analyzed based on the jump relaxation model.

Key words: Conductivity; Dielectric constant; Phase transition; X-ray crystal structure.

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