

Multifunctional characterization of a Bis(1-(2-pyrimidyl)piperazinium) tetrachlorozincate hybrid: Unusual dielectric relaxation, thermal analysis, antibacterial efficacy, and intermolecular contacts

Autorzy

Wijdene Nbili

Mariem Midani

Vinayakaprasanna N. Hegde

Maciej Wojtaś

Werner Kaminsky

Christian Jelsch

Chérif Ben Nasr

Kamel Kaabi

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A novel organic-inorganic hybrid, (HPYPI)₂[ZnCl₄] (where HPYPI = 1-(2-pyrimidyl)piperazinium), was synthesized and characterized. The crystal structure features a layered arrangement stabilized by hydrogen bonding and π - π stacking. Dielectric studies reveal a high dielectric constant (~ 5000) at low temperatures and unusual non-monotonic thermal behavior in impedance and conductivity, attributed to trapping and thermal release of charge carriers. Thermal analysis shows stability up to 480 K. The compound also exhibits dose-dependent antibacterial activity, particularly against *Staphylococcus aureus*. Hirshfeld surface analysis highlights dominant Cl⁻...H interactions and electrostatic complementarity guiding the supramolecular assembly.

Słowa kluczowe

Organic-inorganic hybrid, Dielectric relaxation, Charge carrier trapping, Non-monotonic conductivity, Thermal analysis, Antibacterial activity

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