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Electrical characterization, phase transition and vibrational spectroscopic investigations of a new organic-inorganic material (C₇H₁₀NO)SnCl₃

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ABSTRACT

The X-ray powder analysis, thermogravimetric analysis, differential scanning calorimetry analysis, solid CP-MAS ¹³C NMR characterization, vibrational spectroscopy and complex impedance spectroscopic data have been carried out on (C₇H₁₀NO)SnCl₃ compound. The results show that this compound exhibits a phase transition at 314K which was characterized by ¹HNMR between 298 and 336 K, differential scanning calorimetry (DSC), X-rays powder diffraction, Raman spectroscopy and dielectric measurements. The temperature dependence of the ¹HNMR spectrum for (C₇H₁₀NO)SnCl₃ could be explained by invoking reorientation of ammonium group of the 2-methoxyanilinium cation. The most important changes are observed for two lines at 3087cm⁻¹ and 3175cm⁻¹ (at room temperature) issued from asymmetric and symmetric stretching vibrations of ν_s(NH₃) and ν_{as}(NH₃) band, respectively. AC and DC conductivities, complex dielectric permittivity ε*(ω) and complex electrical modulus M*(ω) were respectively studied as temperature and frequency functions. Moreover, the temperature dependence of the DC conductivity and relaxation frequency followed the Arrhenius relation. The frequency dependence of the real part of the AC conductivity in both phases follows the Jonscher's universal dynamic law: σ_{Tot.}(ω,T)=σ_{DC}(T)+B(T) ω^{S(T)}. The close values of activation energies, obtained from the thermal behavior of the conductivity and the relaxation time confirm that the transport is through ion-hopping mechanism.

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