Conductivity and Permittivity Studies in the Diluted Perovskite System $[(NH_3)(CH_2)_6(NH_3)]Fe_xZn_{1-x}Cl_4$, $x = 1$, 0.8, 0.5, and 0

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Z. Naturforsch. **57a**, 897 – 908 (2002); received May 21, 2001

The dielectric permittivity and AC conductivity of the perovskite-like system $[(NH_3)(CH_2)_6(NH_3)]Fe_xZn_{1-x}Cl_4$ ($HDAF_xZ_{1-x}$), where $x = 1$, 0.8, 0.5 and 0, were measured at different frequencies in the temperature range $100\ K < T < 430\ K$. At temperatures below 273 K, for $x = 1$ the material exhibits a transition at (245 ± 1) K, while for $x = 0$ transitions at (155 ± 5) K, (220 ± 4) K and (255 ± 2) K were found. A rotational-type transition in the range 295 – 305 K was found for the Fe-containing materials. Ferroelectric transitions were observed in the high temperature region for all four concentrations. Differential thermal scanning confirmed the existence of the phase transitions above room temperature. The conductivity decreases with Zn addition, an the conduction mechanism varies with the temperature and concentration. Extrinsic conduction prevails for $T < 150$ K for all concentrations. At intermediate temperatures an Arrhenius relation with frequency dependent activation energy ($\Delta E = 0.46 - 0.06$ eV) is observed for Fe-containing materials. The frequency dependent conductivity for all materials has a linear response following the power law: $\sigma_{ac} = A(T) \cdot \omega^{S(T)}$ with the exponent s varying with temperature and composition. At high temperatures, for Zn-rich materials series type conduction with $s \sim 0.6 \pm 0.1$ is identified, while for Fe-rich materials band type conduction prevails. In the low temperature region ionic hopping prevails.

Key words: AC Conductivity; Permittivity Studies; Structure Transitions in Layered Systems.