Dielectric properties of $Co(CO_3)(H_2O)_2(C_3H_4N_2)_2$ and $[Co(C_3H_3N_2)_2]_n$.

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Streszczenie

We have investigated the dielectric permittivity (ε', ε") of Co(CO3)(H2O)2(C3H4N2)2 and two samples of [Co(C3H3N2)2]n at low frequencies (0.1 – 1000 kHz) and in the temperature range 80 - 400 K. For the studied materials, a diffuse peak in the real part ε'(T) of the dielectric permittivity is observed at Tmax ≈ 315 K. A detailed analysis of the data of [Co(C3H3N2)2]n revealed that the temperature dependence of ε'(T) deviates from Curie-Weiss law below (Tmax + 15 K), showing a (T-Tmax)-2 dependence. A clear dielectric dispersion occurs above Tf ≈ 287 K and it is characterized by a distribution of relaxation times according to the Kohlrausch-Williams-Watts formula. The temperature and frequency dependence of the loss tangent (tanδ)max can be described by the Vogel-Fulcher law, indicating thermal slowing down of non-Debye dynamics. We attribute the observed dielectric properties to a relaxor ferroelectric behaviour, which is caused by the development of a freezing state below Tf. We have analysed the electrical conductivity using the Jonscher formula σ(ω) = σdc + Aωs. The obtained results may be explained with the model, where the dc-conductivity is governed by thermally activated electrons and ac-conductivity due to the tunnelling of the overlapping large polarons. A large value of the dielectric permittivity ε' is found for samples absorbing the moisture from the air and the phenomenon has been associated to a cooperation between the H+ and HCO3- ions and the others in the relaxation process. Due to a moisture absorption property of [Co(C3H3N2)2]n, we suggest that this material is a potential candidate for a low cost room-temperature humidity sensor.

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