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The dynamic crossover in dielectric relaxation behavior of ice Ih

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Abstract

© the Owner Societies 2015. The main mechanism of the dielectric relaxation process of ordinary hexagonal ice (ice Ih) and its temperature dependence remains unclear. The most interesting and as yet unexplained feature of ice is the presence of the dynamical crossover in relaxation time behavior around Tc = 230 ± 3 K. Since there are no phase transitions in the ice at this temperature (first or second order), we cannot correlate the origin of this crossover with any structural change. Here we present a model according to which the temperature of the crossover is defined by the polarization mechanism. The dielectric relaxation driven by the diffusion of L-D orientational Bjerrum defects (at high temperature, T > Tc) is transformed into a dielectric relaxation dominated by the diffusion of intrinsic ionic H3O+/OH- defects (at low temperature, T < Tc). In the framework of the model, we propose an analytical equation for the complex dielectric permittivity that takes into account the contribution of both types of defects.

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