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On the universal scaling of dielectric response

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We present a new scaling relationship accounting for relaxation processes of both real and imaginary parts of the complex dielectric permittivity data in wide temperature range of various dielectric substances (liquid crystals, neoalcohols, liquid glass-formers). It has been successfully used for experimental data related to various dynamics in liquid (IL, N, Ch, SmA) and solid (SmB, Cr, ODIC) phases in soft matter substances (for example see Figure below). Additionally, the scaling was checked for theoretical data of Dissado-Hill cluster model [1]. Scaling procedures proposed earlier by Nagel and co-workers [2-4] and then by Dendzik et al. [5] were restricted to imaginary part of dielectric permittivity only [2-5]. Our scaling procedure points to conclusions that the Debye model and Debye-like stochastic models reproduce experimental data of permittivity in narrow range of frequency. Additionally, we have found that the Dissado-Hill cluster model fulfils well the imaginary part of dielectric permittivity only, and this model does not reproduce fully the experimental data of real part as was believed.

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