**Effect of temperature on dielectric relaxation processes in nanoparticle suspensions**

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As is known, polarization and dielectric losses are determined by the structure of the polymer and the features of the thermal motion of macromolecules. About the type of conductivity of polymer dielectrics is judged, as a rule, by indirect data due to small values of their concentration. This significantly limits information about the mechanism of conductivity of polymers. The properties of a dielectric in a sinusoidal electric field are described by the complex dielectric constant, which takes into account the loss factor, and the circular frequency [1, 2]. In this work a model for calculating the temperature dependence (T = 0÷50 °C) of the dielectric relaxation of water molecules in the centimeter wavelength range (f = 9 HHz; λ = 3.0 ± 0.2 cm) for the ultra-dispersed diamonds (UDD). This material has a cluster structure, includes an inert core, represented by sp3-hybridized carbon atoms, and a functionalized surface layer, characterized by the presence of certain functional groups on the cluster surface: -OH, –NH2, –CH2OH, -CO (NH2). These groups provide a high antioxidant activity of this material, which was estimated by the method of microwave dielectrometry of the resonator type [3]. From our theoretical calculations, it follows that UDDs have a great potential for polarization in electric fields. The behavior of the temperature dependence of dielectric permittivity (ε′) and the tangent of the dielectric loss angle (tgδ), obtained experimentally, indicate the presence of relaxation processes in the structures. It was revealed that during hydration, UDD intensively adsorb moisture, which is accompanied by a significant increase in the dielectric polarization of the samples. Desorption of water molecules under room conditions occurs rather slowly. UDD particles form near-surface water layers at the grain boundaries and the water phase. The presence of such layers can lead to a low-frequency dispersion of the interlayer Maxwell – Wagner polarization, which can be an additional source of information about the nature of the distribution and relaxation of charges in the samples under study. The electric field of the UDD active surface forms a new phase of the structure formation of water between the free water layer and the active surface of the UDD grains. The structured layer is a potential barrier for free water molecules and for molecules oriented by the UDD active surface electric field. It can be concluded that the interfacial region is the most durable impermeable layer capable of increasing the electrical and mechanical characteristics of the structures under consideration. Our agreement with the results of other methods indicates the legitimacy of using the Debye theory to describe the dielectric relaxation of water molecules in UDD suspensions. The proposed computational model for the temperature dependences of the dielectric relaxation of water molecules ensures the accuracy of agreement with experimental data up to 76%.

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