The Behavior of the Hypersonic Velocity in an Aqueous Solution of Gamma-Picoline at Various Concentrations

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For a number of non-stratified aqueous solutions of non-electrolytes, the behavior of a series of physical parameters (intensity and asymmetry of light scattering, absorption of sound, heat capacity, diffusion, etc.) is of non-monotonous, extreme character in a certain range of temperatures and concentrations. These peculiarities are explained by developed fluctuations of concentration or structure. It is supposed that such solutions at certain temperatures and concentrations possess a locked range of stratification, but this range is very small with respect to temperature and concentration, and for such solutions it is practically tightened to a point (the so-called "singular point"). One of the most informative methods used to study the kinetics of various types of fluctuations in such "metastable" solutions is the Brillouin light scattering method. In the present work, we studied the hypersonic velocity (hypersonic frequency 4.8 GHz) in aqueous solutions of gamma-picoline in a wide temperature interval for various concentrations of gamma-picoline. The Brillouin spectra were registered with the help of a high-resolution two-pass Fabry-Perot interferometer. The experimental results showed that the behavior of the hypersonic velocity is rather complicated with respect to the temperature and concentration of gamma-picoline. At 343 K, the velocity increases rather monotonically with decreasing concentration. At the same time, for 293 K, the velocity increases with decreasing concentration, passes through maximum (at 0.4 m.f.), and then decreases with the further decrease of the concentration. There are two concentrations of gamma-picoline where the behavior of the hypersonic velocity with varying temperatures and concentrations is rather unusual. At 0.06 m.f., we observed some displacement from a monotonous concentrational behavior of hypersonic velocity, which is small, but characteristic for each isotherm. At 0.03 m.f., the hypersonic velocity does not depend on the temperature of the solution, within the studied temperatures. Experimentally observed peculiarities in the behavior of the hypersonic velocity with varying temperatures and concentrations of gamma-picoline need to be explained, and deserve further detailed investigations.