Study of Orientational Molecular Mobility of Some Mono Substituted Benzene Solutions

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In spite of the orientational molecular mobility, which is characterized by relaxation time, many studies with methods of dipole relaxation and molecular anisotropic light scattering line broadening have been made, but still the question about the influence of viscosity and intermolecular interaction forces for this type of molecular motion have not been completely solved.

The liquid state problems were namely connected with the study of both orientational and translational molecular motions and their mutual influences. Taking this into account, we studied the orientational molecular mobility of some monosubstituted benzenes: piridine, toluene, ethylbenzene, iodinebenzene, benzylalcohol, phenol, acetophenone, bensaldehyde, methylbenzoate, and ethylbenzoate in solutions by the anisotropic Rayleigh light scattering line broadening method. ethyl ester, CCL_4, cyclohexane and heptane were used as solvents. For the exciting light source, a He-Ne-laser, 632.8 nm, was used. The molecular light scattering spectra was recorded by a difractional spectrometer.

The experimental data showed that at transition from pure liquids to solutions the orientational relaxation times are decreased, which was explained by the breach of neighboring orientational interaction in the transition from pure liquid to solution. We believe that in these studied solutions the orientational interaction is absent at 15% volume concentration of solute. The strong proportionality between orientational relaxation time and viscosity of solution is absent. The temperature and concentrational dependences of the orientational relaxation were studied and the activation energy of relaxation processes for the studied solutions was determined. By analysis of our experimental results and results of Alms and Pecora and other researchers we concluded that if the intermolecular interaction energy is less than the molecular heat motion energy, then the approximate proportionality between the orientational relaxation time and the viscosity is observed. In the reverse case, the main factor is the value of the intermolecular interaction energy.