INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 6, Issue 1, January - 2025

STUDY OF THE DEPENDENCE OF HYPERSONIC VELOCITY AND THERMODYNAMIC PARAMETERS ON THE VISCOSITY TEMPERATURE IN SOLUTIONS

Бурхонов Б. Н.
Хамроев Ж. Х.
Университет Зармед г. Самарканд
Самарканд, Узбекистан

Abstract

The development of the molecular theory of the liquid state of matter contributes to the solution of applied problems in many branches of science and technology. However, the molecular theory of the liquid state of matter lags far behind in its development from the similar theory of gases and solids.

A great contribution to the study of the liquid state can be made by elucidating the nature of changes in the intermolecular interaction between solution molecules at various concentrations and temperatures. Optical methods will give us the opportunity to obtain more complete information about the nature of changes in intermolecular interaction in liquids and solutions. One of these methods is based on the study of the Mandelstam-Brillouin light scattering spectra. As can be seen from the results obtained, with an increase in temperature in solutions, the speed and frequency of hypersonic decreases, and the adiabatic compressibility calculated by the formula: $\beta s = 1/\rho\ \vartheta_{gz2}$ increases. As we have already noted, the relationship between the study of parameters and concentration is characterized by a change in viscosity. The connection is also preserved. With an increase in temperature, the viscosity of the liquid decreases and, accordingly, the speed and frequency of hypersonic decreases, and the adiabatic compressibility increases. This is fully consistent with the basic provisions of the hole theory of J.I. Frenkel.

Keywords: Liquid, solution, concentration, hypersonic, light scattering, nitrobenzene, aniline, frequency, adiabatic compressibility

Introduction

Acoustic studies of binary solutions in a wide range of concentration and temperature are of theoretical and applied importance. This is important both from the point of view of the development of the molecular theory of liquid matter, and with the constantly growing practical application of mixtures in a number of

INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 6, Issue 1, January - 2025

industries /1.2/. We have studied hyperacoustic and thermodynamic parameters in aniline-nitrobenzene solutions at various concentrations and temperatures.

To solve the problem, a spectral apparatus assembled on the basis of a Fabry-Pierrot interferometer with a dispersion region of 0.625 cm2 was used. The source of excitation light was a helium-neon laser with a wavelength = 6328 Aλ^0 /3.4/.

Taking into account the tasks set, we studied the spectra of Madelstamm-Brillouin light scattering in a number of normal alcohols and according to the displacement and half-width of the components, at different pressures, the speed of propagation of hypersound was calculated according to formula (1):

$$\vartheta_{\text{гз}} = \frac{\Delta\nu \cdot c \cdot \lambda}{2 \cdot n \cdot \sin\frac{\theta}{2}} \qquad (1)$$

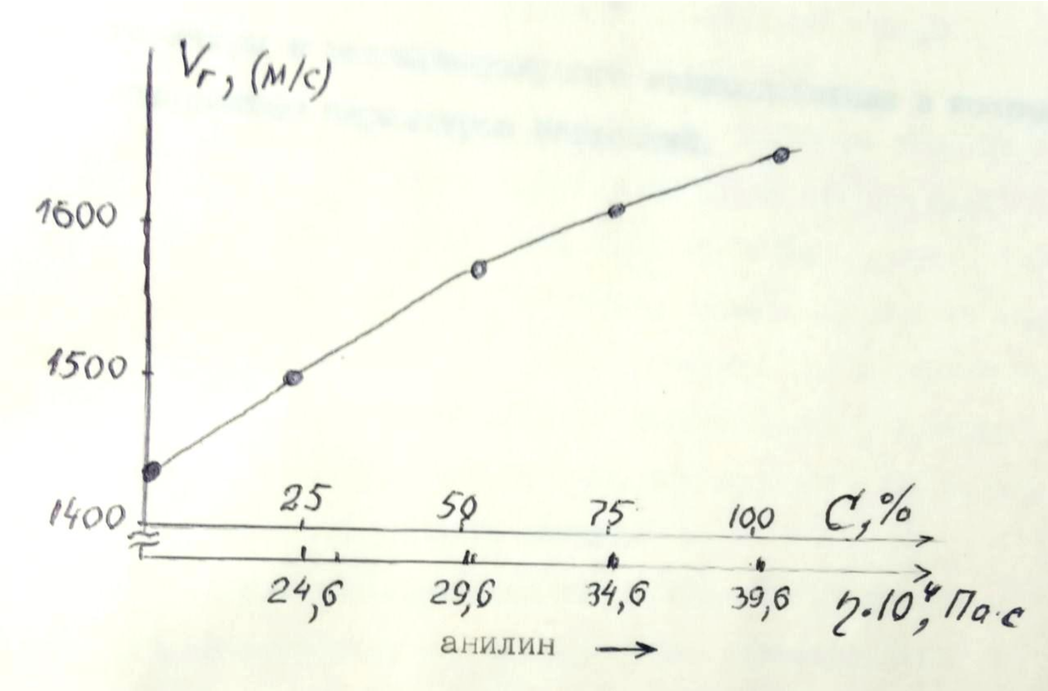
Where, is the displacement of the Mandelstamm-Brillouin component, c is the speed of light, is the wavelength of laser radiation, n is the refractive index of the liquid under study, and is the scattering angle. $\Delta\nu$ λ θ

It has been established that in aniline-nitrobenzene solutions, with an increase in the proportion of aniline in the mixture, the hypersonic velocity as a function of viscosity increases.

$\vartheta_{\text{гз}} = \sum_{i=1}^{n} \vartheta_i \prod_{i \neq j} \frac{\eta - \eta_i}{\eta_i - \eta_j}$The relationship between viscosity and propagation velocity of hypersound at a temperature of 293 K can be expressed by the following expression /5/. (2)

T, K	X1: X2	ϑ_{GZ}, m/s	$f$gz, 10^9 hz	BS $_{1011}$, па $^{-1}$
293	1.0:00 0.75:0.25 0.50:0.50 0.25:0.75 00:1.0	1435 1481 1520 1574 1658	4.9 5.2 5.5 5.8 6.1	40 38 37 36 34
323	1.0:00 0.75:0.25 0.50:0.50 0.25:0.75 00:1.0	1400 1444 1489 1540 1600	4.7 5.1 5.4 5.7 5.9	42 39 37 36 35
348	1.0:00 0.75:0.25 0.50:0.50 0.25:0.75 00:1.0	1370 1405 1445 1480 1536	4.5 4.8 5.1 5.5 5.7	44 41 39 38 36
373	1.0:00 0.75:0.25 0.50:0.50 0.25:0.75 00:1.0	1307 1338 1380 1410 1480	4.3 4.7 4.9 5.1 5.5	46 44 41 38 37

Here, $\eta_{\text{the } i}$ and η_j viscosities at which the hypersonic velocities i are known are the ϑ η viscosities at which the hypersonic velocity is unknown.



As can be seen from the results obtained, with an increase in temperature in solutions, the speed and frequency of hypersound decrease, and the adiabatic compressibility calculated by the formula: $\beta s = 1/\rho\ \vartheta_{gz2}$ increases. As we have already noted, the relationship between the study of parameters and concentration is characterized by a change in viscosity. In thermal studies, this connection is also preserved. With an increase in temperature, the viscosity of the liquid decreases and, accordingly, the speed and frequency of hypersonic decreases, and the adiabatic compressibility increases. By increasing the proportion of aniline in the solution, the hyperacoustic parameters change as a function of the viscosity described by the formula /5/. The change in these values can be explained by a change in the structure and intermolecular interaction in the studied solutions with a change in viscosity in the solution.

References

1. Frenkel Y.I. Kinetic theory of liquids. Leningrad, Nauka Publ., 1987. - 592 p.
2. Yorword A. Jnvestigafion ofrates and mechanisims of orientational motion. New York. -2003. -340 p.

3. Xudoykulova Sh. N.; Burkhonov B.N. Hyperacustic parameters of a series of alcoholsat different state parameters. Academicia: An International Multidisciplinary Research journfl ISSN: 2249-7137 Vol. 11. Issue 11. November 2021 pp. 892-895

4. Бурхонов Б.Н., Хамроев Ж.Х. Dettrmination of changts in intermolecular « free volume» of liquids at different hressures from hyperacoustic data. Academicif Globe: Inderscience Research . ISSN: 2776 – 1010. Vol. 5, Issue 12, December 2024

5. М.Исраилов Хисоблаш методлари, Тошкент. «Укитувчи» 1988., с. 350