Opto-Acoustic Parameters of Liquids at Different Pressures

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ABSTRACT

One of the most important tasks of educators in preschool education today is to cultivate children's creativity, creativity and creative skills. This article discusses the content of the development of creative abilities of preschool children and the role of educational activities.

Keywords: Hypersound, scattering, liquid, pressure, temperature, spectrum, hole theory, high-pressure cell, intermolecular interaction, absorption, frequenc.

Introduction

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 is far behind in its development from a similar theory of gases and solids.

The study of the effect of pressure and temperature on molecular light scattering, on hyperacoustic parameters, and on relaxation processes makes it possible to obtain the most correct information about the mechanism of molecular interactions, about structural changes during the transition of a liquid from its natural to a more densely packed state.

Baric studies of the spectra of Mandelstam-Brillouin scattering of light and the study of hyperacoustic parameters from them are another method for studying the molecular nature of relaxation processes in liquids / 1-3/.

To solve this problem, we used a spectral apparatus assembled on the basis of a Fabry-Pierrot interferometer with a dispersion region of 0.625 cm^2.

The excitation light source was a helium-neon laser with a wavelength λ = 6328 A^0.

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The high pressure cell is a cylinder with a working volume of 30 cm^3 and is made of stainless steel.

The principle of creating pressure in it is that in the high-pressure chamber, inside the investigated liquid, there is a metal bellows, the surface of which is chrome-plated.

Oil is pumped into the bellows using UNGR 2000 through a high-pressure steel capillary, while the bellows expands and creates pressure in the liquid. The pressure value inside the chamber is controlled by a liquid manometer.

The chamber has four mutually perpendicular quartz windows.

Taking into account the tasks set, we investigated the spectra of the Madelstamm-Brillouin scattering of light and by the displacement and half-width of the components, according to formula (1), the hypersound propagation velocity was calculated:

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

Where, Δν is the displacement of the Mandelstam-Brillouin component,

c is the speed of light, λ is the wavelength of laser radiation, n is the index of refraction of the studied liquid, θ is the scattering angle.

hypersound absorption coefficient is calculated by formula (2):

$$\propto = \frac{\pi c \delta\nu}{\vartheta_{гз}} \quad (2)$$

where, δν is the half-width mixing of the Mandelstam-Brillouin component,

ϑ_{gz} is the speed of hypersound, c is the speed of light propagation.

The hyperacoustic and thermodynamic parameters of the liquid vapor of xylene, cyclohexane, and aniline were calculated and studied up to the crystallization pressure, respectively, up to 17.5; 25.5; 180 MPa at constant temperature (293 K). The refractive index of liquids at various pressures is calculated by the formula (3) \ 4 \:

$$n = (\frac{\mu + 2R\rho_p}{\mu - R\rho_p})^{1|2} \quad (3)$$

Where, μ - molecular weight, R - refraction, ρ p - density at various pressures. The results obtained are given in table 1.

Opto-acoustic parameters of liquids at different pressures.

P, MPa	ρ, kg/m3	υ_{gz}, m/s	$\beta_s 10^{11}$,Pa^{-1}	f_{gz}, 109, Hz	$\frac{\alpha}{f^2}$,10^{15}.m^{-1} s^2
		P - xylene			
0.1	863	1310	68	4.4	41
5.0	867	1330	65	4.5	40
10.0	871	1348	63	4.6	38
12.0	873	1365	61	4.7	36
15.0	875	1376	60	4.77	36
17.5	878	1390	59	4.9	34
		C i c l o g e x a n			
,0.1	780	1286	78	4.2	84
5.0	784	1321	73	4.3	82
10.0	787	1364	68	4.4	74
15.0	791	1395	65	4.6	70
20.0	794	1431	62	4.7	63
25.0	796	1491	57	4.8	60
		A n i l and n			
0.1	1025	1671	35	6.1	46
20.0	1031	1726	33	6.3	40
40.0	1040	1791	30	6.5	38
60.0	1048	1838	28	6.6	34
80.0	1057	1878	26	6.9	32
100.0	1062	1925	25	7.0	30
120.0	1069	1965	24	7.1	29

As can be seen from the results obtained, with increasing pressure, there is an increase in the hypersonic velocity and a decrease in the calculated values $\frac{\alpha}{f^2}$, β_s. The decrease in β_s has a non-linear character, which is associated with an uneven decrease in the free volume of the studied liquids.

For para-xylene and cyclohexane, the maximum pressure value corresponded to the beginning of the solidification pressure.

For cyclohexane, the dispersion value increases slightly. For cyclohexane and para-xylene, as the solidification pressure is approached, the values of $(d\vartheta/dp)_{gz}$ also slightly increase.

The data obtained correspond to the main position of the "hole" Frenkel's theory /5/.

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