

Acoustic-Optical Method for Studying High-Frequency Acoustic Waves in Liquid Matter

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A new technology for studying longitudinal and transverse high-frequency acoustic waves in liquids is proposed. This new method differs from all existing technologies currently implemented in measuring acoustic wave velocities. Also, this method is a unique way to determine the velocity of artificial transverse hypersonic waves in liquids. In the proposed method, Bragg light diffraction is used on the hypersonic wave in any solid sample.

It is well known that the intensity of diffracted light depends on the sound intensity. At the same time, if we put the liquid matter adjacent to the free crystal face, we can observe decreasing light intensity, because part of the acoustic energy passes through the boundary to the liquid phase. Measurement of this energy allows us to calculate the acoustic impedance of the investigated liquid, and to determine the velocity of the appropriate hypersonic wave. In contrast to known acoustic impedance methods, this method enables us to determine the velocity value very precisely.

In the present work, Bragg light diffraction of the hypersonic wave in fused quartz has been used for measuring the transverse hypersonic wave velocity in glycerin. The original results were obtained in a frequency range from 420 to 1200 MHz. In this frequency range, we detected the frequency dispersion of the transverse hypersonic wave velocity in glycerin. All necessary calculations have been made, taking into account various factors, which can be changed while the acoustic wave is propagated in the sample. As a whole, this method is quite new and will be useful for the investigation of transverse hypersonic waves in liquids.