Acoustic properties of ionic liquids

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Ionic liquids are interesting systems with many fascinating properties and many potential applications. However, due to ionic character, their properties are different from the properties of molecular liquids. Ionic liquids are dissipative systems because of their two-three orders of magnitude larger viscosity than those of typical molecular organic solvents at room temperature. Therefore, the shear contribution can be appeared in ultrasonic wave propagation. The acoustic method has found acceptance as a precise tool for the determination of thermodynamic properties of liquids at atmospheric and high pressures provided fulfill two conditions. The speed of sound is the thermodynamic equilibrium property (*i.e.* it can be used in the Laplace-Newton equation) at low frequencies, where the speed of sound does not depend on frequency as well as when the effects of absorption on the speed of sound are small *i.e.* the dissipative processes are neglected [1]. Some ionic liquids exhibit dispersive effects at relatively low frequency range. Thus, the speed of sound measured with available equipment is a non-thermodynamic one and cannot be used for determining thermodynamic properties. IUPAC recommended "*…the interpretation of speed-of-sound values and their usability for the determination of related thermodynamic properties can only be done when the absorption coefficient or relaxation regions are known...*" [2] based on our work [1] as "*Good Research Practice because it may require additional measurements for complete characterization of the system.*" [2]. The classical absorption coefficient can be calculated and the ultrasound absorption coefficient of aprotic ionic liquids can be estimated at the low frequency range using viscosity, density and speed of sound [1]. It allows to select measurement method and conditions in order to obtain thermodynamic speed of sound.

References:

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