

Ionic Liquid Induced Shifts in the Temperature of Maximum Density of Water

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Water is known to exhibit a maximum in density around 4 °C. The effect of various solutes, including salts and organic solvents, on the temperature of maximum density (TMD) of water has already been studied, and it has been established that such effect is not a colligative (solute independent) property but depends on the structure of the solution and the underlying solute/solvent interactions. Ionic liquids (ILs) are a new class of organic salts with bulky organic cations attached to different anions. This mismatch results in a salt that is liquid at or near room temperature. In this work we have tested the effect of these novel salts on the TMD of water. We have selected 26 ILs and used a vibrating tube densimeter technique to measure the densities of different aqueous solutions in the range of 0 °C to 7 °C with a temperature step of 0.1 °C. Very smooth parabolic shape curves have been obtained which were fitted to polynomials whose derivative was used to calculate the maxima, i.e., the TMD of the respective solution. The results of the ILs solutions obtained were compared with the effects caused by classical salts/organic solutes. The extent of TMD shifting in a given direction gives us a novel scale for looking at the structure-breaking or structure-making capabilities of a specific ionic liquid in aqueous media.

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