



Investigation of solute-solvent interactions in {1-butyl-3-methyl imidazoliumBis(trifluoromethylsulfonyl)imide + dimethylcarbonate} mixture using physicochemical properties

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Abstract

Physical properties, such as density (ρ), speed of sound (u) and refractive index of [Bmim][NTf₂], DMC and their binary mixtures are measured over the whole composition range as a function of temperature between (303.15 and 323.15) K at atmospheric pressure. Experimental values are used to calculate excess values of molar volumes ()/partial molar volumes ()/partial molar volumes at infinite dilution ()/isentropic compressibility ()/free length (), speed of sound () and isobaric thermal expansion coefficient () for the binary mixture. These excess properties are fitted to the Redlich-Kister equation to obtain the binary coefficients and the standard deviations. A qualitative analysis of these parameters indicates strong intermolecular interactions and the interaction increases with the increase in temperature. Further, through physicochemical properties, an attempt for calorimetric excess chemical potential using different equations is computed at $T = 308.15$ K. The present investigation also comprises of evaluation of the acoustic non-linearity parameter (B/A) in the mixtures and calculation of cohesive energy (ΔA), Van der Waal's constants (a, b), distance of closest approach (d). The presence of strong interactions is further supported by IR spectroscopy and the Prigogine-Flory-Patterson (PFP) theory.

Graphical abstract

