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Effect of Temperature on the Binary Mixture of Imidazolium Ionic Liquid with Pyrrolidin-2-One: Volumetric and Ultrasonic Study

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Abstract : The densities, speeds of sound and refractive index of the binary mixture of ionic liquid (IL) 1-Butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([BMIM][Imide]) and Pyrrolidin-2-one(PY) was measured at atmospheric pressure, and over the range of temperatures T= (298.15 -323.15)K. The excess molar volume, excess isentropic compressibility, excess speed of sound, partial molar volumes, and isentropic partial molar compressibility were calculated from the values of the experimental density and speed of sound. From the experimental data excess thermal expansion coefficients and isothermal pressure coefficient of excess molar enthalpy at 298.15K were calculated. The results were analyzed and were discussed from the point of view of structural changes. Excess properties were calculated and correlated by the Redlich–Kister and the Legendre polynomial equation and binary coefficients were obtained. Values of excess partial volumes at infinite dilution for the binary system at different temperatures were calculated from the adjustable parameters obtained from Legendre polynomial and Redlich–Kister smoothing equation. Deviation in refractive indices ΔnD and deviation in molar refraction, ΔRm were calculated from the measured refractive index values. Equations of state and several mixing rules were used to predict refractive indices of the binary mixtures and compared with the experimental values by means of the standard deviation and found to be in excellent agreement. By using Prigogine–Flory–Patterson (PFP) theory, the above thermodynamic mixing functions have been calculated and the results obtained from this theory were compared with experimental results.

Keywords : density, refractive index, speeds of sound, Prigogine-Flory-Patterson theory
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