THERMOPHYSICAL PROPERTIES OF 1-BUTYL-3-METHYLIMIDAZOLIUM TRIFLUOROMETHANESULFONATE

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Ionic liquids are salts that are liquids at ambient temperatures and included to the green chemistry solvents. They have small vapor pressure, low melting point, high solvating capacity, high ionic conductivity and high thermal stability, which make them attractive for practical applications.

In this work, we will present the thermophysical properties of 1-butyl-3-methylimidazo-lium trifluoromethanesulfonate, [BMIM][TFO] at pressures up to $p = 140$ MPa and over a temperature range $T = (283.15$ to $413.15)$ K. These investigations covering such an extended p, T-range were performed the first time. The experiments were carried out using a specially adapted high pressure – high temperature Anton Paar DMA HPM vibration-tube densimeter with an estimated relative combined standard uncertainty up to $\Delta\rho/\rho = \pm 0.08$ % in density. The temperature T in the measuring cell is administrated with an error of ± 10 mK and is measured using the (ITS-90) Pt100 thermometer with an experimental error of ± 15 mK. Pressure p is measured with a relative uncertainty of 0.1 % (up to 100 MPa) and 0.5 % (up to 140 MPa), respectively, of the measured value.

The density values $\rho(p_0, T)/\mathrm{kg \cdot m^{-3}}$ at ambient pressure and at $T = (283.15$ to $413.15)$ K were investigated using the combination of the Anton Paar DMA 5000M, DSA 5000M and DMA HPM vibration tube densimeters with an uncertainty of $\Delta\rho = \pm(5 \cdot 10^{-3}$ to $3 \cdot 10^{-1})$ $\mathrm{kg \cdot m^{-3}}$. The constant pressure specific heat capacity $c_\mathrm{p}(p_0, T)/\mathrm{J \cdot kg^{-1} K^{-1}}$ is measured at $T = (283.15$ to $413.15)$ K using the DSC differential scanning calorimetry. The speed of sound values $u(p_0, T)/\mathrm{m \cdot s^{-1}}$ at ambient pressure and temperatures at $T = (283.15$ to $343.15)$ K are investigated using the Anton Paar DSA 5000M vibration tube densimeter and sound velocity meter.

The dynamic viscosity $\eta(p_0, T)/\mathrm{mPa \cdot s}$ of [BMIM][TFO] at ambient pressures and at $T = (283.15$ to $413.15)$ K is measured using an Anton Paar SVM 3000 Stabinger Viscometer and Rheometer MCR 302.

The literature values available were subject to a consistency check with our data. An equation of state was established using parameters based on the new results to calculate the isothermal compressibility κ_T, isobaric thermal expansibility α_p, thermal pressure coefficient γ, internal pressure p_int, specific heat capacities at constant pressure c_p and at constant volume c_v, speed of sound u, and isentropic exponent κ_s of this IL.