

Measurement and correlation of CO₂ solubility in 1-ethyl-3-methylimidazolium ([BEIM]) cation based ionic liquids: [BEIM][Tf2N], [BEIM][BF4], [BEIM][PF6]

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The solubility of carbon dioxide (CO₂) was investigated using three different 1-butyl-3-ethylimidazolium ([BEIM]) cation based ionic liquids: 1-butyl-3-ethylimidazolium bis(trifluoromethylsulfonyl)imide ([BEIM][Tf2N]), 1-butyl-3-ethylimidazolium tetrafluoroborate ([BEIM][BF4]), 1-butyl-3-ethylimidazolium hexafluorophosphate ([BEIM][PF6]). The CO₂ solubility data in the three ionic liquids was produced by measuring the bubble point and cloud point pressures of the CO₂ + ionic liquid mixtures. The temperature range was from 303.15 to 373.15 K. The solubility is determined by CO₂ mole fraction in ionic liquids, and the order of magnitude of the CO₂ solubility was found to be [BEIM][Tf2N] > [BEIM][BF4] > [BEIM][PF6]. For the correlation and calculation of the experimental data, modified Lydersen-Joback-Reid method was proposed to estimate critical properties and acentric factors of ionic liquids. Conventional van der Waals one fluid mixing rule and Peng Robinson equation of state (PR-EoS) was used to correlate equilibrium pressure acquired from the experiment.