

Solubility Measurements of Mixed Vapor Containing Carbon Dioxide in Ionic Liquids, and Predictions

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Room temperature ionic liquids have received growing attention as alternative green solvents for reactions and separations. Two-phase systems of an ionic liquid and carbon dioxide are of potential importance for extracting components from or to the ionic liquid phase. An increasing number of studies are reported on ionic liquid and pure vapor systems. However, no equilibrium data or calculation methods for mixed vapor systems are known to the present authors. In the present study, the vapor-liquid equilibria of carbon dioxide + nitrogen + 1-hexyl-3-methylimidazolium tri (bisfluoromethylsulfonyl) imide and carbon dioxide + propane + 1-hexyl-3-methylimidazolium tri (bisfluoromethylsulfonyl) imide were measured at 298.15 K and up to 1 MPa. The amounts and compositions of the vapor phase were determined before and after equilibration to obtain equilibrium data. The hydrogen-bonding nonrandom lattice fluid model in a group-contribution form was used for equilibrium calculations. The ionic liquid was modeled as a neutral ion pair. Interaction parameters between ionic liquid and vapor components were determined using pure component solubility data in the ionic liquid, and those between vapor components were determined from vapor-liquid equilibrium data in the absence of an ionic liquid. The predicted results were found to be in reasonably good agreement with the experimental data.