543c Solubility and Diffusion of Gases in Ionic Liquids

Dean E. Camper, Collin Becker, Carl Koval, and Rich Noble

Because Room Temperature Ionic Liquids (RTILs) have a negligible vapor pressure and will not evaporate, they are a good candidate to be used in many different applications, where solubilitity and diffusion of gases in the RTILs can be a major parameter. In order to determine the solubility of gases in RTILs, a model was developed. In the derivation of the model it was assumed that enthalpic effects dominated at low to moderate pressure and regular solution theory was used to model the enthalpic effects. For the RTILs used, solubility parameters were estimated using the lattice energy density. For the hydrocarbons used, it was observed that the solubility increased as the carbon number increased and when the number of carbon bonds increased. Diffusion coeficients were measured and compared to the RTILs viscosity. This work was applied to eight different gases using five different RTILs. The gases used were ethane, ethene, propane, propene, butane, 1-butene, 1, 3-butadiene, and carbon dioxide. The RTILs used were butylmethylimidazolium hexafluorophosphate ([bmim][PF6]), butylmethylimidazolium tetrafluoroborate ([bmim][BF4]), ethylmethylimidazolium bis(trifluoromethanesulfonyl)amide ([emim][Tf2N]), ethylmethylimidazolium trifluoromethanesulfone ([emim][CF3SO3]), and ethylmethylimidazolium dicyanamide ([emim][dca]).