CO_2 Solubility and Selectivity in Room-Temperature Ionic Liquids and Metal Organic Framework Composites

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We present a systematic study of CO_2 solubility and selectivity of room temperature ionic liquid (RTIL) and MOF composites. Our work is motivated by the desire to develop new solid state sorbents, which are based on RTIL and nanoparticles, and employ high surface area and high capacity of greater than 0.1 mL/gram of sorbents. RTIL are non-volatile, tunable solvents that have been recently investigated to be utilized as a sorption media for CO_2 separation. And a number of solubility measurements of CO_2, N_2, and CH_4 have previously been investigated using imidazolium based ionic liquids in particular [1], have shown promising results. In this work, we mix metal organic framework (MOF) which has a pore size of 5.6 Angstrom, and surface area of 300 m^2/g into RTIL, 1-hexyl-3-methyimidazolium bis(trifluoromethylsulfonyl)imide [hmim][Tf_2N] to attain perfect mixtures. We measure the CO_2, N_2, and CH_4 solubilities at near ambient temperature and pressure as a function of MOF weight fraction. The synthesized MOF was characterized via X-ray, and it was shown that the MOF structure were stable upon activation, and CO_2 adsorption. We would then explain the contribution of MOF in the RTIL for CO_2 solubility. Our initial results showed that the CO_2 solubility and CO_2/N_2 and CO_2/CH_4 selectivity increases compare to pure ionic liquid at low MOF loading. This study has shown that gas solubility and selectivity are improved by addition of MOF in RTIL.

[1] Cadena, C., et al., *Why is CO2 so soluble in imidazolium-based ionic liquids?* Journal of the American Chemical Society, 2004. **126**(16): p. 5300-5308.