

Removal of Carbon Dioxide and Sulfur Dioxide Gases Using Room-Temperature Ionic Liquid

Akimichi Yokozeki^C

Fluoroproducts Laboratory, DuPont, Wilmington, DE, U.S.A.

Mark Shiflett^S

Central Research and Development, DuPont, Wilmington, DE, U.S.A.

Removal of CO₂ and SO₂ from industrial flue gases in the combustion of fossil fuels is highly important due to their adverse environmental effects. Apart from the conventional removal techniques using limestones or organic solvents, room-temperature ionic liquids (RTILs) are being considered as possible candidates for capturing these acid flue gases. Solubility studies of CO₂ in many RTILs have been reported, and significantly high solubilities are observed even in the physical absorption, relative to those of simple hydrocarbons and N₂. In the case of SO₂, only a few RTILs have been examined for the binary phase behaviors, and all of them show much higher solubility than the CO₂ cases. For example, Henry's law constants are 31.30 and 1.64 bar at 298 K for CO₂ and SO₂ in the RTIL, [hmim][Tf₂N], respectively [1]. This large difference in the Henry's constant may suggest the possible selective capturing of these acid gases. Some authors report on the high SO₂ selectivity of separation from CO₂ using supported ionic liquid membranes: *ideal* selectively without considering the SO₂ and CO₂ interactions [2]. However, the selective capturing of these gases may be misleading as stated in Ref. [1]. In the present study, we clarify these points by predicting the ternary phase diagrams of CO₂ + SO₂ + [hmim][Tf₂N], using our cubic equation-of-state method [3] with each binary solubility data from Refs.[1], [4], and [5]. Then, the capturing and selectivity of these acid gases with RTIL [hmim][Tf₂N] are calculated at several feed, *T*, and *P* conditions. It is shown that there is no selectivity advantage using this RTIL, but that simultaneous CO₂/SO₂ capture characteristics are predicted.

[1] J. L. Anderson, et al., J. Phys. Chem. B 110 (2006) 15059-15062.

[2] Y-Y. Jiang, et al., J. Phys. Chem. B (2007) web publication.

[3] A. Yokozeki and M. B. Shiflett, Applied Energy 84 (2007) 351-361.

[4] M. B. Shiflett and A. Yokozeki, J. Phys. Chem. B 111 (2007) 2070-2074.

[5] DDB (Dortmund Data Bank) (2008).