Transport Properties of Imidazolium Ionic Liquids Saturated with Compressed Gases

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The low volatility of ionic liquids (ILs) allows for their potential utilization in a multitude of engineering applications especially with compressed gases, e.g. absorption refrigeration, separations, lubricants, etc. However, transport properties are needed for their wide-scale use and scale-up. Here, the liquid thermal conductivity, viscosity, density, and self-diffusivity were investigated from 298.15K to 348.15K and pressures to ~15 MPa. The model IL, 1-hexyl-3-methyl-Imidazolium bis(trifluoromethylsulfonyl)amide [HMim][Tf_2N], was used for most of the studies. Compressed gases of interest include carbon dioxide, 1,1,1,2-Tetrafluoroethane (R-134a) and other hydrofluorocarbon gases. The viscosity significantly decreases with even small compositions of the dissolved gas which increases the self-diffusion. This decrease is mainly attributed to a diluent effect. However, for thermal conductivity, a small decrease is observed with composition of dissolved gas until large compositions, at which a large decrease occurs. This indicates that simple mixing rules for mixture properties based upon pure component properties would not be appropriate. The qualitative behavior of thermal conductivity seems more largely dependent on the relative polarity of the dissolved component.