High pressure density and solubility for the CO2+1-ethyl-3-methylimidazolium ethylsulfate system - DTU Orbit (09/01/2019)

High pressure density and solubility for the CO2+1-ethyl-3-methylimidazolium ethylsulfate system
The solubility and density of the CO2 + 1-ethyl-3-methylimidazolium ethylsulfate system were investigated. The carbon dioxide solubility in the IL was measured in the temperature range 273-413 K, for pressure up to 5 MPa and CO2 mole fractions ranging from 0.02 to 0.5 using the isochoric method, while the system density was carried out at temperatures ranging from 278.15 K to 398.15 K, pressures from 10 MPa to 120 MPa and 0.2, 0.4, 0.7 and 0.8 CO2 mole fractions. Similar to what was previously observed for phosphonate-based ILs, the ionic liquid high polarity leads to positive deviations from ideality resulting from unfavorable interactions with the CO2. The results from the density and solubility derived properties show that the system presents important negative excess molar volumes, over the whole range of compositions and temperatures, and a negative entropy of solvation that suggests an increase in ordering of the solvent molecules surrounding the solute. The observed negative excess molar volumes result from the large difference between the molecular volumes of the species involved, with the small carbon dioxide molecules occupying the empty spaces between the larger IL ions, supporting the notion that the carbon dioxide, upon dissolution, occupies essentially the bulk free volume since the IL does not significantly expand upon gas absorption. These results portray ionic liquids as a porous media, like a soft sponge, with a huge free volume in which large amounts of carbon dioxide are able to accommodate during the dissolution process. (C) 2014 Elsevier B.V. All rights reserved.

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