

## Corresponding States in Solutions of Ionic Liquids

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Until recently, liquid-liquid phase transitions in ionic solutions were observed only on very few systems [1]. The salts used were chemically rather unstable. Now, a great number of rather stable salts with melting points below 100°C, termed ionic liquids, are available. A substantial number of solutions of ionic liquids with a critical point at ambient temperatures have been discovered recently, enabling systematic investigations of the critical properties and corresponding state analysis [2]. Here we report 20 phase diagrams of binary and ternary solutions of alkyl-methyl imidazolium trifluoromethyl sulfonates (C<sub>n</sub> mim triflat) in haloarenes (Chlorobenzen, Bromobenzene, Jodbenzene), alcohols, dioxane, and water. All systems have an upper critical solution point. The phase diagrams are consistent with the presumption of Ising critical behavior. In order to gain insight a corresponding state analysis is carried out using as a reference the so called restricted primitive model (RPM), which considers charged hard spheres in a dielectric continuum. Using the corresponding-state variables of this model general agreement for the location of the critical point with the RPM prediction is found for solutions in solvents with low dielectric permittivity. The linear variation of the critical temperatures in the RPM temperature scale with the dielectric permittivity of the solvent agrees with the findings of the analyses of other solutions of ionic liquids. The analysis of the critical composition and of the shape of the coexistence curves suggests a major difference between solutions in aprotic (alkanes, arenes) and protic solvents (alcohols, water). In the RPM temperature scale the critical points in the aprotic solvents are upper critical points, while in protic solvents the critical points become lower critical points [2], which indicates that in protic solvents the coulomb interactions and the breaking of hydrogen bonds both are the driving forces of the phase transition. The widths of the phase diagrams are very similar for the solutions in aprotic solvents and different from that in protic solvents. No systematic is observed within one of the two groups when comparing the parameters describing the phase diagrams in the corresponding state representation. The same statement holds for the slope of the diameter of the phase diagrams.

[1] H. Weingärtner, W. Schröer, Adv. Chem. Phys. 16 1-66 (2001)

[2] A. Butka, V. R. Vale, D. Saracsan, C. Rybarsch, V. C. Weiss, W. Schröer  
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