The Interplay of Ionic Liquid Phase Boundaries:
Liquid-Liquid and Vapor-Liquid Equilibria of Imidazolium Triflate Ionic Liquids with *n*-Alkyl Alcohols

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We have performed a systematic study of isobaric liquid-liquid (LLE) and vapor-liquid equilibria (VLE) of binary mixtures of different 1-alkyl-3-methlimidazolium trifluoromethanesulfonate ($C_{n=2,4,6,8}$mimTfO) ionic liquids (ILs) and different *n*-alkyl alcohols (C_nOH; methanol - *n*-dodecanol C_{1-12}OH). By a gradual variation of the chain lengths of one component of the systems small changes of the molecular interactions are achieved resulting in characteristic shifts of the phase behavior. Therefore, mixtures with shorter chained alcohols allow for a combined view on the VLE and the LLE which is shown for the IL 1-ethlyl-3-methylimidazolium trifluoromethanesulfonate (C_2mimTfO) and C_{3-5}OH. For mixtures of the ILs with higher homologues alcohols ($C_{n>5}$OH) the solubilities / the LLE have been determined. Partially, the limits of both chemical and temperature stability have been reached. The VLE have been obtained at pressures of p = 500, 700 and 1000 mbar while the LLE have been determined at ambient pressure. At arbitrary temperatures the two components IL + C_nOH show partial miscibility with an upper critical (liquid-liquid) solution temperature (UCST, T = 251 K– 380 K). Complementing previous studies, the LLE have been analyzed in accordance to Ising criticality yielding critical temperatures, critical compositions and coefficients describing the shape of the phase diagram. The results are discussed and compared with other alcoholic IL mixtures formed by imidazolium based salts. The VLE of mixtures of C_{1-4}OH have been determined and evaluated in terms of the PC-SAFT EoS and the NRTL model. A corresponding state approach for the congruent description of both, the LLE and the VLE, is proposed.