

Mixing State of Benzene Solutions of Imidazolium-based Ionic Liquid, C12mim+TFSA-

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Room-temperature ionic liquids (RT-ILs) have unique properties, such as extremely low vapor pressure, thermal stability, nonflammability, high polarity, and electroconductivity. However, their high viscosity is a serious problem for application of ionic liquids in many fields. Thus, RT-ILs are frequently used by mixing with conventional molecular liquids, such as water, methanol, and acetonitrile. In the present work, an effect of pi-pi interaction on the mixing state of benzene solutions of 1-dodecyl-3-methylimidazolium bis(trifluoromethanesulfonyl)amide (C12mim+TFSA-) has been elucidated using small-angle neutron scattering (SANS) technique.

C12mim+TFSA- was synthesized by a conventional method [1]. Sample solutions were prepared by mixing C12mim+TFSA- with deuterated benzene (C6D6) at various benzene mole fractions x_{C6D6} . SANS intensities of the sample solutions at 298 K were measured on the SANS-U spectrometer with the camera lengths of 1, 4 and 8 m.

Figure 1 shows the Ornstein-Zernike correlation lengths ξ_i of C12mim+TFSA-C6D6 solutions estimated from the SANS spectra as a function of x_{C6D6} . The ξ_i values of C12mim+TFSA-C6D6 solutions gradually increase with increasing x_{C6D6} from 0.9 and reach a maximum at $x_{C6D6} = 0.99$. However, the ξ_i value of the solution decreases at $x_{C6D6} = 0.995$. Thus, C12mim+TFSA- is heterogeneously mixed with C6D6 in the very narrow mole fraction range of $0.9 < x_{C6D6} < 0.995$ with the maximum at $x_{C6D6} = 0.99$. The present SANS results, together with the results from ATR-IR, NMR, and LAXS measurements, suggest that C12mim+TFSA- form clusters in the solutions. The pi-pi inter-

action between the imidazolium ring and C6D6 may stabilize C12mim+TFSA- clusters in the solutions. However, the clusters are disrupted above $x_{C6D6} = 0.99$ due to the solvation of C12mim+ and TFSA- by the large amount of C6D6.

Reference

[1] Nockemann, P.; Binnemans, K.; Driesen, K. *Chem. Phys. Lett.*, 415 (2005) 131.

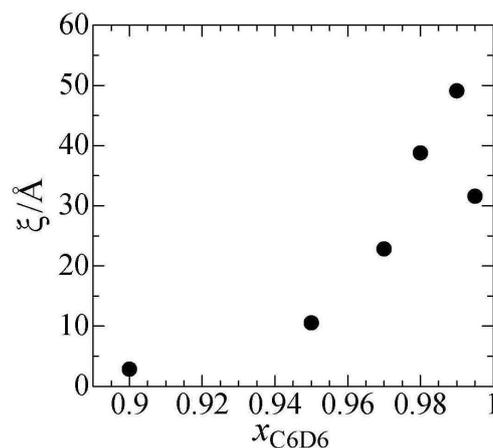


Fig. 1. Figure 1. Ornstein-Zernike correlation lengths ξ_i of C12mim+TFSA-C6D6 solutions as a function of C6D6 mole fraction.