

Studies on Thermo-Chemical Properties of a New Ionic Liquid Prepared by Mixing 1-Methyl-3-Pentylimidazolium Chloride with InCl₃

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A new ionic liquid PMIInCl₄ was prepared by mixing 1-methyl-3-pentylimidazolium chloride (PMIC) with InCl₃ and was characterized by Raman spectrum [1]. The molar solution enthalpies of PMIC and PMIInCl₄ with various molalities were determined by the solution reaction isoperibol calorimeter in water at 298.15 K. According to Pitzer's electrolyte solution theory [2], the molar solution enthalpy of PMIC and PMIInCl₄ at infinite dilution, $\Delta_s H_m^0$, and Pitzer's parameters: $\beta^{(0)L}_{MX}$, $\beta_{MX}^{(1)L}$ and $C_{MX}^{\phi L}$ were obtained. Then the values of apparent relative molar enthalpy Φ_L and relative partial molar enthalpies of solute (PMIC and PMIInCl₄), L_2 , were calculated, respectively.

The reaction heat of PMIC with InCl₃ is depicted in Fig. 1. According to the thermodynamic cycle of Fig. 1, the reaction heat of PMIC with InCl₃ can be calculated:

$$\Delta_r H = \Delta_s H_m^0 (\text{PMIC}) + \Delta_s H_m^0 (\text{InCl}_3) - \Delta_s H_m^0 (\text{PMIInCl}_4)$$

where $\Delta_s H_m^0 (\text{PMIC}) = -17.85 \text{ kJ} \cdot \text{mol}^{-1}$, $\Delta_s H_m^0 (\text{PMIInCl}_4) = -83.06 \text{ kJ} \cdot \text{mol}^{-1}$, and $\Delta_s H_m^0 (\text{InCl}_3) = -103.4 \text{ kJ} \cdot \text{mol}^{-1}$ which was taken from our previous paper[3], so that $\Delta_r H = -38.19 \text{ kJ}$. During preparation of ionic liquid PMIInCl₄, it was observed that the reaction (Fig. 1) is exothermic, so it shows that the calculation may be reasonable.

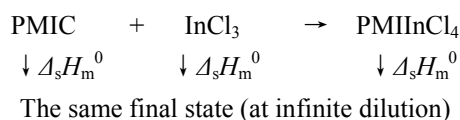


Fig.1. Thermo-chemical cycle for measuring the heat of reaction, $\Delta_r H_m / \text{kJ} \cdot \text{mol}^{-1}$

- [1] J.-Z. Yang, P. Tian, L. L. He, W. G. Xu, *Fluid Phase Equilibria*, **204**, 295-302 (2003).
- [2] K. S. Pitzer, In: Activity coefficients in Electrolyte Solutions, revised edn., K. S. Pitzer, ed., CRC, Boca Raton, Chap.3 (1991).
- [3] W. Guan, L. Li, H. Wang, et al., *Studies on the Thermochemistry for InCl₃*, Chem. J. Chinese Uni. **27**, 310-313 (2005).