Thermodynamic Properties of $[C_6mim][PF_6]$ Ionic Liquid

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The decomposition temperature of the ionic liquid $[C_6mim][PF_6]$ (1-hexyl-3-methylimidazolium hexafluorophosphate), $T_d \approx$ 663 K, was obtained first, then density and surface tension were measured over a temperature range of 293.15 K to 323.15K at standard atmospheric pressure. According to the definition of thermal expansion coefficient a, we obtained the value, $a = 6\times10^{-4}$, over a temperature range of 293.15 K to 323.15K with the density data at that temperature range. According to Glasser's experiential equation, the standard entropy, S^0 (298.15 K) = 529 $J\times K^{-1}\times mol^{-1}$, was obtained. In terms of Eötvös equation, Plotting $\gamma V_m^{2/3}$ against $T_C - T$ was carried out, a good straight line and the slope, $k = -1.9\times10^{-7}$ $J\times K^{-1}$, were obtained. The surface excess entropy, $S_a = -(\partial\gamma/\partial T)_p$, could be obtained from the slope of the line, that is, $S_a = 6.39\times10^{-2}$ $mJ\times K^{-1}\times m^{-2}$. In addition, the surface excess energy E_a likewise could be obtained from the surface tensions data, and $E_a = \gamma - T(\partial\gamma/\partial T)_p = 57.6$ $mJ\times m^{-2}$ for $[C_6mim][PF_6]$ at 298.15 K.