# Low Temperature Heat Capacity of 1-Hexyl-3-Methylimidazolium Bis(Trifluoromethylsulfonyl)Imide

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Ionic liquids are salts but are liquids in ambient temperature and pressure. Their unique properties have attracted attentions for application as functional solvents. Thermophysical properties were however not taken interests so much. To encourage systematic studies of thermodynamic and thermophysical properties, an IUPAC project on ionic liquids started. We participated in the project on heat capacity measurement of 1-hexyl-3-methylimidazolium bis(trifluromethylsulfonyl)imide ([hmim][$Tf_2N$]). Although the requested data was heat capacity at 298.15 K, our experiment was performed for the whole range of temperature below room temperature. Heat capacities of liquid, crystalline phases and liquid-quenched-glass of the [hmim][$Tf_2N$] sample, which was distributed from NIST for the IUPAC project, were measured by adiabatic calorimetry. Heat capacity at 298.15 K and its expanded uncertainty, evaluated for the IUPAC project, were 631.6 J/(K mol) and 0.5 J/(K mol), respectively. Fusion was observed at 272.10 K from the stable crystalline phase with molar enthalpy and entropy of fusion 28.34 kJ/mol and 104.2 J/(K mol), respectively. Purity was evaluated by fractional melting method yielding the mole fraction of 99.83 %. Glass transition with large heat capacity jump was observed at around 183 K. Glass transition temperature is approximately 2/3 of melting point. This satisfies with an empirical relation between glass transition temperature and melting point of some glass formers [1]. Heat capacity of liquid-quenched-glass is larger than that of the crystal. The excess heat capacity is very small around 15 K and shows a peak around 6 K, which is probably due to the so-called boson peak.

[1] S. Sakka and J. D. Mackenzie, *J. Non-Cryst. Solids* 6, 145 (1971).