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Study of Thermal Phase Behavior for an Ionic Liquid by High Sensitive DSC

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Ionic liquids have attracted much attention in recent years because they have some unique properties that molecular liquids do not show, e.g., negligible vapor pressure, high thermal stability, extremely low flammability, high ionic conductivity, unique solubility and so on. Application of ionic liquids to electrolytes, biotechnology, novel reaction media and separation/extraction processes has been widely studied. Investigation of basic physical properties of ionic liquids, especially thermal phase behavior, is important for not only obtaining ionic liquids having desirable properties for the applications but also their basic understanding. 1-butyl-3-methylimidazolium hexafluorophosphate ([C4mim]PF₆) is one of the most typical ionic liquids composed of a representative cation and anion. It shows three crystal polymorphs and complex thermal phase behaviors [1-3]. We have reported the thermal phase behavior at the slow scanning rate of 0.3 K/min [1] using a lab-made calorimetry with a high-temperature control system [4]. [C4mim]PF₆ shows a cold crystallization (226.5 K), then it has two endothermic peaks at 250 K and 276 K before melting (285 K) in the heating process [1]. Since the peak at 276 K is very small and close to the melting point, it was not observed clearly in the previous work performing the measurement at the heating rate of 10 K/min using a conventional DSC [3]. Here we focus on the behavior of the peak at 276 K in a variety of scanning rates using a high sensitive DSC. The peak was clearly distinguished from the melting peak at the heating rate of 1 K/min.

References:

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