Thermodynamic Investigation of a Room Temperature Ionic Liquid: Heat Capacity, Standard Enthalpy of Formation and Heat of Reaction for Synthesis of EMIES

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Room temperature ionic liquids (RTILs) are viewed as a novel class of green benign solvents, which promise to have widespread application in industry, possibly replacing traditional organic solvents, due to their unique properties such as negligible vapor pressure, broad liquid temperature range and high specific solvent abilities [1-3]. Even though the solvent properties of different halogenoaluminate ionic liquids were studied as early as in 1986 [4], very little is known about the various properties of the ionic liquids and their intermediates despite their extensive usage in synthetic applications. We refer, for instance, to that the data of heat capacity, standard enthalpy of formation, thermodynamic functions and so on, which are paramount for the design of technological processes concerned and these data are very scarce [5].

As a part of our systematic investigations on RTILs, in the present study the molar heat capacities of EMIES and its synthesis materials (1-methylimidazole, diethyl sulfate) were measured by an adiabatic calorimeter [6] in the range from 80 to 390 K. Based on the measured heat capacity data and thermodynamic relationship, the thermodynamic functions of EMIES and the synthesis materials relative to 298.15 K were calculated. The glass and phase transitions of EMIES and the synthesis materials were observed, and the molar enthalpies and entropies of the transitions were evaluated. The molar enthalpies of combustion of EMIES and the synthesis materials were determined by oxygen-bomb combustion calorimeter. The standard molar enthalpies of formation were evaluated. The heat of reaction for synthesis of EMIES from 1-methylimidazole and diethyl sulfate was further determined.

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