Thermal behavior and thermal decomposition mechanism of some alkyl-imidazolium ionic liquids

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Recently, investigations of ionic liquids (ILs) have greatly increased. Thanks to their distinctive properties such as negligible vapor pressure; a wide temperature range of existence of the liquid state; high conductivity; excellent dissolution ability for organic, inorganic, and polymeric compounds; simplicity of recycling, and nonflammability, ILs have a multitude of applications. Ionic liquids contain a large organic cation and an inorganic or an organic anion. It was established that thermophysical properties of ionic liquids strongly depend on the nature of the cation and anion. Since a large diversity of cations and anions combinations can be achieved is no theoretical limit to the number of possible ionic liquids. This peculiarity of ILs provides means to design specific ionic liquids with targeted properties for required applications. The applicability of ionic liquids can be realized through studies of thermophysical properties such as phase equilibria, viscosities, electrical conductivities, etc.
The main purpose of this work was to obtain the valuable information on main characteristics of the solid and liquid states upon heating and cooling processes and maximum operating temperature, and to conceive the mechanism of decomposition of alkyl-imidazolium ionic liquids. The thermochemical behavior of two groups of ILs, 1-ethyl-3-methylimidazolium [EtMeIm] and 1-butyl-3-methylimidazolium [BuMeIm] halides (Cl, Br and I), has been investigated in the temperature range −100 ÷ 600 °C by different thermal methods such as differential scanning calorimetry (DSC) and thermogravimetric analysis (TG/DTA) coupled with a mass spectrometer (MS).

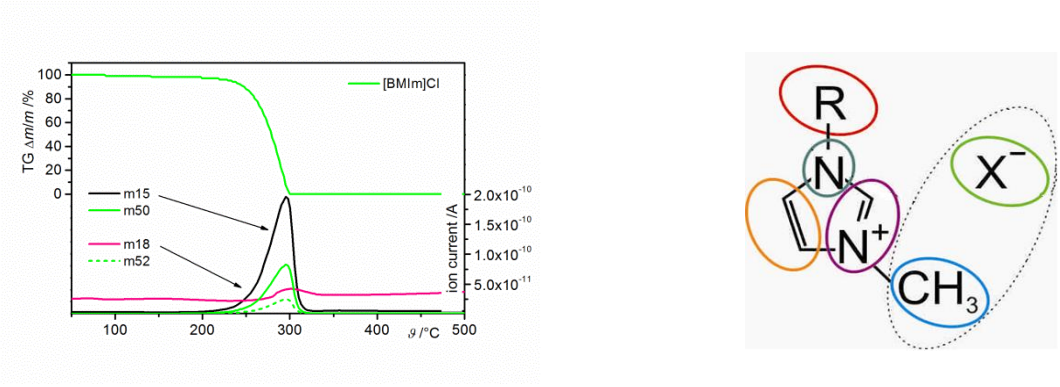

Figure 1: The established mechanism of thermal decomposition of 1-butyl-3-methylimidazolium halides [BuMeIm]X (X = Cl, Br, I) inferred from the TG/MS measurements via assignment of the resultant fragments.

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