

## Densities, Viscosities, Decomposition Temperatures, and Heat Capacities of Ionic Liquids

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Ionic liquids are being intensively investigated for a variety of applications, including as solvents for reactions and separations, as non-volatile electrolytes, and as heat transfer fluids. Basic thermophysical properties are vital for design and evaluation for these applications. Densities both as a function of temperature and as a function of pressure, viscosities as a function of temperature, dynamic and static decomposition temperatures, and heat capacities for a variety of pyridinium- and imidazolium-based ionic liquids are presented. The properties follow quite reasonable trends. Density as a function of temperature increases as the molecular weight of the anion increases. Isothermal compressibility increases with increasing alkyl chain length. Viscosities generally increase with increasing strength of the coordinating anion. The thermal stability is also largely determined by the coordinating ability of the anion, with ionic liquids made with the least coordinating anions having the best thermal stability. Comparing the thermal stability of several bis(trifluoromethylsulfonyl)imide ILs under static conditions shows that significant decomposition occurs at temperatures much lower than their starting dynamic decomposition temperatures. The temperature dependence of the decomposition rate constant follows the behavior described by Arrhenius' Law very well for all ILs studied. Heat capacities increase approximately linearly with increasing molar mass, which corresponds with increasing numbers of translational, vibrational, and rotational energy storage modes.