Preparation and Properties of High Mass Tetraalkylphosphonium Ionic Liquids

Cynthia Corley, Rico Del Sesto, John Wilkes

US Air Force Academy
Department of Chemistry
2355 Fairchild Dr., Suite 2N225
USAF Academy, CO 80840-6230

Most of the molten salts now identified as ionic liquids have either large cations or large anions with many degrees of freedom that inhibit crystallization. We describe here ionic liquids that have both massive cations and massive anions. The formula mass for some of these liquids exceeds 2000 g/mole, yet they are still liquids. The cations used are tetraalkylphosphoniums; ranging in size from tetrabutylphosphonium to tetradecyltrihexylphosphonium. The anions range in size from chloride (reported by others) to the C_{60} fulleride dianions and the tetrasulfonated copper phthalocyanine. The massive ionic liquids are viscous, but there is a poor correlation with anion size. Cation size appears to have a greater effect on properties. The liquids are significantly less dense than the more common imidazolium ionic liquids. Nearly all examples undergo glass transitions, rather than crystallization. The thermal stability and electrochemistry are determined by the nature of the anion. Some of the ionic liquids have interesting optical and magnetic properties.