The initial utilization of ILs was for specialized electrochemical applications3. They possess a variety of properties that make them desirable as solvents for investigation of electrochemical processes. They often have wide electrochemical windows, reasonably good electrical conductivity and solvent transport properties, a wide liquid range, negligible vapor pressure, and they are able to solvate variety of inorganic, organic, and organometallic species.

#### Electrochemical window

A key criterion for selection of a solvent for electrochemical studies is the electrochemical stability of the solvent. This is most clearly manifested by the range of voltage over which the solvent is electrochemically inert. In ILs this useful electrochemical potential "window" depends on the resistance of the cation to reduction and the resistance of the anion to oxidation. Generally ILs have a wide electrochemical window of ~4V. The choice of the working electrode has some impact on the overall electrochemical window measured. In addition, the presence of impurities can play an important role in limiting the potential windows of ILs. During the synthesis of many of the non-haloaluminate ILs, residual halide and water may remain in the final product. Halide ions (Clˉ, Brˉ and Iˉ) are more easily oxidized than the fluorine-containing anions used in the most non-haloaluminate ILs. Consequently, the observed anodic potential limit can be appreciably reduced if significant concentrations of halide ion are present. Contamination of an IL with significant amounts of water can affect both the anodic and the cathodic potential limits, as water can be both reduced and oxidized in the potential limits of many ILs. For example, the electrochemical window of 'dry' [bmim][BF4] was found to be 4.10V, while that for the IL with 3% water by weight was reduced to 1.95V1. In addition to its electrochemistry, water can react with the IL components (especially anions) to produce products that are electroactive in the electrochemical potential window. For instance, the PF6ˉ ion is known to react with water to form HF3 .

### Ionic conductivity

Superficially, ILs are expected to possess very high conductivities because they are composed entirely of ions. Actually, this is not the case. As a class, ILs possess reasonably good ionic conductivities, comparable to the best non-aqueous solvent/electrolyte systems. However they are significantly less conductive than concentrated aqueous electrolytes. ILs conductivity appears to be most strongly correlated with viscosity and there is a reciprocal relationship between them.In addition, the smaller than expected conductivity of ILs can be attributed to the reduction of available charge carriers due to ion pairing and/or ion aggregation, and to the reduced ion mobility resulting from the large ion size found in many ILs.Conductivity also depends on the planarity of the cation. Generally, an increase in planarity of the cation increases the conductivity3.

### Applications of ILs5

The early electrochemistry of ILs research was dominated by their application as electrochemical solvents. Much of the initial development of ionic liquids was focused on their use as electrolytes for battery, fuel cells and capacitor applications. The non-flammable liquids with high ionic conductivity are practical materials for use in electrochemistry. At the same time non flammability and non-volatility inherent in ion conductive liquids open new possibilities in other fields as well. Because most energy devices can accidentally explode or ignite, for motor vehicles there is plenty of incentive to seek safe materials. ILs are being developed for energy devices1 .