# LIQUID ELECTROLYTE BASED ON IONIC LIQUIDS FOR RECHARGEABLE BATTERIES

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Rechargeable battery are a major of technological challenges in the new century as they are the key method to make more efficient use of energy. Li-ion technology has mostly conquered the portable electronic market, however it still falls the demands dictated by the powering of both electric vehicles and hybrid electric vehicles or by the storage of renewable energy (wind, solar…). The main obstacles are known as the lower cost, the durability and the safety problem. Some new chemistries of sodium batteries or divalent cation batteries have been suggested in the recent years in order to replace the Li-ion technology for a large-scale application. Unfortunately, these new chemistries are still involved in searching the new solid electrode compounds and the compatible electrolytes that could be in good cycling performance. The electrolytes play a key role in determining the safety and the efficient cyclability. The electrolyte is reduced and oxidized during charge and discharge process, hence the formation of solid electrolyte interface (SEI) at the first charge is considered as the protective film of negative electrode for long cycling behavior in lithium batteries. However, it's still unachievable in others chemistries [1,2].

Since ionic liquid is explored as new trend catalyst in organic and aliphatic chemistry, it also effectively influenced in electrochemistry of electric generator. Due to negligible vapor pressure, large electrochemical window, chemical and thermal stability, ionic liquids become a very promising candidate in high safety and high density energy Li-ion batteries. Many research papers reported the use of room temperature ionic liquids (kind of quaternary ammonium, pyrrolidinium, imidazolium) as principal component of lithium electrolyte [3,4]; or as flammable additives [5], as enhanced protective SEI film in conventional electrolyte [6]. However, the future of ionic liquids is still unapparent due to its high viscosity, low Li-ion mobility (strong coordination of $Li^+$ and anion of ILs) and evident corrosion of aluminum current collector by anion TFSI-. Recent efforts have focused on decreasing the viscosity of ILs by mixed of different ILs or mixed with different kinds of organic solvent (carbonate, sulfone, fluorocarbonate…) [7,8]. Some promising results emphasized not only on the viscosity decrease but also on the enhancement of $Li^+$ mobility. Hence, the new potential way of using ionic liquids as electrolyte is still motivated the batteries researcher. In addition, ionic liquids take a great interests in sodium-ion or divalent cation batteries due to the different interactions behavior of electrolyte-electrode compared to the conventional electrolyte. Each kind of ionic liquid conduct a new design of electrolyte – electrode interface which will assure the efficient cycling performance.

The presented work is focused on the synthesis, the application of ionic liquids as electrolyte in lithium-ion batteries and so far presented the potential of its electrolyte in new chemistries of rechargeable batteries.

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**Research Fields:**

Electrochemistry, Materials for electrode and electrolyte in rechargeable batteries, supercapacitors