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Preparation and properties of ionic liquid-based quasi-solid polymer electrolytes for high safer lithium batteries

Qingpeng Guo, Yu Han, Hui Wang, Chunman Zheng and **Kai Xie**
National University of Defense Technology, China

A new approach to solve the leakage problem and ameliorate interface performance of the lithium battery is proposed here. We designed quasi-solid electrolytes containing polymer matrix of poly(vinylidene fluoride) (PVdF), ionic liquid of 1-ethyl-3-methylimidazolium triluorome thanesufonate (EMITFSI) and bis(trifluoromethane)sulfonimide lithium salt (LiTFSI) as the main components with solution casting method to form electrolyte membrane (ILQsPEs). Meanwhile, the small molecule of solvent EC and PC were used as additives for the modification in ionic liquid. ILQsPEs were found to have considerable ionic conductivity after activated by the mixed solvent, which represents a very good compromise high safety and good performance. At the same time, the Li/$LiCoO_2$ cell with this electrolyte exhibit certain cycling performance, the results indicate that a small amount of free-active solvent molecules on the electrolyte surface enables the construction of an "ionic liquid bridge" between the electrode material and the quasi-solid electrolyte, which ameliorated the interface and accelerated the migration of Li^+ between the electrode active material and the electrolyte. The most of liquid components was confined in the polymer matrix to avoid the occurrence of battery leakage, which is suggested as a promising for high safer lithium batteries.

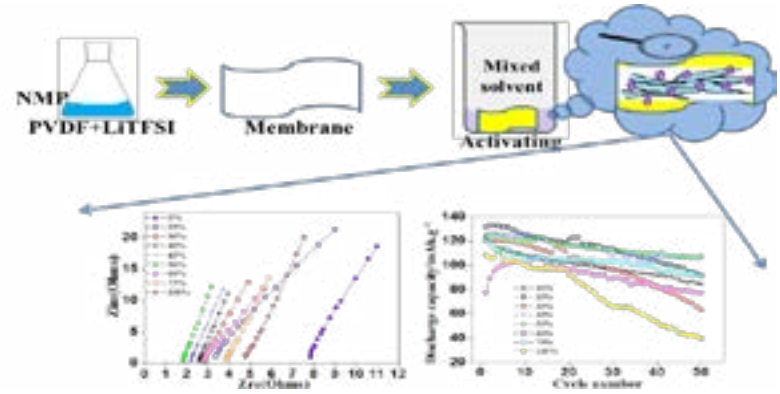

Figure 1: The scheme of the preparation of ILQsPEs, Nyquist plots of steel/ILQsPEs/steel with different mass percent ionic liquids at high frequency and cycle performance of Li/ILQsPEs/$LiCoO_2$ cells.

Biography

Qingpeng Guo is a Doctoral student in the College of Aeronautics and Materials Engineering, National University of Defense Technology, China. He studies energy materials and their electrochemistry, and the current research direction is the design of safe electrolyte for lithium batteries including ionic liquid electrolytes, gel polymer electrolyte and solid polymer composite electrolyte as well as their applications in lithium storage and conversion.

qingniao36@163.com

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