Mixture of Ionic Liquid and Organic Carbonate as an Electrolyte for LiFePO₄ Battery

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In the interest of expanding the available options for safe and inexpensive electrolyte in lithium ion batteries, we examined a novel electrolyte consisting of 30% IL (triethylmethylammonium bis(trifluoromethylsulfonyl)imide, N1222-TFSI) mixed with 70% commercial carbonate electrolyte (EC/DMC = 1:1 by wt%, 0.78 mol kg⁻¹ LiPF₆) to form a hybrid electrolyte. The hybrid electrolyte failed to ignite after exposure to flame, a demonstration of high thermal stability. The aluminum corrosion is inhibited in N1222-TFSI mixed carbonate electrolyte, while the N-methyl-N-propylpyrrolidinium TFSI mixed carbonate electrolyte experienced serious pitting corrosion. The electrolyte has been observed with the LiFePO₄ as positive electrode and the mesophase graphite as negative electrode in 18650 full cells. The electrochemical properties of hybrid electrolyte for the LiFePO₄ electrode at 25°C and 60°C showed improved performance at high temperature in comparison to commercial electrolyte EC/DMC (1:1 by wt%) 0.78 mol kg⁻¹ LiPF₆. Vinylene carbonate (VC) as electrolyte additive in hybrid electrolyte at 2% addition was found to enhance the cycling performance at 25°C and 60°C, however a decrease in cell performance was observed at -10°C.

Keywords: lithium-ion batteries, vinylene carbonate, ionic liquid, triethylmethylammonium bis(trifluoromethylsulfonyl) amide

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