Lithium-Sulfur Batteries : Electrolytes and alternative anodes

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The commercialization of Lithium-Sulfur (Li-S) batteries is limited by some short cycle life, low cycling efficiency, poor safety and high self-discharge rate.These drawbacks are associated with loss of sulfur active materials due to high solubility of polysulfide intermediates in electrolyte and cause internal shuttle phenomenon. It must be considered that partial dissolution of polysulfide formed on cathode is essential to create fresh active sites. Herein we report the effect of pyrrolidinium based ionic liquids (IL) on Li-S battery performance. A wide range of IL percentage with different types of separators were examined .The combination of a suitable separator and PYR13TFSI as electrolyte additive shows stable capacity around 600 mAh/g for more than 50 cycles.

Silicon is one of the most promising anode materials for lithium-ion but also post lithium-ion batteries: it shows a low working potential and is the second abundant element on the earth crust. The theoretical capacity of silicon at room temperature is 4200 mA h /g based on the fully alloyed form of $Li_{4.4}$ Si. However, the semiconducting nature of silicon restricts its use as anode material. In addition, its large volume change during cycling, more than 300%, causes a serious pulverization of electrode and loss of electrical contact between Si and the current collector, which leads to rapid capacity decay during cycling. This contribution reports the initial results of Si@CNS-rGO anode obtained by embedding silicon nanoparticles in pyrolised cyclodextrin based nanosponges (CNS) and consequently wrapping with rGO sheets. The promising first results obtained and the synthesis characteristics, being simple and low cost, make this an interesting new way to obtain an anode alternative to graphite, which can be easily scalable at industry level.

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