The Improvement of Cycling Performance for Lithium-Sulfur Battery

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The lithium-sulfur battery has excellent theoretical energy density (2567 Wh/Kg^{-1}), based on the combination of lithium anode (~3860 mAh/g) and sulfur cathode (~1675 mAh/g). It already becomes one of the most popular candidates as high-energy storage devices for next generation [1-2].

However, the performance of lithium-sulfur battery is strongly limited by insulative sulfur, dissolution and shuttle effect of polysulfide in liquid electrolyte [2]. For example, the continue dissolution of polysulfide into electrolyte will cause electrochemical active materials detach from conductive framework and aggravate the loss of reversible capacity.

In this study, we develop a new system for Li-S battery to overcome its own considerable challenges. First, the carbon/sulfur composite cathodes with higher conductivity and better porous structure can be well-prepared through particular procedure. As shown in figure 1, the composite cathode clearly shows higher initial capacity and better capacity retention during cycling test. Because of improving electric contacts, the new carbon/sulfur composite cathodes can also improve high-rate capability (1.0C) (Fig. 2).

Second, the new type hyperbranched polymer electrolyte plays an important role in retarding dissolution of polysulfide, suppressing the shuttle effect and preventing contamination of lithium metal. More details will be including in this report.

The whole assembly procedure is conceptually providing a new opportunity for energy device design that can be commercialized in near future.

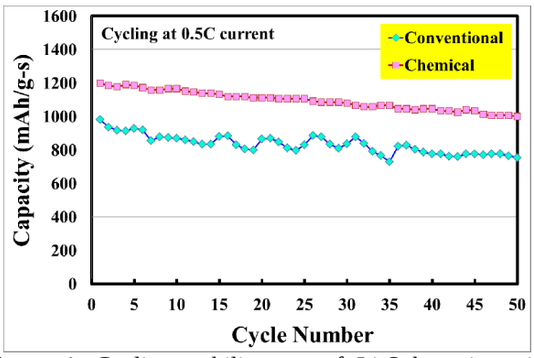

Figure 1. Cycling stability test of Li-S batteries with different composite cathodes at 0.5C current.

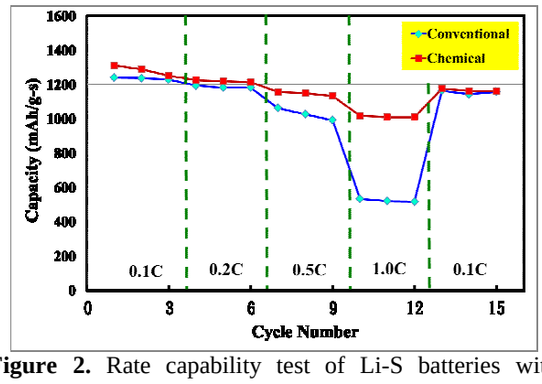

Figure 2. Rate capability test of Li-S batteries with different composite cathodes.

Referemce:

[1] X. Ji; K. T. Lee; L. F. Nazar, *Nat. Matter.*, ***2009***, 8, 500.
[2] X. Ji; L. F. Nazar, *J. Mater. Chem.*, ***2010***, 20, 9821.