The Change of Electrochemical Properties of Li/S Batteries with Discharge Rate

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Introduction

The lithium/sulfur cell was an extremely attractive redox couple because of high theoretical specific energy of 2600Wh/kg(1672mAh/g-sulfur), assuming complete reaction to the Li_2S.

The successful development of a lithium sulfur battery requires extensive research on the electrochemical behaviors under various operation conditions.[1,2,3,4,5] Cheon et al. reported that the capacity of Li/S cell decreased with the increasing of current density and thick Li_2S layer formed at the surface of the cathode causes the diminution of the second discharge region at high discharge rate by using the scanning electron microscope (SEM).[6]

In this paper, the performance changes of the lithium/sulfur (Li/S) battery with discharge rate are reported. The change of sulfur electrode was tested by scanning electron microscopy (SEM), X-ray diffracto-meter (XRD), differential scanning calorimeter (DSC) et al. Based on the above analysis results, we tried to find factors that affects the rate capability of the Li/S batteries.

Experiment

Sulfur electrodes were prepared by mixing sulfur, carbon black and PEO powders. The composition of electrode is 70wt% sulfur, 15wt% electric conductor, 15wt% PEO. The slurry is mixed by attrition ball milling for 2h, and then is cast on the Al current collector.

The solution of 0.5M $LiCF_3SO_3$ in tetraethylene glycol dimethylether (Tetraglyme, TG) was used as an electrolyte.

The configuration of the Li/S cells is Li(350㎛ thick, Aldrich)/celgard with electrolyte/sulfur electrode. All assemblies of the cells are carried out in argon-filled glove box. Cell tests were conducted under galvanostatic conditions using a WBCS3000 to 1.5V with various discharge rates at room temperature.

In order to investigate the changes of Li/S batteries with discharge rate, we tested by using XRD, DSC, SEM, and Energy Dispersive Spectrometer (EDS).

Results

Figure 1 showed changes of capacities with current densities. The Li/S cell showed above 80% sulfur utilization at very low current density.

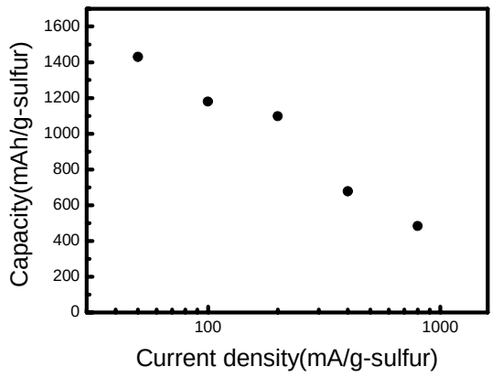

Fig. 1. The capacities change of Li/S cells with current densities

References

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