The addition of nano material to the sulfur electrode for lithium/ sulfur battery

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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. However, it was very difficult to make a high utilization Li/S cell because of high resistivity and reactivity of sulfur.[1,2] Recently, some researchers overcame the problem of the insulating character of elemental sulfur in composite cathode by homogeneous mixing of an electronically conductive material such as carbon black powder.[3,4]

However, the discharge capacity decreased drastically during charge-discharge cycling.[4] Gorkoyenko mixed the vanadium oxides, silicates, aluminum oxide to the sulfur electrode.[5] And, Han et al[6] reported the cycle life of Li/S battery could be improved by addition of MWNT to the sulfur electrode.

In this study, we investigate to the effect of the addtion of nano material and the optimum amount of nano-material in sulfur cathode for Lithium/Sulfur battery.

Experiment

Sulfur electrodes are prepared from a mixture of sulfur (Aldrich), carbon black (Aldrich), nano material and PEO (Aldrich) in ACN (Aldrich).

The electrode of composition is 50wt% sulfur, 30wt% electric conductor, 15wt% PEO and 5wt% Li-salt. The electric conductor was mixture of carbon black powder and nano material. The ratio of nano material to carbon black was changed from 0% to 30%.

The slurry is stirred for 24h before attritor ball milling for 2h.

The electrolyte consisted of organic solvent of 0.5M $LiCF_3SO_3$ in tetraethylene glycol dimethylether (Tetraglyme, TG) as plasticizer.

The configuration of the Li/S cells is Li(350□ thick, Aldrich)/celgard with electrolyte/complex 50% 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 between 1.5 and 3.4V with current density of 100mA/g-sulfur at room temperature. The morphology of sulfur electrodes and carbon nano material were examined using scanning electron microscopy (SEM, JEOL,.JSM-6400).

Results

Fig. 1. showed the SEM photograph of carbon nano tube which was used as electronic conductor

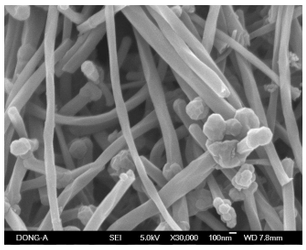

Fig. 1 SEM photograph of carbon nano tube

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