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A Study on Discharge properties of the lithium battery as active material FeS₂ Composite Powder fabricated by Mechanical Alloying Method

Woo-Hyun Jung*, In-Shup Ahn, Hyo-Jun Ahn, Bong-Seok Ko, Sang-Won Lee, Sung-Yeal Bae
Division of Materials Science and Engineering & ERI
Gyeongsang National University, Chinju, Kyeongnam 660-701, Korea.

1 Introduction.

In recent years, according to the popularization of the electronic equipment such as cellular phones, laptop computers and camcoders, the development of the advanced secondary battery for power source is proceeded extensively. To comfortably carry, small and light batteries are preferred.

As the electrodes of the secondary battery are made of lithium and sulfur, the batteries have excellent electrode system because of the light weight of the lithium, the high electronic density, rich resources and low cost. Although Li/S battery has good initial discharge capacity, it has poor cycle characteristic due to the loss of the active material. With this reason, the material of metal sulfide series is recently being studied as substitute.

In this study, the possibility of FeS₂ compound powder which has fine particle size was examined by using MA method and the discharge capacity was measured.

2. Experimental.

2-1 Preparation of FeS₂ composite powder.

Elemental powders of iron(99.99%, 44 μ m, Hönanäs Co.), sulfur(99.99, 40 μ m, DEAJUNG Co.) were mixed to a composition of Fe-66.6at.%S. The initial weight of the powers before MA 40g and the balls-to-powder weight ratio was approximately 40:1. The mechanical alloying process was carried out in a horizontally high-energy attritor-type(Zoz Simoloyer) under argon atmosphere at room temperature up to 30h with a discontinuous rotating speed of 1000rpm for 4minutes and 300rpm for 1minutes.

2-2 Discharge properties of the lithium battery as active materials.

The electrochemical cells comprise a lithium anode, a liquid electrolyte consisting of tetra ethylene glycol dimethyl ether(10ml)+LiF₃SO₃(1.56g), a composite cathode comprising FeS₂ composite powder.

The fabricated cell were carry out an experiment in discharge with rest time for 2h, discharge currents were 50mAh/g-FeS₂ and cut-off voltage of charge were 0.9v.

3.Results and Discussion.

The XRD pattens confirm the phase of FeS₂ composite powder fabricated after ball milling for 20hrs. From the SEM morphologies and the result of particle analazer, the mean partcle size was 0.64 μ m at ball milled powder for 30hrs.

The initial discharge capacity of Li/FeS₂ battery was 430mAh/g-FeS₂ at the milled powder for 20hrs and 910mAh/g-FeS₂ at the milled powder for 30hrs.