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Conductive polymer coated sulfur cathode for increasing performance of Li-S rechargeable battery

玄, 晶銀

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氏　　名　：ヒョン　ジョンウン

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論　文　内　容　の　要　旨

Sulfur is basically electrically-nonconductive material, so it is important to enhance the conductivity of the electrode. Therefore, before enhancing the sulfur cathode material using the conductive polymer, we studied the sulfur electrode with various parameters such as binder, conductive material and electrode loading to synthesize the electrode efficiently. The main objective of this study is to improve the cycle stability of sulfur cathode for Li-S rechargeable battery. Since preventing the dissolution of S into electrolyte during discharge process is an important issue for increasing cycle stability, effects of electrode component and also optimization of coating polymer on sulfur are main objective of this study

In Chapter 2, I investigated the prepared high density electrode as well as electrolyte on the discharge energy density and cycle stability of Li-S battery system. I developed the effective polymer binder material and conductive material, and optimizing the electrode loading by analyzing of the electrochemical characteristics. We also focused on the rate capability of lithium sulfur battery, and it was found that rate property can be increased by optimizing carbon, binder, PANi coating, electrolyte and salt concentration.

In chapter 3, I developed the polypyrrole-sulfur composite. The dissolution of polysulfides from the cathode remains a key roadblock in the advancement of Li-S batteries. In this work, the possibility of using sulfur-polypyrrole composite cathodes was studied for suppressing polysulfide dissolution.

In chapter 4, I tested with other conductive polymer, PANi. A polyaniline (PANi)-coated sulfur cathode was prepared by in-situ polymerization to improve the performance of Li–S batteries and prevent polysulfide dissolution. As PANi polymerization requires only the addition of sulfur powder, the polymerization method was simple. A highly homogenous distribution of sulfur particles in PANi was achieved, resulting in sulfur-coated composite materials and allowing for the preparation of a conductive polymer by a relatively simple sulfur distribution method.

In chapter 5, results of this study were summarized and future view of Li-S battery will be discussed