C/Fe_3O_4 composite as a negative electrode for rechargeable secondary batteries

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Nowadays, secondary battery, in particular, lithium-ion batteries mounted in portable devices are inevitable to sustain our daily life. To use the devices longer, of course, capacity and its retention of the active materials such as metal, alloy, oxides, fluorides, and sulfides, are greatly important. Among them, metal oxides are of interest because of their reaction related to repetitive insertion-conversion process that delivers higher capacity than conventional graphite materials. Among transition metal oxides, iron oxide is promising negative electrode material in terms of material cost, non-toxicity and abundance.

In the present study, $FeCl_3 \cdot 6H_2O$ was dissolved in ethylene glycol to form yellowish solution. Sodium acetate, poly ethylene glycol and sucrose were then added in yellowish solution to produce brownish solution with vigorous stirring for 30min. The brownish solution was transferred into Teflon lined stainless autoclave and hydrothermally treated at 200^oC for 48h. The black precipitates were collected and washed with ethanol and distilled water for several times and then dried at 80^oC for 24h. Also, the synthesized products were characterized by XRD, SEM, and TEM. Electrochemical properties of magnetite powder were examined by galvanostatic cycle test and electrochemical impedance spectroscopy.

As a result, the synthesized powders were crystallized to magnetite without impurities. Spherical morphology was observed and the particle size measured ranged 250-300nm. Electochemical test showed that the synthesized magnetite, Fe_3O_4, delivered a specific capacity of 750mAhg^{-1} with good rate capability in operation range of 0.5-2.5V. Application was also made to confirm the reactivity against sodium. We found that the synthesized Fe_3O_4 showed the capacity of about 200 mAhg^{-1} reversibly in Na cell. Details will be discussed in the conference site.