Synthesis and Characterization of Maghemite as an Anode for Lithium-Ion Batteries

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Thermal decomposition method were used to synthesize magnetite nanoparticles which then oxidized to maghemite. Simultaneous thermal analysis, X-ray diffraction, and Fourier transform infrared spectroscopy disclosed the formation of iron-urea complex and also revealed pathway of iron oxide formation from iron-urea complex in thermal decomposition method. It was demonstrated that the iron-urea complex calcined at 450°C in argon resulted in the formation of magnetite. The magnetite were heated at 230°C for 2h to be oxidized to maghemite. The formation of maghemite were confirmed using Mössbauer spectroscopy. The average particle size of obtained maghemite was estimated 43nm using field emission scanning electron microscopy and high-resolution transmission electron microscopy. The anode body was doctor bladed using maghemite with carbon black and polyvinylidene difluoride powder. Electrochemical performance of this anode in lithium-ion battery was further investigated by cyclic voltammetry and galvanostatic charge–discharge. Galvanostatic charge–discharge cycling at current density of 50 mA g⁻¹ showed a reversible capacity of 538 mAh g⁻¹. The reason for this competent performance was thought to be dependent upon the size of particles.

Keywords: Maghemite; lithium-ion battery; anode; thermal decomposition; nanoparticles

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