Nano-sized Tin Oxide-Modified Graphite Composite as Efficient Anode Material for Lithium Ion Batteries

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Nano-sized tin based compounds dispersed graphite composites, synthesized by the electroless plating process and pyrolysis method, act as efficient anode materials for lithium ion batteries (LIBs). The nano-sized tin complexes on the graphite surface can be obtained through a simple chemical reaction between $\text{Sn}(\text{BF}_4)_2$ and $\text{Na}_2\text{S}_2\text{O}_4$ in aqueous solution and completely converted to SnO_2 after pyrolysis. The synthesized tin-modified graphite composites were characterized by X-ray diffraction (XRD), field-emission scanning electron microscopy (FE-SEM), and high-resolution transmission electron microscopy (HRTEM). The electrochemical performance of the composites for application as anode materials in lithium-ion batteries was investigated. The average particle size of nano- SnO_2 is ~ 14.7 nm, as determined by HRTEM. Results of infrared spectra and electrochemical properties indicate that such an optimized nano Sn-based compound on graphite influences the formation of the thin solid electrolyte interface (SEI) in the electrode and thus improves the cycling performance, with high efficiency of 97.3% in LIBs. Nyquist plots show that during Li^+ intercalation, the thin SEI film and the low charge transfer resistance of SnO_2 -modified graphite composite anode plays important roles in improving the electrochemical properties of LIBs.

Keywords: Graphite; SnO_2 ; Anode; Electroless method; Lithium ion battery

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