TiO₂ Microparticles/Reduced Graphene Oxide Composite as Anode Material for Lithium Ion Battery

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doi: 10.20964/2020.03.11

Received: 12 August 2018 / Accepted: 5 December 2019 / Published: 10 February 2020

Over the past decade, anatase phase titanium dioxide (TiO₂) has attracted a great deal of attention as one of the most promising electrode materials for lithium ion batteries due to its safety, eco-friendliness, price and excellent properties such as high operating potential (~1.75 V vs. Li/Li⁺), chemical and mechanical stability. This work presents an extensive study of the TiO₂ micro particles-based electrode and the composites electrode of micro-TiO₂ with nano-multilayered graphene. Graphene was synthesized from Sri Lankan natural graphite and was characterized using XRD, FTIR, Raman and SEM. The electrochemical performance of the electrodes prepared with anatase TiO₂ micro particles and TiO₂/graphene composites has been tested using constant current charge/discharge studies. TiO₂ electrode shows a discharge capacity of 141.5 mAh g⁻¹ in the 1st cycle and that of 111.2 mAh g⁻¹ after 50 cycles with an initial irreversible capacity loss of 12.3% and a coulombic efficiency of 99.1%. TiO₂-graphene composite electrode shows discharge capacities of 159.2 mAh g⁻¹, 143.0 mAh g⁻¹, 143.0 mAh g⁻¹ in 1st, 50th and 100th cycles, respectively with significantly small initial irreversible capacity loss of 6.5% and a coulombic efficiency of 99.5%. Moreover, this composite presents high material stability at high current rates and good cycle performance.

Keywords: Anatase TiO₂, Lithium ion batteries, Sri Lankan natural graphite, graphene oxide, graphene

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