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NANO-STRUCTURED TiO_2-B FOR LITHIUM-ION BATTERY APPLICATIONS

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Many researchers have investigated electrode materials for the lithium-ion battery (LIB) industry in the past decade. Among them, titanium dioxide (TiO_2) has attracted a great deal of attention due to its excellent properties, such as high operating potential, chemical and mechanical stability. However, the poor electrical conductivity and low ionic diffusivity are the main obstacles that hinder the production of high-performance LIBs with Titanium anodes. These drawbacks can be minimised by adding (a) conductive additives, (b) controlling the morphology, respectively. This work presents an extensive study of the TiO_2-B nanobelts-based electrode with the reduced graphene oxide (rGO). As a conductive additive, rGO (~5 layers) was synthesised using Modified Hummer's method. The optimum hydrothermal temperature for growing TiO_2 nanobelt was noted as 176 °C. The length of the synthesised TiO_2-B nanobelt was between 410 nm & 15 µm with an average width of 45 nm. The electrochemical performance of the TiO_2-B/rGO composite anode was tested using constant current charge/discharge studies in the potential range of 1.0 – 3.0 V vs Li/Li^+. The first discharging and charging capacities were 177.2 and 138.9 mA h g^{-1}, respectively. The second discharge and charge capacities were 142.7 and 137 mA h g^{-1}, respectively. The composite anode material of LIB's shows low cyclic performance and retained a low discharge capacity of 112 mA h g^{-1} over 80 cycles, which is a significant capacity loss. A possible capacity fading mechanism will be discussed.

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Keywords: Hydrothermal temperature, Lithium-ion battery (LIB), Reduced graphene oxide(rGO), TiO_2-B