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V₂O₃/rGO composite as a potential anode material for lithium ion batteries

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Abstract V₂O₃ is a promising anode material and has attracted the interests of researchers because of its high theoretical capacity of 1070 mAh g⁻¹, low discharge potential, inexpensiveness, abundant sources, and environmental friendliness. However, the development and application of V₂O₃ have been hindered by the low conductivity and drastic volume change of V₂O₃ composites. In this work, V₂O₃/reduced graphene oxide (rGO) nanocomposites are successfully prepared through a facile solvothermal method and annealing process. In this synthesis protocol, V₂O₃ nanoparticles (NPs) are encapsulated by rGO. This unique structure enables rGO to inhibit volume changes and improve the ion and electronic conductivity of V₂O₃. In addition, V₂O₃ NPs, which exhibit sizes of 5–40 nm, are uniformly dispersed on rGO sheets without aggregation. The Li⁺ storage behavior of V₂O₃/rGO is systematically investigated in the potential range 0.01–3.0 V. The V₂O₃/rGO nanocomposite can achieve a high reversible specific capacity of 823.4 mAh g⁻¹ under the current density of 0.1 A g⁻¹, and 407.3 mAh g⁻¹ under the high current density of 4.0 A g⁻¹. The results of this study provide insight into the fabrication of rGO-based functional materials with extensive applications.

Keywords: lithium-ion battery, vanadium trioxide, reduced graphene oxide, nanoparticles

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