Si-Ti Oxide/Reduced Graphene Oxide Nanocomposite Anodes with Enhanced Capacity and Stability for Lithium-Ion Batteries

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Although, silicon (Si) is a promising high capacity anode material for Li-ion batteries (LIB), it suffers from rapid capacity fading due to extremely large volumetric expansion(>300%) upon Li insertion/extraction. To address these issues, in this work Si−Ti oxide/rGO nanocomposite was prepared by mild mechanical ball milling of Si nanoparticles, titanium (Ti) oxide nanoparticles, and rGO nanosheets, followed by thermal treatment to reduce TiO_2 (Ti^{4+}) to Ti_2O_3 (Ti^{3+}). In particular, Ti oxide in the Si-based anode provides the role of the matrix to alleviate the stress caused by the volume change of the Si structure and enhances electron and ion transport during the repeated cycling. As a result, the novel Si-Ti oxide/rGO nanocomposite exhibits the significantly improved reversible capacity and cycling stability. We anticipate that this system would further be extended to other nanocomposites as high-performance anode materials for Li-ion battery applications.