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TiO_2 Coated Si/C interconnected Microsphere with Stable Framework and Interface for High-Rate Lithium Storage

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Abstract:

Si is considered as the most promising anode material for lithium ion batteries (LIBs) because of the high specific capacity (3579 mAh g^{-1}). However, the huge volume changes (> 300%) causes structural cracking and unstable solid state electrolyte (SEI) film, leading to fast capacity fading. Herein, TiO_2 coated Si/C-interconnected microsphere (Si/C@TiO_2) with dual-protection is designed and fabricated via a two-step procedure. In this composite, the inner flexible carbon and outer rigid TiO_2 layer work together to maintain the structural integrity, stabilize the SEI film, and enhance the conductivity of the anode composite. As a result, the obtained Si/C@TiO_2 composite delivers a reversible capacity of 1077.3 mA h g^{-1} at 0.2 A g^{-1} after 100 cycles, capacity retention of 58.4% at even 10 A g^{-1}, and improved coulombic efficiency. In addition, a full cell consisted of Si/C@TiO_2 anode and $LiCoO_2$ cathode exhibits a reversible capacity of 1048 mAh g^{-1} at 0.2 A g^{-1} and 820 mAh g^{-1} at 1.5 A g^{-1} based on the anode active material with a working potential beyond 3.1 V.