One-pot Synthesis of radial ZnO microparticles deposited on graphene nanosheets as the Anode Materials for Lithium-Ion Batteries

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A novel ZnO/graphene nanosheet (ZnO/GN) composite has been successfully synthesized by a facile one-pot hydrothermal method. ZnO micro-particles, with the quasi-spherical radial morphology, are uniformly deposited on the wrinkled GN. According to the hydrothermal method used and characterization results observed, the formation process is proposed. When adopted as anodes for lithium-ion batteries, the ZnO/GN composite shows enhanced cyclability and rate capability compared with the pristine ZnO counterpart. The ZnO/GN electrode could yield a discharge capacity of 620 mAh g⁻¹ at the 2nd cycle with the corresponding coulombic efficiency of 71 % over 100 cycles at 0.2 A g⁻¹. In addition, the ZnO/GN composite exhibits a good rate capability with discharge capacity of 132 mAh g⁻¹ at high current density of 3.2 A g⁻¹. This improved electrochemical performance stems from the positive combinative effects of both radial microparticle structure of ZnO and GN additives, wherein radial ZnO microparticle provides a large surface with a short ion transport and electrolyte diffusion length and GN renders a flexible robust conductive matrix, buffering the large volume changes during the charge/discharge processes.

Keywords: lithium ion battery; ZnO/graphene nanosheet composite; anode; one-pot hydrothermal; energy storage

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