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Time-efficient synthesis of MnO_2 encapsulated α-Fe_2O_3 ellipsoids for lithium ion battery applications

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Abstract

Herein, Fe_2O_3 was enlisted as an environmentally benign and inexpensive anode active material. A facile time-efficient synthesis strategy was developed to prepare hematite Fe_2O_3 ellipsoid particles via hydrothermal method. The structural and morphological properties of the prepared materials were characterized using XRD, FE-SEM, HR-Raman, and HR-TEM. The electrochemical properties were investigated using galvanostatic cycling, cyclic voltammetry, and impedance spectrum analysis. To further overcome the drawbacks of α-Fe_2O_3 ellipsoids, a MnO_2 coating was applied. The encapsulated α-Fe_2O_3 ellipsoids exhibited improved electrochemical properties, such as a high specific capacity, high coulombic efficiency, stable cyclic performance, and a high rate capability. The improved electrochemical performance of the ellipsoids could be attributed to the uniform and continuous MnO_2 layer coatings, yielding an enormous advantage through the sustained integrity of nanoparticles, stimulating the electronic conductivity of electrode materials leading to the formation of a thin SEI (Solid Electrolyte Interphase) layer on the electrode surface, and by maintaining the as-formed layer. The obtained results demonstrated MnO_2 encapsulated α-Fe_2O_3 ellipsoid particles as a superior anode material for lithium ion batteries compared to bare α-Fe_2O_3 and commercially available graphite electrodes.

Keywords: Anode, Hydrothermal, Ellipsoid, Coating, α-Fe_2O_3

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