An Electrostatic Self-Assembly of Amine-Functionalized Fe_3O_4 Nanoparticles with Graphene Oxide and Its Application for Li-ion Battery Anodes

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Magnetite, Fe_3O_4, is a promising anode material for lithium ion batteries (LIBs) due to its high theoretical capacity (924 mAh/g), high density, low cost and low toxicity. However, it is still hampered by the poor cycling performance caused by the severe aggregation and huge volume change of Fe_3O_4 particles during conversion reaction process. To stabilize the cycling performance of high capacity Fe_3O_4 nanoparticles, the Fe_3O_4/GS composites in which Fe_3O_4 nanoparticles were evenly distributed on graphene sheets (GS) by an electrostatic self-assembly. Fe_3O_4/GS samples were prepared by electrostatic self-assembly between negatively charged graphene oxide and positively charged amine-functionalized Fe_3O_4 nanoparticles in an acidic mixture (pH =2) of water and ethanol followed by chemical reduction. The Fe_3O_4/GS nanocomposites showed stable cycling performances with high rate capability due to efficient accommodation of volume changes during the conversion reaction process and good electrical contact between active materials and graphene sheets.