One pot synthesis of Mn_3O_4/graphene hybrids for high performance lithium ion battery electrodes

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There is great interest in developing highly efficient electrode materials for rechargeable lithium ion batteries (LIBs). Owing to their high theoretical capacities, nanostructured metal oxides have been widely studied as anode materials for LIBs.[1] Among various transition metal oxides, nanostructured Mn_3O_4 is an attractive material because of its high theoretical capacity, low toxicity, low cost and increased abundance.[2] However, their extremely low electrical conductivity, poor cycle stability and capacity fade still remain a challenging issue. To solve these drawbacks, Mn_3O_4/graphene nanocomposites have recently been demonstrated as efficient anode materials with improved electrochemical performances.[3] To further enhance the energy and power densities, it is important to make Mn_3O_4 nanostructures with controllable size and morphologies. Here we report the synthesis of Mn_3O_4 nanostructures with a novel morphology comprising of nano-octahedron embedded nanorods *via* a surfactant free hydrothermal method. Further, graphene composites with Mn_3O_4 nanostructures uniformly anchored on few-layered graphene sheets are prepared and their electrochemical properties have been studied as anodes for Li-ion battery. The structural and morphological characterization have been performed by using X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM), high resolution transmission electron microscopy (HR-TEM), Infra-red (IR) spectroscopy, Raman spectroscopy and Brunauer–Emmett–Teller (BET) surface area measurements. Electrochemical characterization has been performed by using cyclic voltammetry (CV), galvanostatic charge-discharge and electrochemical impedance spectroscopy (EIS) measurements. The Mn_3O_4/graphene hybrid electrode material showed improved electrochemical performance with a good cycling stability and rate performance. The obtained results are interesting and demonstrate a low cost, environmentally friendly anode material for lithium ion batteries.

References

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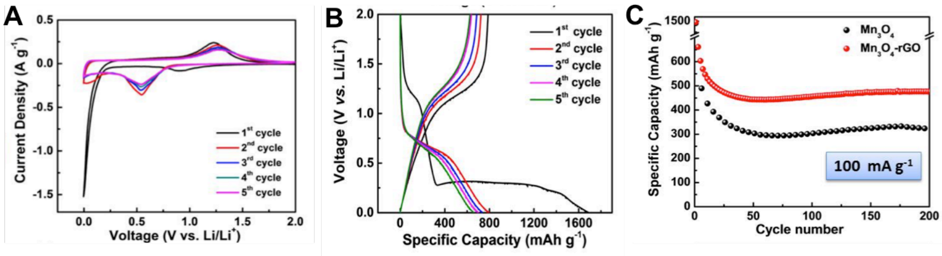

Fig 1. (A) Cyclic voltammogram, (B) Galvanostatic charge-discharge profiles and (C) Capacity *vs.* cycle number plot of Mn_3O_4/graphene composite electrode.