Reversible lithium insertion into magnetite anchored on graphene and carbon nanotubes

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Composites of graphene and other carbon nanostructures with transition metal oxides are widely regarded as promising electrode materials [1-4]. It his work, magnetite (Fe_3O_4) nanoparticles have been deposited onto graphene flakes and multi walled carbon nanotubes by means of an in-situ solvothermal reaction at several magnetite to carbon ratios. Magnetite nanoparticles are homogenously distributed onto the substrates. Electrochemical lithium cation insertion has been accomplished in two-electrode Swagelok-type cells with electrolyte consisting of 1M $LiPF_6$ in EC/DMC, using two techniques: galvanostatic charging/discharging and cyclic voltammetry. CV measurements revealed that important part of Li+ is located between the graphene layers in a manner similar to that found in graphitic materials, although the majority of the discharge capacity comes from Li+ insertion in the magnetite structure. Both in the case of graphene-supported and MWCNT-supported magnetite, high reversible capacities have been obtained, significantly exceeding those observed for pristine graphite (regarded as a benchmark material). Favourable electrochemical behaviour has been ascribed to a conductive networks provided by both types of carbon nanostructures, enabling effective charge propagation in the electronically insulating magnetite phase.

References

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Figures

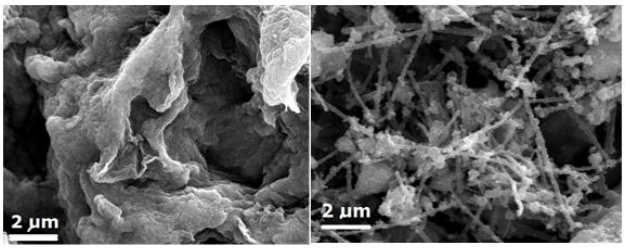

Figure 1: Comparison of SEM images of magnetite distributed on graphene (left) and MWCNT (right)

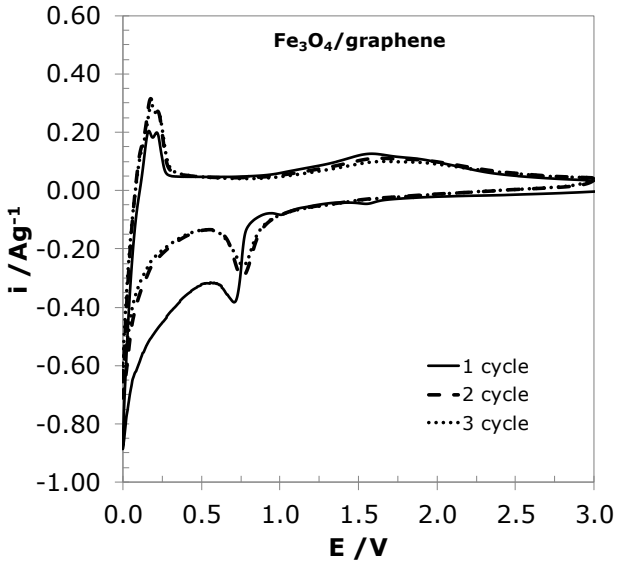

Figure 2: Cyclic voltammetry of the magnetite/graphene composite in a Li-ion battery electrolyte