Lithium-ion batteries (LIBs), with the use of sulfides as anode materials, are of research topic because of their high theoretical specific capacities. It is promising for rechargeable energy storage because of their high energy density and the extremely cheap materials. However, there is a problem that sulfides have low electrical conductivity and poor cycling performance. In this work, efforts were made in encapsulating sulfide particles with conducting substrate of graphenes to fabricate nanoporous sulfide/graphene composites for LIBs.

Graphene oxide (GO) was prepared by oxidizing graphite powder via modified Hummers method. We fabricated nanoporous sulfide/reduced graphene oxide (rGO) composites by one-spot solvothermal route. Samples were characterized with X-ray powder diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), energy dispersive X-ray spectroscopy (EDS), field emission scanning electron microscopy (FE-SEM), high-resolution transmission electron microscopy (HR-TEM), and N2 adsorption and desorption at 77K. Electrochemical characterization was carried by means of galvanostatic discharge-charge process, cyclic voltammetry and electrochemical impedance spectroscopy.

As shown in Figure 1, sulfides of several nanometers were uniformly distributed on graphene sheets. The sulfides nanoparticles also prevented the stacking of graphene sheets, which leads the high specific surface area of the composites. Electrochemical characterization showed that sulfide/graphene composites had a large reversible capacity and an excellent high rate discharge capability and long-term cycling performance as anode materials. The improvement in the electrochemical properties could be attributed to graphene nanosheets, which acts as an electron conductor, a support of dispersed sulfides and a buffer layer. While the highly nanoporous structures of the composites shortened the diffusion length for lithium ions, improving their reversible storage.

**Key words:** synthesis, nanopore, electrode, graphene, sulfur, composite, lithium, battery

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**References**

