Nanosized Fe$_2$O$_3$ on three dimensional hierarchical porous graphene-like network composites as high-performance lithium ion batteries anode materials

Qinwei Zhang, Yunyong Li, Pei Kang Shen*

The State Key Laboratory of Optoelectronic Materials and Technologies and Key Laboratory of Low-Carbon Chemistry & Energy Conservation of Guangdong Province School of Physics and Engineering, Sun Yat-sen University, Guangzhou, 510275, P. R. China

*E-mail: stsspk@mail.sysu.edu.cn

Metal Oxide-graphene nanocomposites have attracted much attention as high performance materials for lithium ion batteries and supercapacitors. The Fe$_2$O$_3$ on three dimensional hierarchical porous graphene-like networks (3D HPG) have been synthesized by a facile two-step method. First, the 3D HPG was synthesized by the ion-exchange/activation combination method using a metal ion-exchange resin as a carbon precursor at low temperature. Then, the nanosized Fe$_2$O$_3$ supported on the 3D HPG is synthesized by homogeneous precipitation. Characterization results show that the 3D HPG has an ultrahigh specific surface area, a high C/O atomic ratio and interconnected micro-, meso-, and sub-micrometer pores and the Fe$_2$O$_3$ nanoparticles are well dispersed on the 3D HPG. As an anode material for lithium ion batteries, the Fe$_2$O$_3$-3D HPG composites exhibit discharge capacity of 1745 mAh/g with excellent cycling performance (1083 after 50 cycles) and high rate capability. Importantly, the large-scale synthesis of nanosized Fe$_2$O$_3$-3D HPG composites can be achieved.