Graphene-based materials for lithium ions batteries

Hongbin Feng, Yongmin Wu, Jinghong Li
Department of Chemistry, Tsinghua University, Beijing 100084, China

As a new class of materials, graphene-based materials exhibit unique properties such as high surface area, lightweight, good electrical conductivity, compatibility with other materials, and controlled pore size distribution. A combination of extraordinary electrical, thermal, and mechanical properties makes graphene sheets not only attractive as atom-thick components in nanoelectronic devices, but also excellent molecular building blocks for assembling new macroscopic materials, ideal for energy storage devices. We are committed to develop high throughput material processing for high quality graphene sheets and create assembly of graphene based composite materials. These materials will act as active components in electrical energy storage, such as supercapacitors and batteries. We have designed a simple method by combining GO reduction and Sn^{2+} oxidation in one step by using just GO and $SnCl_2$ as reagents to yield SnO_2-nanocrystal/graphene-nanosheets composites. The electrochemical experiments showed that the cycle performance of composites was greatly enhanced and might pave a way to commercialize the composites electrode because of the simplicity. We also designed a facile and reliable method for the synthesis of $LiFePO_4$ (LFP) nanoparticles loaded on graphene with sucrose as a linker. These graphene composites could significantly facilitate the liquid electrolyte to pass through their surface, so that more surface sites would be accessible for lithium ions. The electrochemical experiments showed that the composites almost deliver approaching theoretical capacity and good cycling performance.

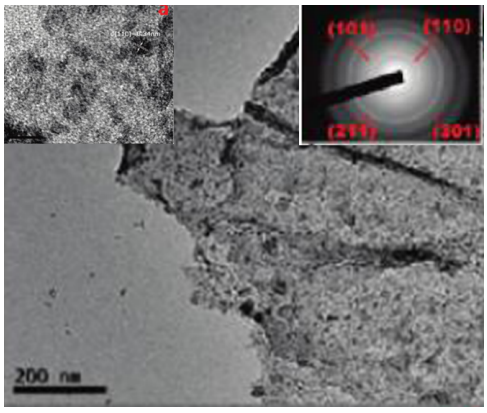

Figure 1. TEM images of SnO_2/G

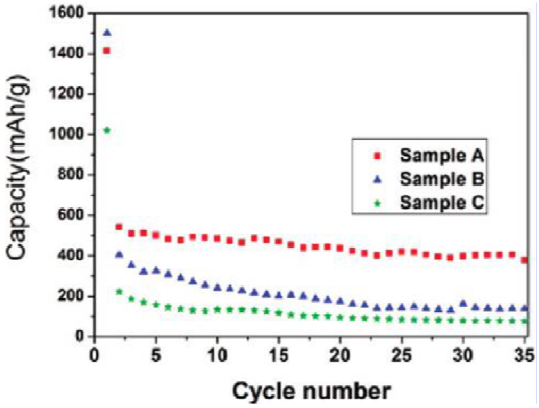

Figure 2. Cycle performance plot of SnO_2/G