**Electronic Supporting information (ESI)**

**Fe$_2$O$_3$ nanoparticles coated on ferrocene-encapsulated single-walled carbon nanotubes as stable anode materials for long-term cycles**

Jiaxin Li, Yi Zhao, Yunhai Ding and Lunhui Guan*

State Key Laboratory of Structural Chemistry, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, YangQiao West Road 155#, Fuzhou, Fujian 350002, P.R. China.

S1. Raman spectra of the SWCNTs and Fc@SWCNTs

**Fig. S1.** Raman spectra of the SWCNTs and Fc@SWCNTs with the excitation wavelength of 785 nm. The insets show the enlarged RBM and G regions. After doping with Fc, the charge transfer for SWCNT carrier is enhanced obviously, which
result is consistent with the Raman test shown in the following Fig. 2. Both RBM and G bands shifted slightly because of the charge transfer between Fc and host SWCNTs. The G band of the Fc@SWCNTs has a higher intensity, and the shoulder of G band (G' band) is broaden (see the inset in Fig. S1), indicating that the intercalation of Fc molecules into SWCNTs leads to n-doping. These would provide another proof to explain the improvement of conductivity for SWCNT carrier caused by Fc dopant.

S2. Cycling performance of Fe$_2$O$_3$/SWCNTs and Fe$_2$O$_3$ NPs

![Fig. S2](image-url)  

**Fig. S2.** Cycling performance of Fe$_2$O$_3$/SWCNT and Fe$_2$O$_3$ electrodes as a function of cycle number. Without carrier, Fe$_2$O$_3$ NP electrode sharply deteriorated due to the quick aggregation of NPs and the disconnection of the material. The capacity of Fe$_2$O$_3$ NPs dropped rapidly to 20 mAh g$^{-1}$ only after 10 cycles. The capacity for Fe$_2$O$_3$/SWCNTs (measured at 100 mA g$^{-1}$) was about 400 mAh g$^{-1}$ after 80 cycles,
which is notably lower than that of Fe$_2$O$_3$/Fc@SWCNTs (960 mAhr$^{-1}$). The enhanced performance can be surely obtained by filling ferrocene.

S3. Electrochemical impedance spectra for Fe$_2$O$_3$/Fc@SWCNTs

![Electrochemical impedance spectra](image)

**Fig. S3.** The electrochemical impedance spectra for Fe$_2$O$_3$/Fc@SWCNT electrode before and after electrochemical test. Conductivity for this electrode remarkably enhanced after test, resulting in the improvement of electrochemical performance.