Porous Olive-Like Carbon Decorated Fe_3O_4 Based Additive-Free Electrode for Highly Reversible Lithium Storage

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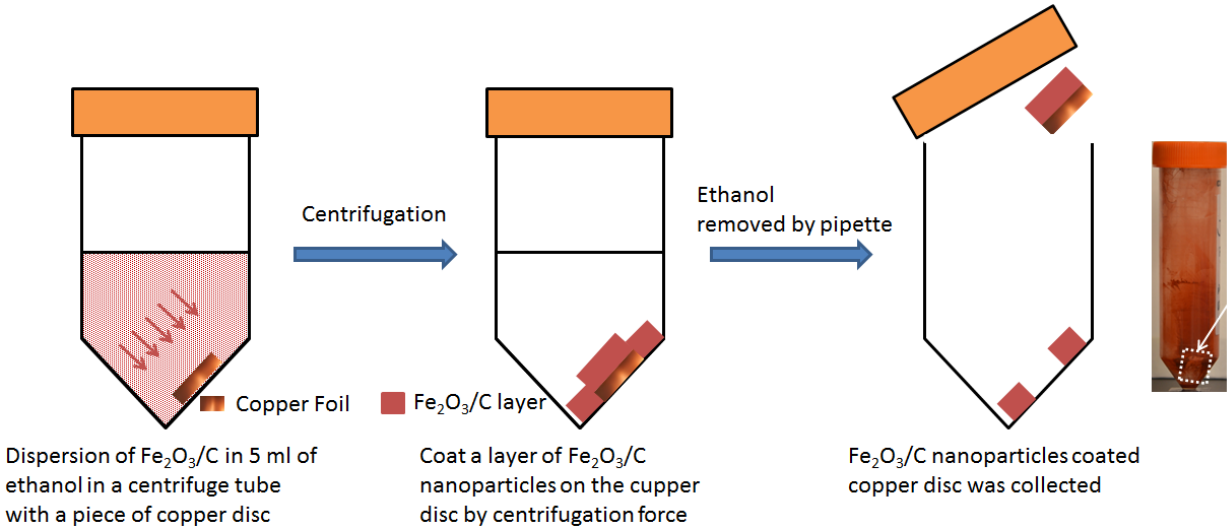

Figure S1. Schematic of the process of centrifugation-assisted preparation of additive-free electrode of olive-like Fe_2O_3/C coated directly on copper current collector. Optical image of the centrifuge tube after coating and the dash square highlighted the location of olive-like Fe_2O_3/C coated on copper current collector collected.

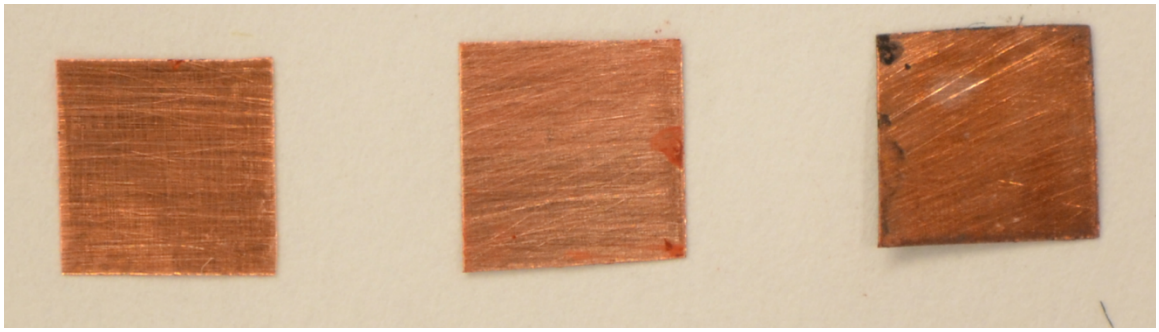

Figure S2. The corresponding optical image of the other side of Cu discs at each step of treatment showing that no Fe_2O_3/C layer or Fe_3O_4/C layer coated on the other side of copper discs: from the left to the right, back view of bare → Fe_2O_3/C layer coated → Fe_3O_4/C layer coated Cu discs.

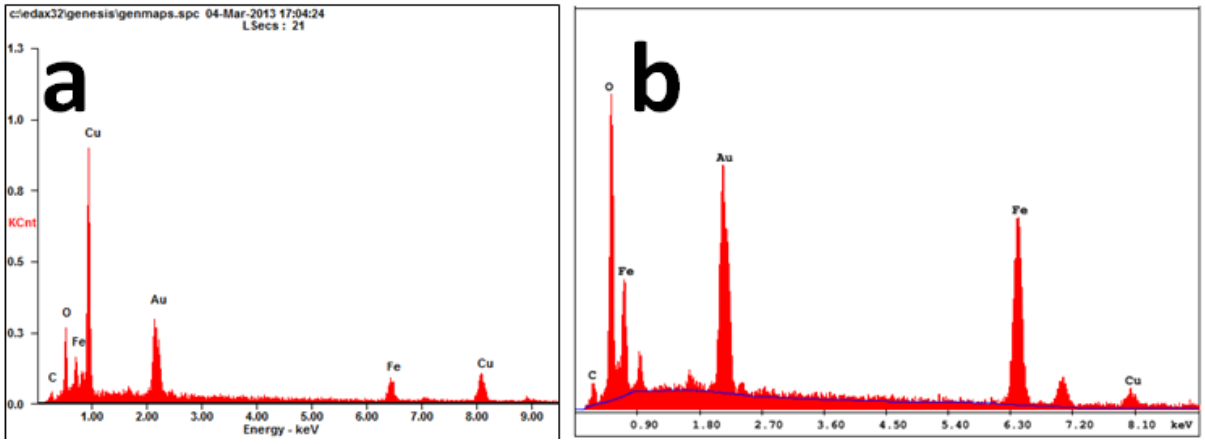

Figure S3. EDS analysis of (a) precursor of olive-like Fe_2O_3/C, and (b) carbon decorated Fe_3O_4 obtained by *in-situ* carbothermic partial reduction of the precursor. Au and Cu peaks are from sample coating and sample holder respectively.

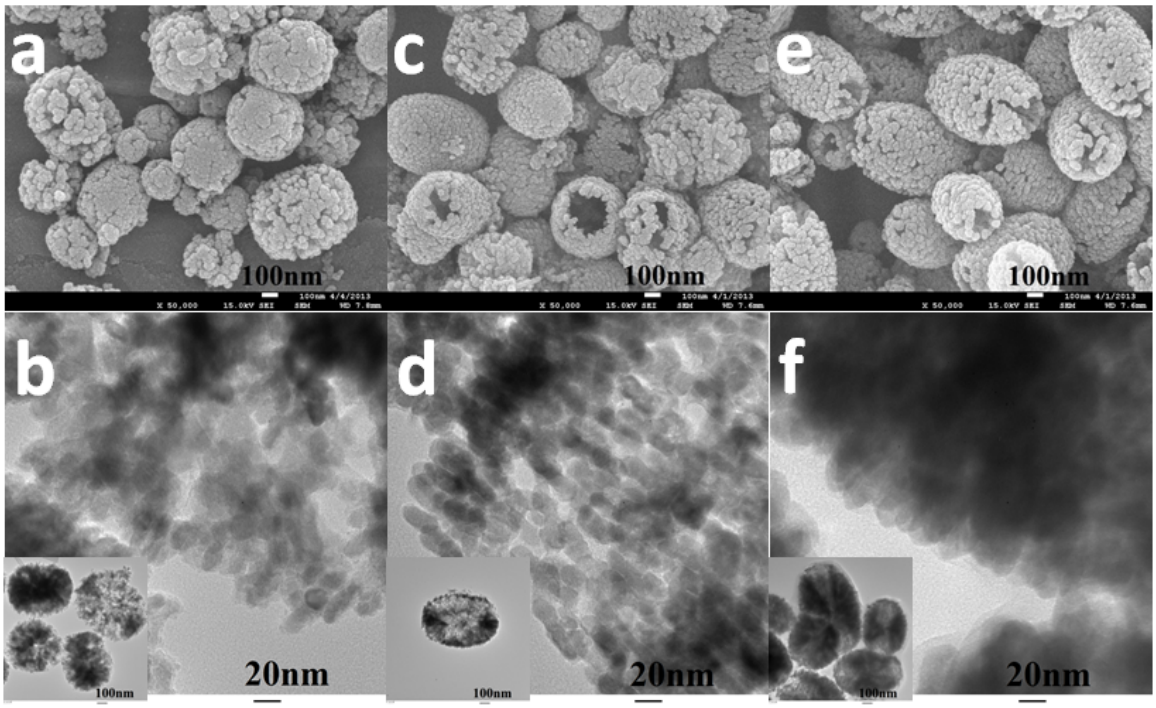

Figure S4. Effect of amount of glucose: FESEM images (top row) and TEM images (bottom row) of Fe_2O_3/C nanoparticles prepared with (a, b) 0.4, (c, d) 0.2 and (e, f) 0.1 mmol of glucose. Insets of (b,d,f) are low magnification TEM images with scale bar of 100 nm. The reaction time was 3 h instead of 75 min. Interesting hollow structures were observed with prolonged reaction time.

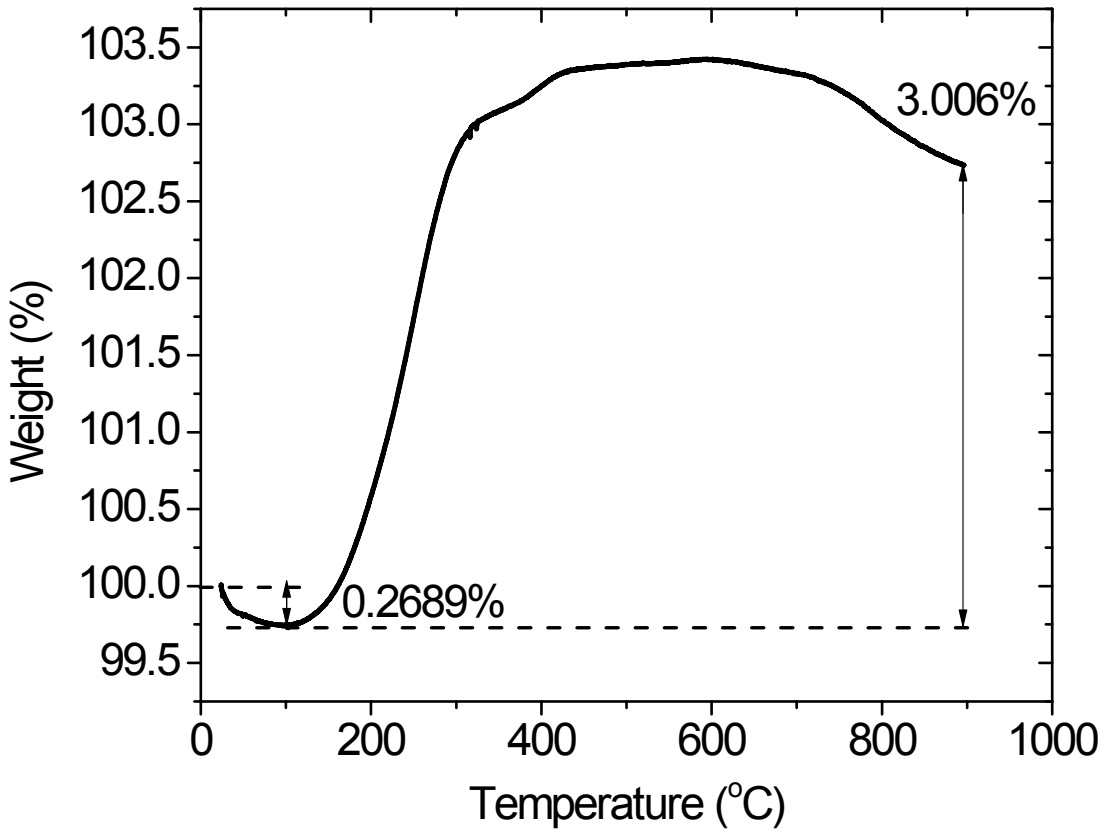

Figure S5. TGA profile of the carbon decorated Fe_3O_4 nanoparticles analyzed in air.

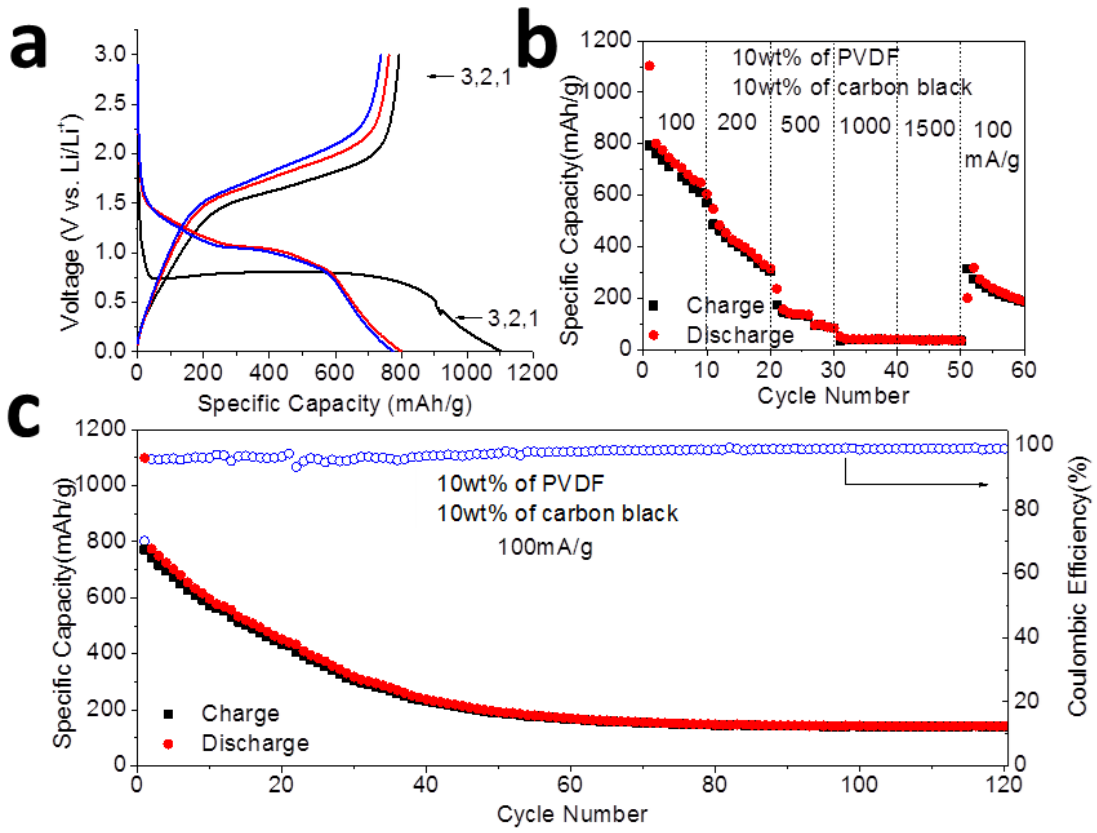

Figure S6. Electrochemical measurement of electrode prepared by conventional method* (slurry, coating and drying, with 10% binder and 10% carbon black) from the same olive-like Fe_3O_4/C: (a) Charge–discharge voltage profile for the initial three cycles at rate of 100 mA/g, (b) rate performance at current of 100, 200, 500, 1000 and 1500 mA/g at interval of 10 cycles each, and (c) cycling performance at current of 100 mA/g.

*Note: the active materials of C-doped Fe_3O_4 was mixed 10 wt% PVPF binder, 10 wt% carbon black conductivity enhancer in a NMP solvent to make a slurry by stirring overnight. The slurry was then coated on to a copper current collector. The coated current collector was dried in a vacuum oven overnight.

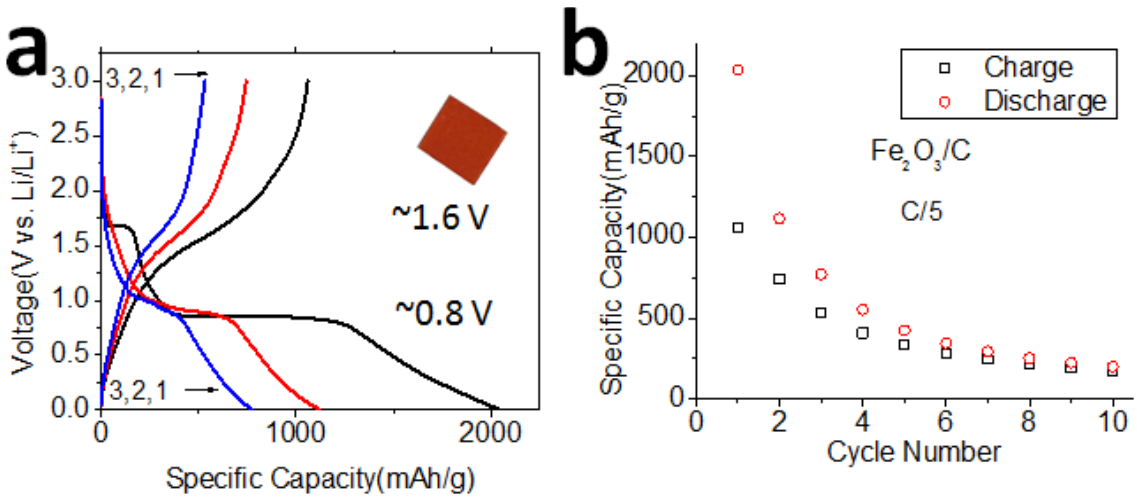

Figure S7. Electrochemical performance of olive-like α-Fe_2O_3/C deposited on current collector without any additives by CAP: (a) First 3 cycles of charge-discharge profiles, and (b) capacity vs. cycle number plots at current rate of C/5. Inset of (a) shows the optical image of red colored additive-free Fe_2O_3/C deposited on a copper disc current collector as a ready electrode.

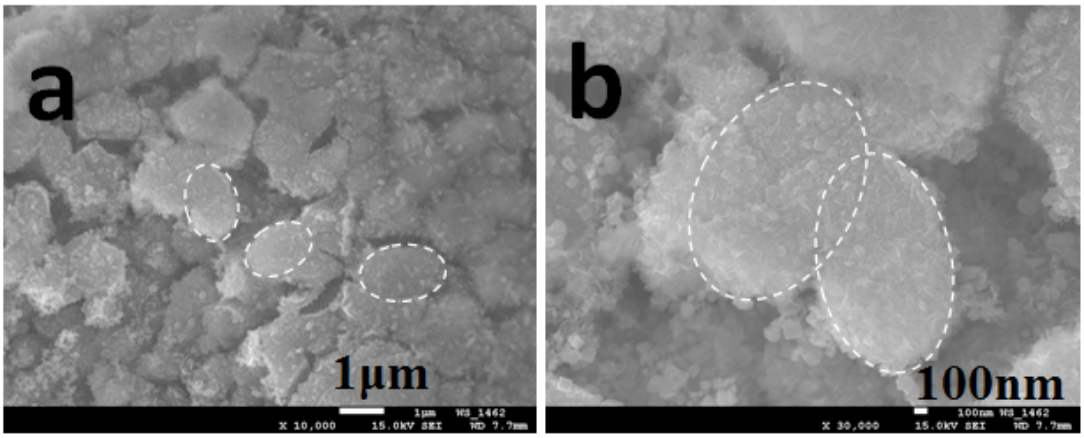

Figure S8. The morphology of the porous olive-like carbon decorated Fe_3O_4 based additive-free electrode after 120 cycles of electrochemical test was investigated by FESEM: (a) low-magnification overall view and (b) high-magnification view two typical olive-like nanoparticles. The olive-like shape can still be observed from the sample after the electrochemical test, indicating the relatively structural stability.