Supporting Information for

Controlled Growth of SnO_2@Fe_2O_3 Double-sided Nanocombs as Anodes for Lithium-Ion Batteries

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Experimental

***Synthesis*:** The SnO_2@Fe_2O_3 double-sided nanocombs were prepared by a simple two-step process, which can be easily scaled up. The Fe_2O_3 nanoflakes were firstly synthesized by heating the polished (by sand paper) and cleaned (with distilled water) Fe foil (Aldrich, 0.1 mm thick, 99.9+ %) on a hotplate at 400 ºC for 24 h in air. Then, a piece of as-obtained Fe foil covered by Fe_2O_3 nanoflakes was placed in a 50 mL sealed Teflon autoclave filling with 30 mL aqueous solution containing 0.174 g of $SnCl_4$. $2H_2O$ and 0.534 g of NaOH. After growing at 220 ºC for 3 h, the substrate was removed from the solution, rinsed with distilled water, and dried with N_2 blow.

***Material Characterization*:** Samples were characterized by powder X-ray diffraction (XRD) (Bruker D-8 Avance), scanning electron microscopy (SEM) (JSM-6700F, 10.0 kV), transmission electron microscopy (TEM) (JEM-2010, 200 kV).

***Electrochemical Characterization*:** Electrochemical measurements were performed using two-electrode CR2016 coin-type cells with lithium foil serving as both counter and reference electrodes at room temperature. The SnO_2@Fe_2O_3 nanocombs on Fe foil were directly used as working electrode. Besides, the Fe_2O_3 nanoflakes on Fe foil were also tested for comparison. The electrolyte used was 1.0 M $LiPF_6$ in a mixture of ethylene carbonate and diethyl carbonate (1:1 by volume). Cell assembly was carried out in an argon-filled glovebox with both moisture and oxygen contents below 0.1 ppm. Galvanostatic charge/discharge tests were performed using a NEWARE battery tester at a voltage window of 0.005–3 V. Cyclic voltammetry (CV, 0.005–3 V, 0.5 mV s^{-1}) and Impedence measurement (0.1-30000 Hz) were performed on the as-made cells using an electrochemical workstation (CHI 760D).

Supplementary Figures

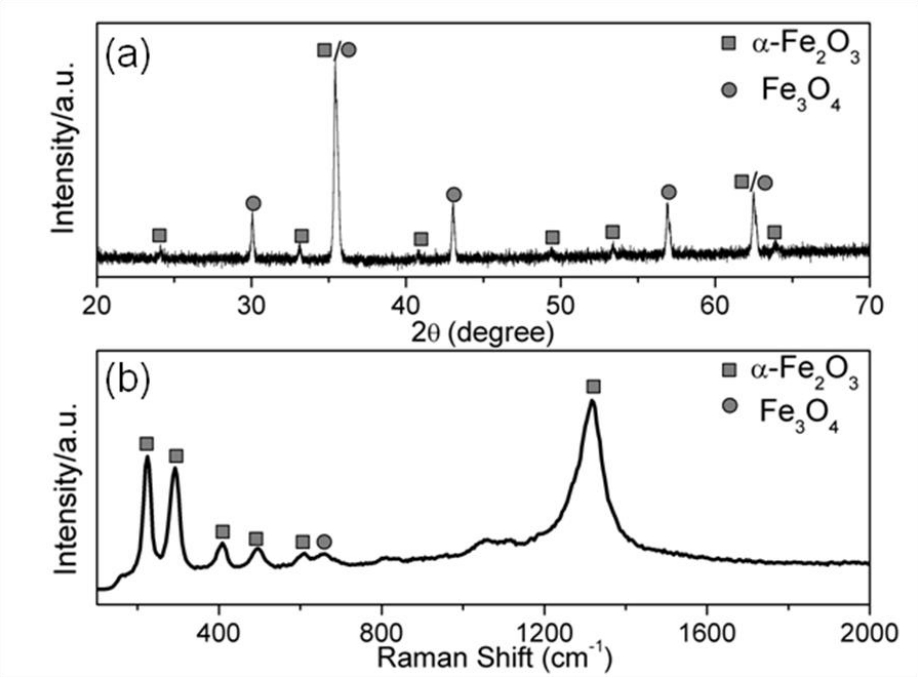

Fig. S1. (a) XRD pattern and (b) Raman spectrum of the as-obtained Fe_2O_3 nanoflakes.

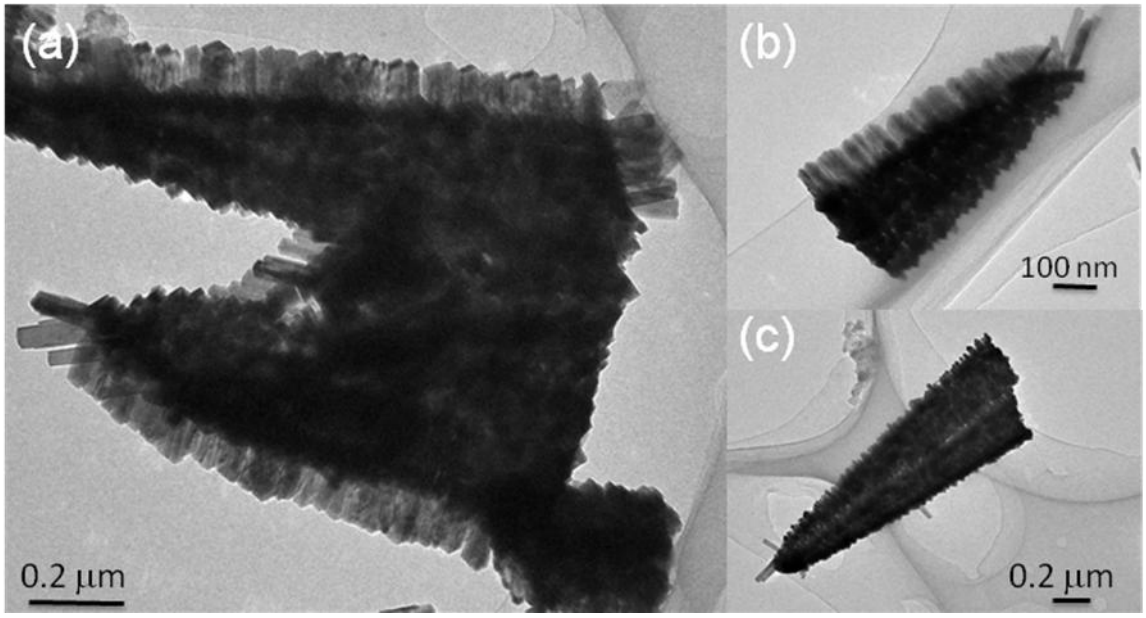

Fig. S2. TEM images of SnO_2@Fe_2O_3 nanocombs after being sonicated for 0.5 h, suggesting the strong adherent forces between the SnO_2 branches and Fe_2O_3 cores.

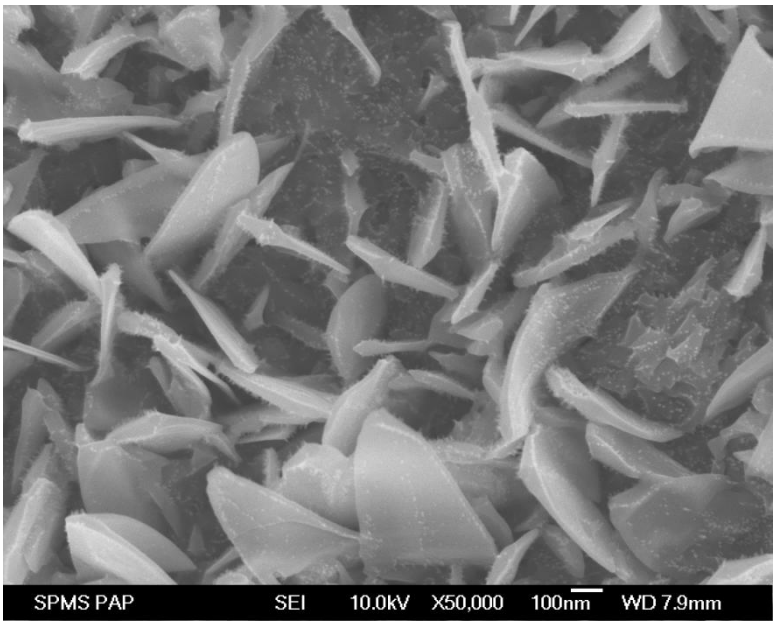

Fig. S3. SEM image of the product gained after 2 h of hydrothermal growth of SnO_2 branches, showing the initial nuclei of SnO_2.

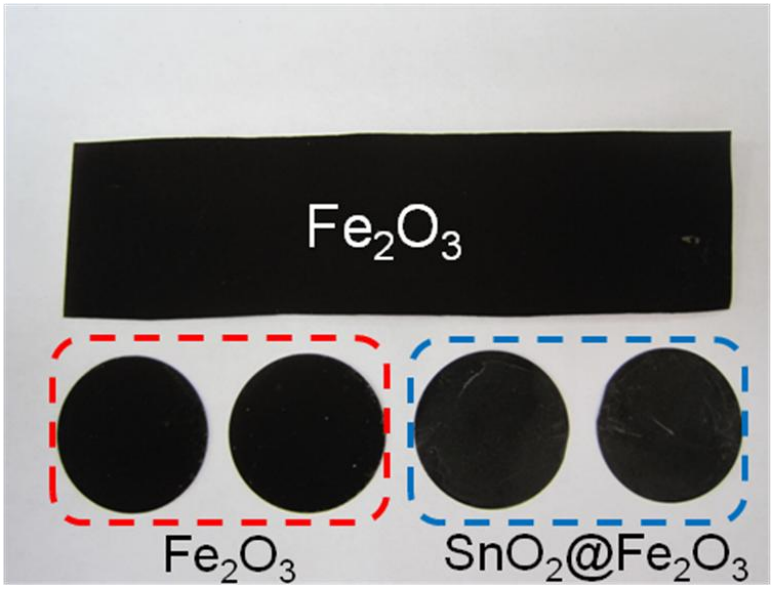

Fig. S4. Optical image of our samples, showing that the working electrodes, namely Fe_2O_3 and $SnO_2@Fe_2O_3$, can be simply obtained by cutting the as-gained products into platelets with certain sizes.