Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Honeycomb-Like Carbon Nanoflakes as a Host for SnO_2 Nanoparticles Allowing Enhanced Lithium Storage Performance

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Experimental Section

Materials Synthesis. All chemicals including basic magnesium carbonate $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$ (Alfa), tin(II) 2-ethylhexanoate (Aldrich), hydrochloric acid and ethanol were used as received.

Synthesis of honeycomb-like CNF. 2 g of the basic magnesium carbonate was placed in to alumina ceramic tube in a horizontal furnace, and temperature was ramped up to 1200 °C at a rate of 10 °C/min and kept for 30 min under Ar/CH_4 flow (200 sccm Ar and 20 sccm CH_4). After the furnace was naturally cooled down to room temperature, CNF were obtained by stirring the MgO@C product in concentrated HCl solution and washing thoroughly with distilled water until the neutral pH value, which were then dried at 60°C overnight.

Synthesis of SnO_2@CNF. Certain amounts of tin(II) 2-ethylhexanoate and CNF were mixed and dispersed in ethanol under ultrasonic irradiation for 1 h, and transferred into an electric oven in order to completely evaporate the ethanol. The dry products were annealed in air at 300°C for 1h to obtain SnO_2@CNF The relative content of SnO_2 and CNF can be readily adjusted by controlling the weight ration of tin(II) 2-ethylhexanoate and CNF.

Materials Characterization. Phase structures of the samples were examined on a Bruker D2 Phaser X-ray diffractometer using Cu Kα radiation (λ=1.5418 Å) operated at a voltage of 30 kV and a current of 10 mA. The morphologies of the products were characterized by scanning electron microscope (SEM, Quanta250F FEI) and transmission electron microscope (TEM, JEOL-2100 TEM) operated at 200 kV. Thermogravimetric analysis (TGA) was carried out in air on a thermal analysis TGA/DSC system (Mettler Toledo). The specific surface area was investigated by N_2 adsorption-desorption isotherms at 77 K on a Quantachrome Surface Area Analyzer (Autosorb iQ-MP), on the basis of the Brunauere-Emmette-Teller (BET) method. X-ray photoelectron spectroscopy (XPS) was carried out on a Physical electronics PHI-5802 instrument, and the binding energies were calibrated according to the reference C 1s peak at 284.6 eV.

Electrochemical Measurements. Electrochemical properties were investigated by using CR2025 coin-type cells assembled in an Ar-filled glovebox (both H_2O and O_2 content less than 1.0 ppm). A paste was firstly prepared by mixing active materials, acetylene black and polyacrylic acid (Sigma) with weight ratio of 8:1:1 in distilled water, which was then casted on a copper foil current collector. After drying at 120 ^oC in a vacuum for 12 h, the working electrodes were obtained by cutting the copper foil into circular form with a diameter of 14 mm; the loading amount of the active materials was kept in the range of 1.0±0.2 mg. Lithium foil was used as the counter and reference electrode, and Celgard 2400 microporous membrane was used as the separator. An electrolyte contained 1 M $LiPF_6$ in ethylene carbonate/dimethyl carbonate (1/1 in volume). Galvanostatic discharge/charge tests were performed on a battery test system (Neware BTS, China) in the range of 0.01-3.0 V (*vs.* Li/Li^+) at 25 ^oC. Cyclic voltammetry was performed on a Autolab PGSTAT 302N electrochemical station in the range of 0.01-3.0 V (*vs.* Li/Li^+) at a scan rate of 0.2 mV/s. The specific capacities were calculated based on the weight of the active materials.

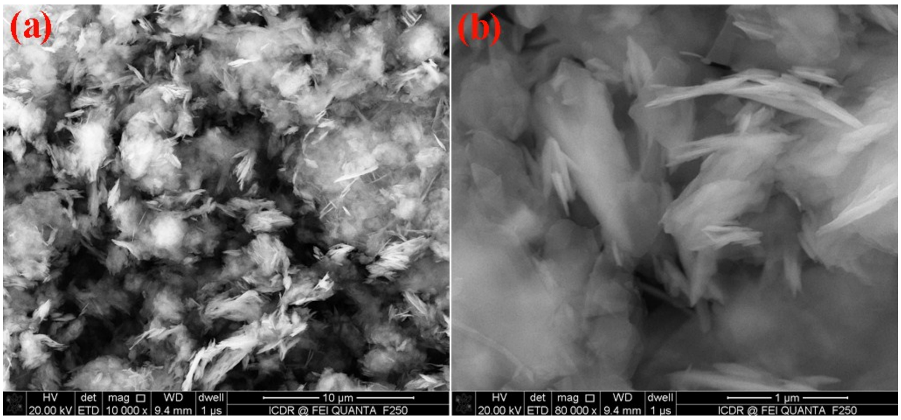

Figure S1. (a, b) SEM images of the basic magnesium carbonate template.

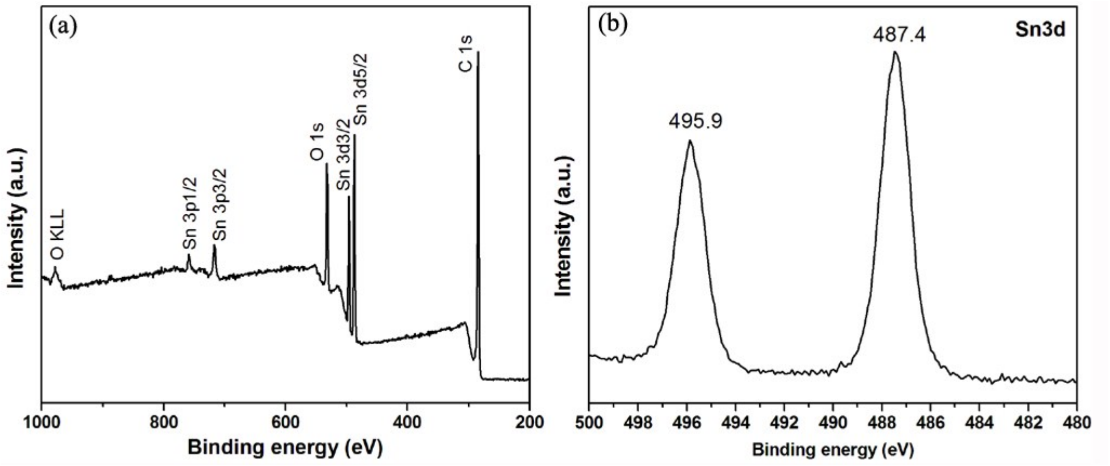

Figure S2. (a) Survey XPS spectrum of SnO_2@CNF-10 and (b) its high resolution XPS spectrum of Sn 3d. The results showed that no Mg element was detected after HCl washing and Sn element with oxidation state of Sn(IV) emerged after annealing with tin(II) 2-ethylhexanoate in air.

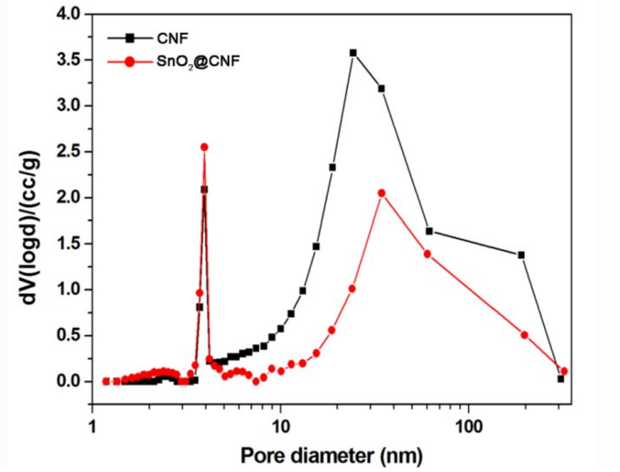

Figure S3. Pore size distribution of the bare CNF and SnO_2@CNF-10 calculated by Barrett-Joyner-Halenda (BJH) method.

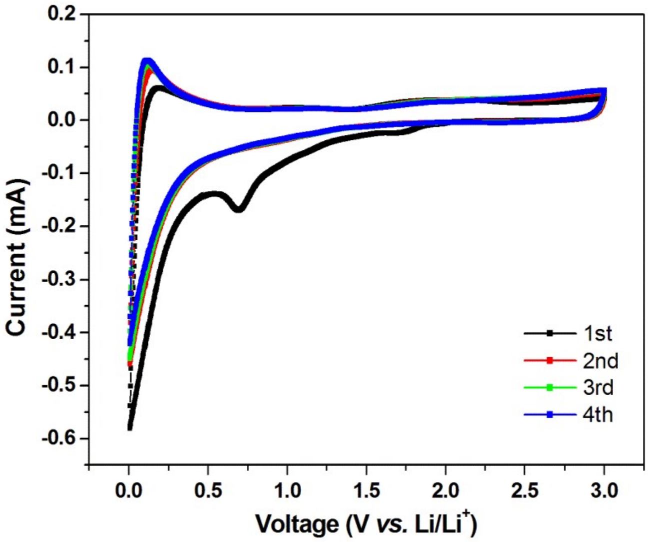

Figure S4. CV curves of the bare CNF electrode in the range of 0.01-3.0 V at a scan rate of 0.2 mV/s.

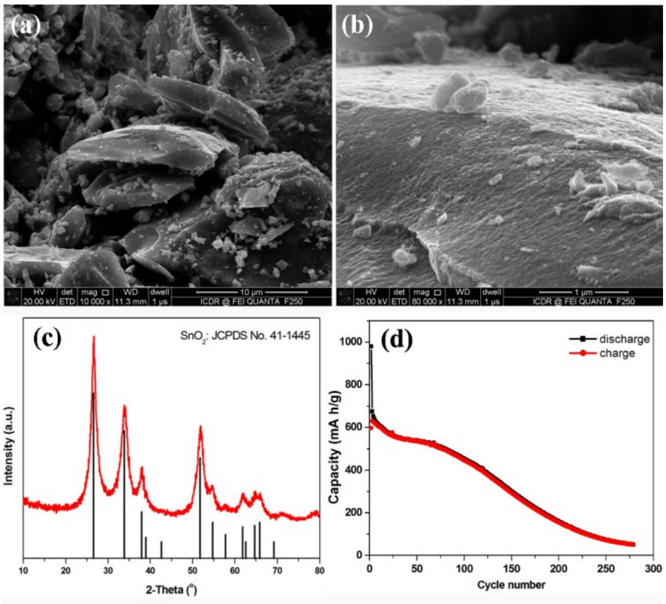

Figure S5. (a, b) SEM images and (c) XRD pattern of the pure SnO_2 obtained by annealing tin (II) 2-ethylhexanoate at 300°C in air. (d) Cycle performance of the as-prepared SnO_2 at 1000 mA/g.