Supplementary materials for

Cost-effective Synthesis of Bamboo-structure Carbon Nanotubes from Coal for Reversible Lithium Storage

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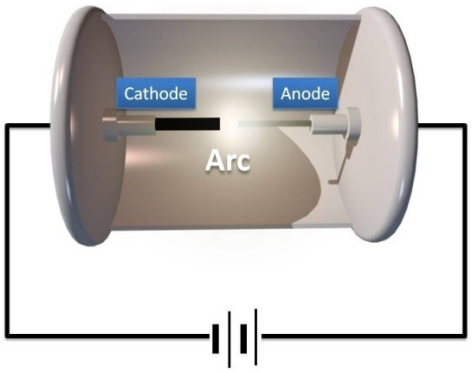

Fig. S1 The Set-up of DC apparatus

The cathode and anode were horizontally installed at the center of a water-cooled chamber. The left-hand cathode was a graphite rod with 8 mm in diameter. The right-hand anode could be adjusted manually from outside of the water-cooled stainless steel chamber as anode was consumed. The procedure for preparing the anode from coal was described below. The coal which we used was a bitumite from Sinkiang Uighur Autonomous Region of China. The raw coal was crushed and sieved to 75 μm, and fully dried at 80 ^{o}C for 24 h before use. The catalyst of Ni-Sm_2O_3 was finely mixed with coal powder in a weight ratio of 8:2. Subsequently, the mixture was further mixed with coal tar in a weight of 2.5:1 to get a paste. The paste was pressed

at about 20 MPa to form coal rods with a diameter of *ca.*10 mm. Then the coal rods were carbonized in an electric furnace under N_2 flow to make anodes. The furnace was ramped at 10 $^oC \cdot min^{-1}$ to 500 ^oC and kept for 3 h, and then the furnace was ramped at 5 $^oC \cdot min^{-1}$ to 950 ^oC and kept for 3 h before cooling down to room temperature. The arc discharge was conducted at a current of 60-70 A and the voltage of 30-40 V in an atmosphere of N_2 and H_2(95:5; V/V) at 0.05 MPa, and the gap between the electrodes was kept at *ca*. 2 mm during the arcing discharge by manually feeding the anode. The arcing experiment lasted about 15 min.

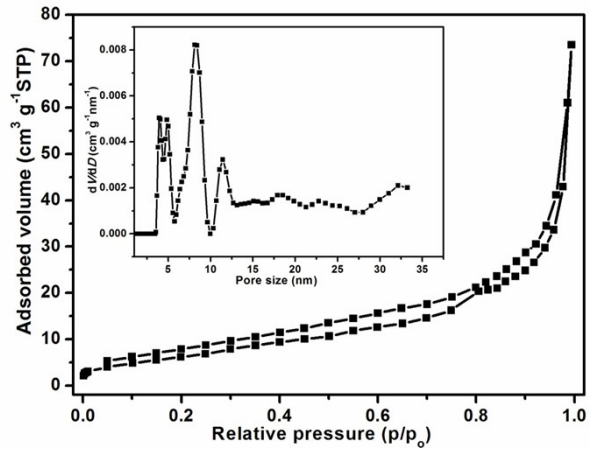

Fig. S2 Nitrogen sorption isotherms and corresponding pore size distributions (insets) of the B-CNTs

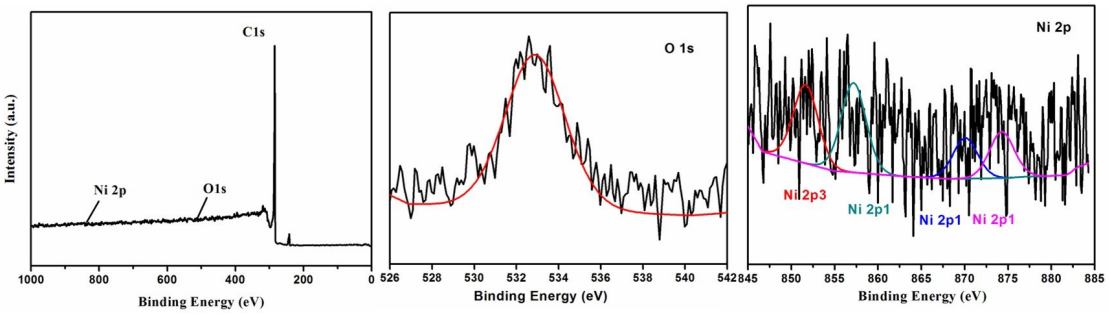

Fig. S3 XPS spectra of B-CNTs

The Nyquist plots for the B-CNTs in fresh coin cells, and a Nyquist plot for the

B-CNTs after a CV were tested, as shown in Figure S4. The Nyquist plots consist of a semicircle in the high-frequency region and a straight line in the low-frequency region. In general, the depressed semicircle is attributed to the charge-transfer resistance of the electrochemical reaction, and the straight line is related to the diffusion-controlled Warburg impedance [1, 2]. Apparently, the diameter of the semicircle in the high- frequency region for the B-CNTs electrode decreases significantly after CV, which can be ascribed to improvement of the electrochemical kinetics. The diffusion resistance of lithium ions is reduced by fully opening the lithium ion transfer channels which improves the electrochemical activity of the B-CNTs.

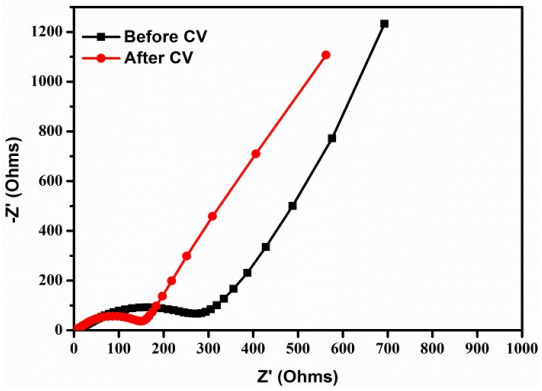

Fig. S4 The Nyquistplots of B-CNT selectrode before and after cyclic voltammetry

Reference

[1] Y. Yang, K. Wu, R. Pang, X. Zhou, Y. Zhang, X. Wu, C. Wu, H. Wu and S. Guo, RSC Adv., 2013, 3, 14016-14020.

[2] P. Guo, H. Song, X. Chen, Electrochem. Commun., 2009, 11, 1320-1324.