Supporting information

Bi_2S_3 Nanorods Modified with $Co(OH)_2$ Ultrathin Nanosheets to Significantly Improve Its Pseudocapacitance for High Specific Capacitance

Huan Yang, Jiale Xie, and Chang Ming Li*

Institute for Clean Energy & Advanced Materials, Southwest University, Chongqing 400715, P.R. China;

Chongqing Key Laboratory for Advanced Materials & Technologies of Clean Electrical Power Sources, Chongqing 400715, P.R. China;

Faculty of Materials and Energy, Southwest University, Chongqing 400715, P.R. China.

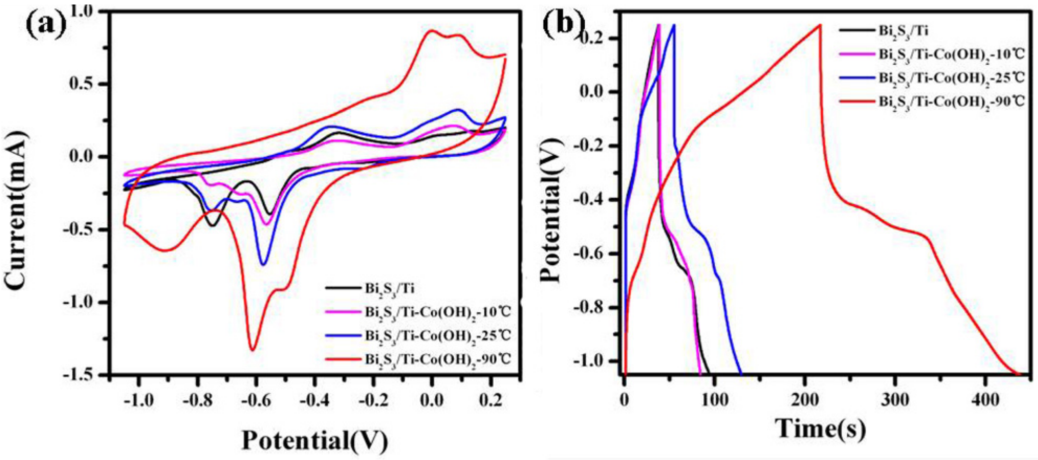

Figure S1 (a) The Cyclic voltammetry image of BNRs, BCCs-10 °C, BCCs-25 °C,BCCs-90 °C at 50 mV/s. (b) Charge-discharge image of BNRs, BCCs-10 °C, BCCs-25 °C, BCCs-90 °C at 0.5 mA/cm^2

It shows that the increase of the electrodeposition temperature of $Co(OH)_2$ result in higher peak current and longer discharge time, which presume higher specific capacitance. When the temperature comes to 90 °C, it presents the highest discharge time. Thus the optimal electrodeposition temperature is 90 °C.

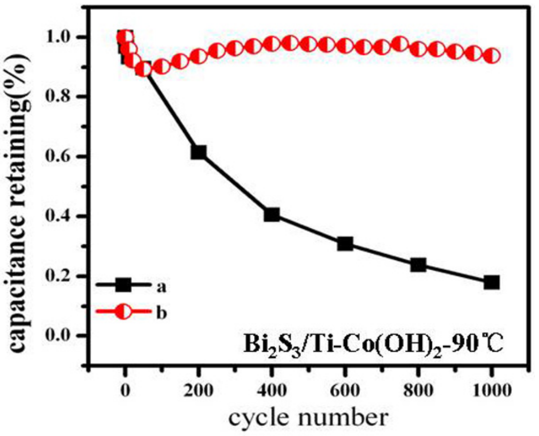

Figure S2 The cycle stability image of BCCs-90 °C in different potential window, a. from -1.05 V to 0.25 V. b. from -0.85 V to 0.1 V.

The cycle stability of BCCs-90 °C hybrid product don't show good performance in wider potential window from -1.05 V to 0.25 V, which can only keep 20% of its initial specific capacitance after 1000 cycles. When the potential window reduced to a range of -0.8 V to 0.1 V, the cycle stability improves to 94%. Thus we choose the potential window from -0.8 V to 0.1 V.

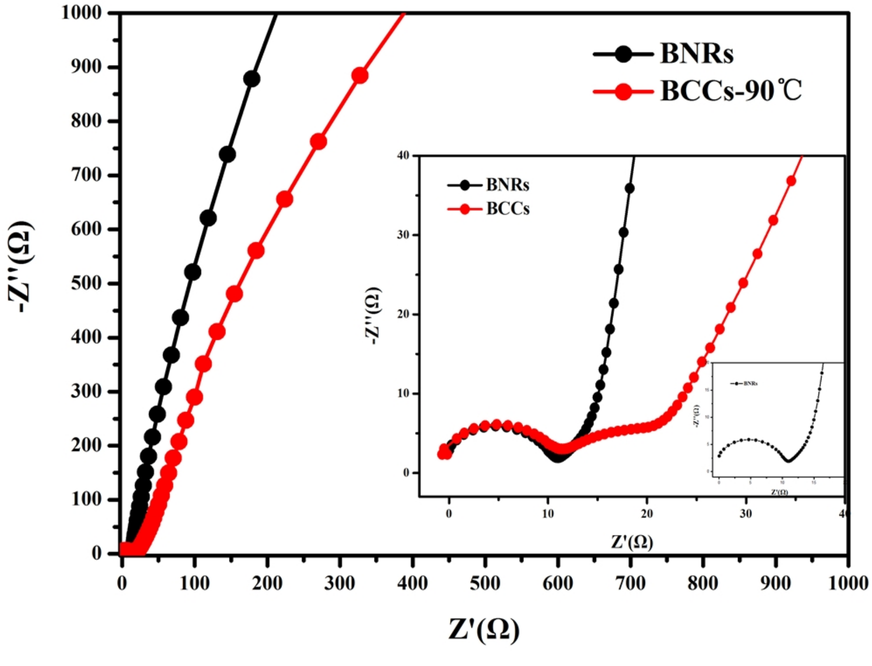

Figure S3 Nyquist plots of BNRs and BCCs-90 °C at a voltage amplitude of 5 mV.

EIS measurements were carried out to compare the characteristics of charge and ion transfer in BNRs and BCCs-90 °C. Inset figure show well-defined small semicircles over the high-frequency range for both BNRs and BCCs-90 °C, which means the electrode material can react easily and fast. There is no significant improvement for the Faraday resistance due to their similar semi-circles. Then the Nyquist plots show a straight sloped line in the low-frequency region for both samples, the straight line is ascribed to the diffusive resistance (Warburg impedance, W) of the electrolyte in the electrode pores and proton diffusion in the host materials, both BNRs and BCCs-90℃ show pretty good ion diffusion ability.

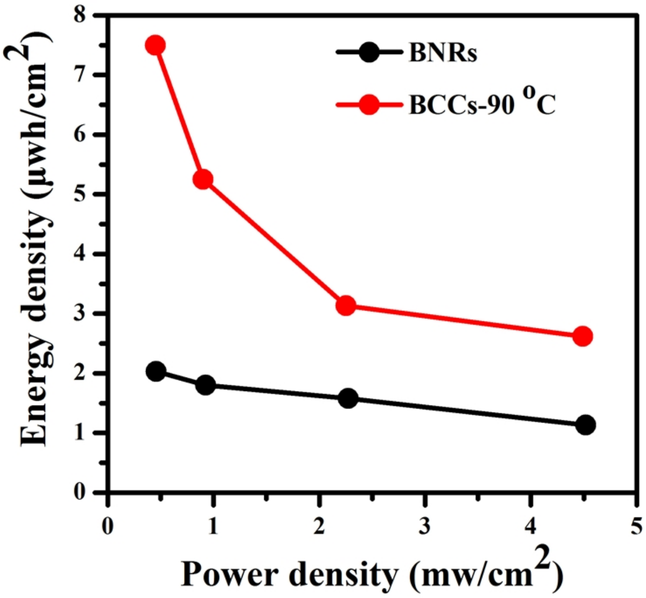

Figure S4 Ragone plot (power density vs. energy density) of BNRs and BCCs-90 °C

The Ragone plot (power density vs. energy density) of BNRs and BCCs-90 °C shows that after modification Bi_2S_3 with $Co(OH)_2$, the energy density of BCCs-90 °C is bigger than that of BNRs, and the power density is almost the same.

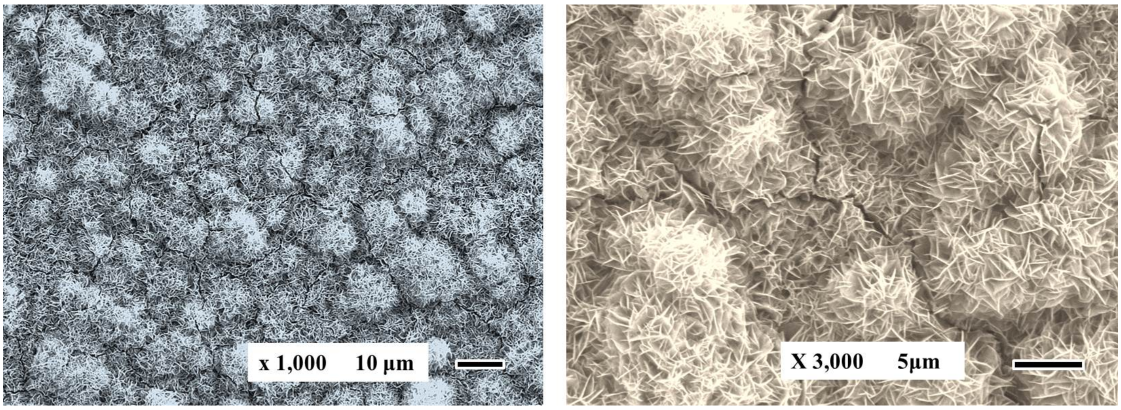

Figure S5 The low magnification SEM images of BCCs-90 °C.

Figure S5 shows that the BCCs-90 °C is uniform.