

Supporting information (SI)

Rapid low-cost synthesis of Spherical Sn@C nanocomposites as High rate and Long life anodes for lithium-ion batteries

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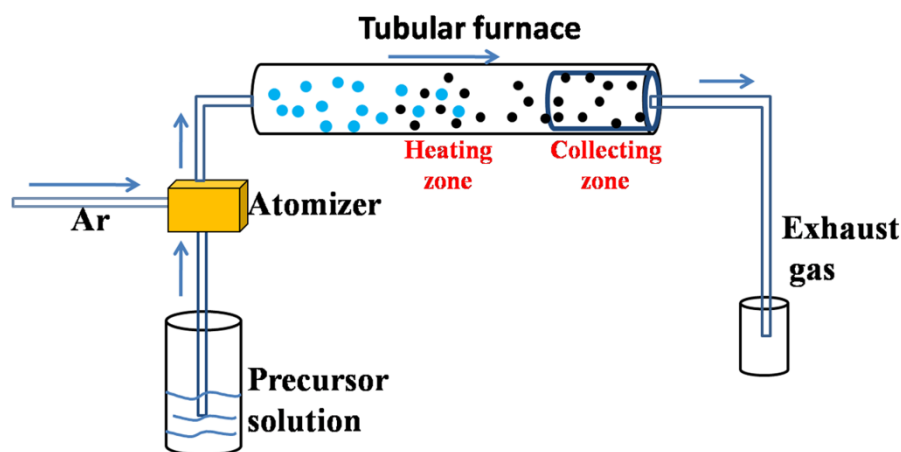


Figure S1. Schematic of the aerosol spray pyrolysis platform.

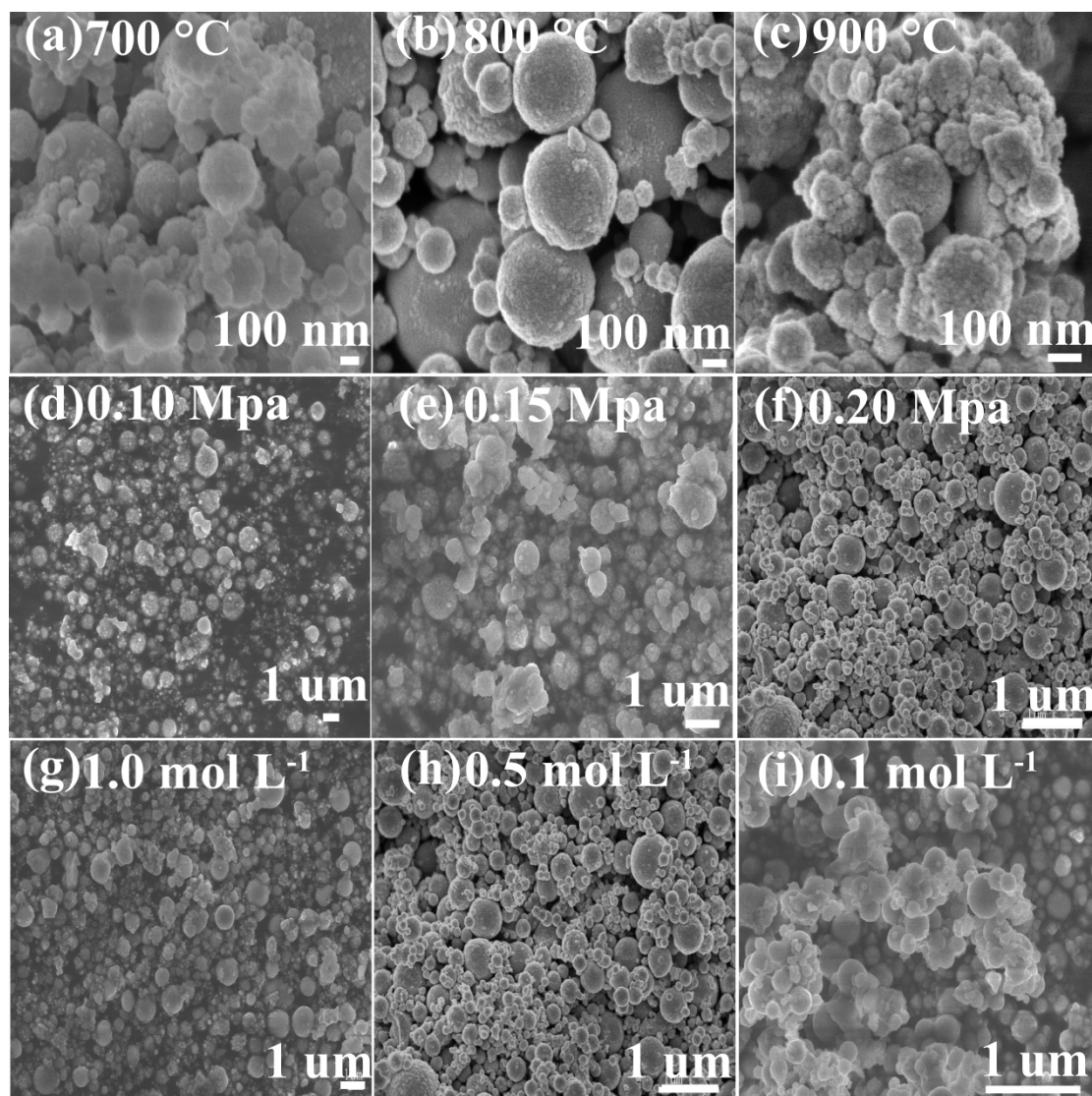


Figure S2. SEM images of Sn@C samples obtained from different reaction parameters including: (a-c) different reaction temperature at the same gauge pressure (0.2 MPa) and precursor concentration ($0.5 \text{ mol L}^{-1} \text{ SnCl}_2$), (d-f) different gauge pressure at the same precursor concentration ($0.5 \text{ mol L}^{-1} \text{ SnCl}_2$) and reaction temperature (800°C), (g-i) different precursor concentration at the same reaction temperature (800°C) and gauge pressure (0.2 MPa).

Reaction temperature affects the evaporation rate of solvent and the dispersion of Sn@C particles, but a higher temperature will induce Sn@C particles agglomeration, due to a faster solvent evaporation rate leading to a lot aerosol particles aggregating, as shown in Fig. S2 (a-c). The higher carrying gas pressure will bring a better dispersion of Sn@C particles (Fig. S2 (d-f)). Fig. S2 (g-i) shows samples obtained at different precursor concentration, which could control the particle size. At a lower concentration of SnCl_2 , the size of Sn@C particles and embedded Sn nanograins is smaller.

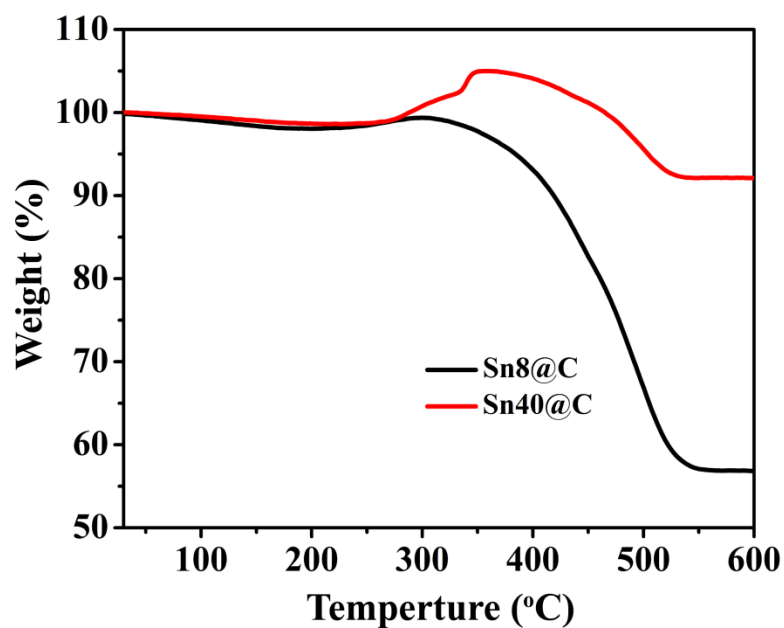


Figure S3. Thermogravimetric (TGA) curves of Sn8@C and Sn40@C in air.

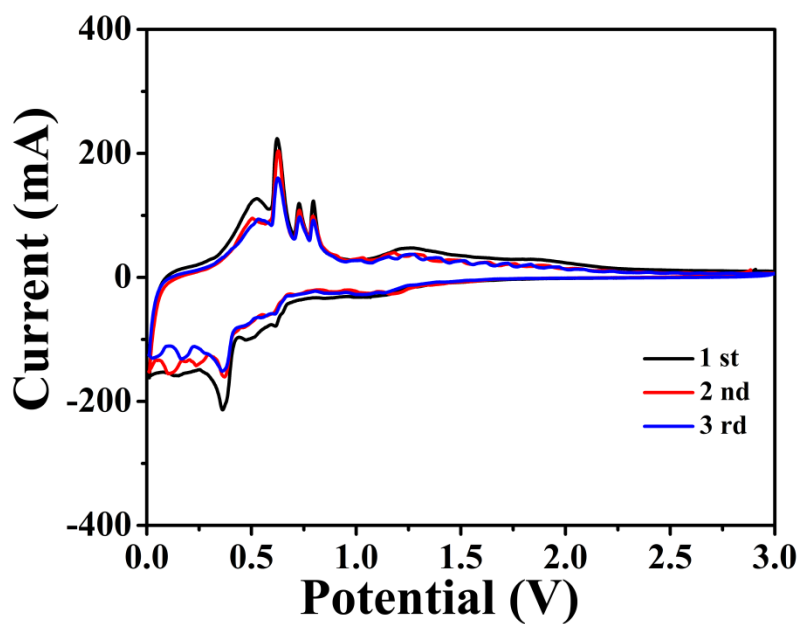


Figure S4. Cyclic voltammograms of the initial 3 cycles of Sn40@C scanned in the range of 0 - 3

V at a rate of 0.1 mV s^{-1} .

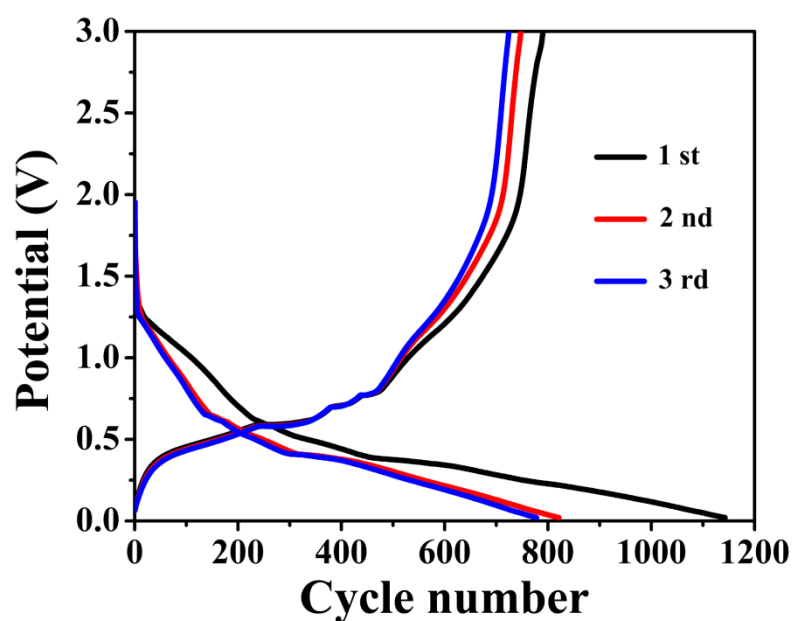


Figure S5. Charge/discharge profiles of Sn40@C in the initial three cycles.

Fig. S5 shows the charge-discharge profiles of Sn40@C composite at 200 mA g^{-1} between 0.02 V and 3.0 V. The initial discharge and charge capacities are $1142.7 \text{ mA h g}^{-1}$ and $790.8 \text{ mA h g}^{-1}$.

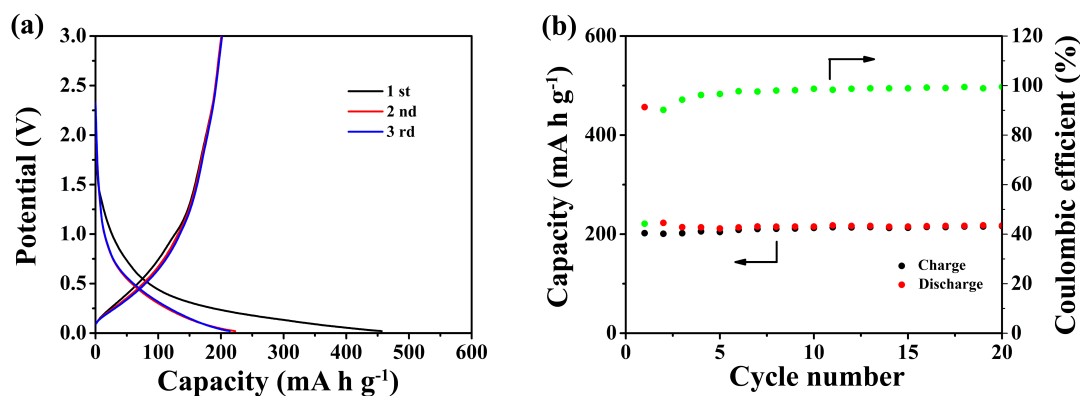


Figure S6. (a) Charge/discharge profiles at the 1st, 2nd and 3rd cycles of pyrolyzing carbon at 200 mA g^{-1} between 0.02 V and 3.0 V, (b) Cycling performance of the pyrolyzing carbon. The pyrolyzing carbon without Sn was synthesized as following steps: 7.7 g resorcinol and 10 ml formaldehyde were prepolymerized in advance to form a clear solution at room temperature. After 60 min stirring, the solution was carbonized with a heating rate of $5 \text{ }^{\circ}\text{C min}^{-1}$ in flowing argon at $800 \text{ }^{\circ}\text{C}$ for 30 min.

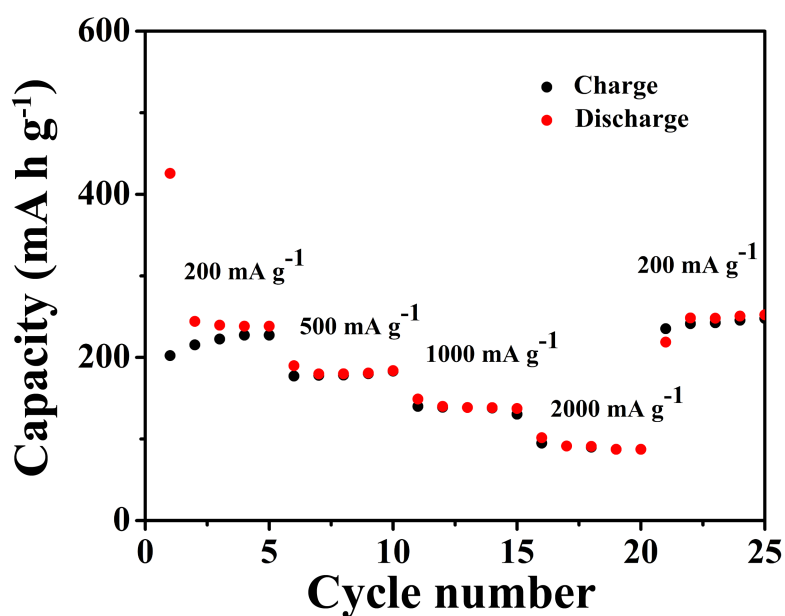


Figure S7. Rate capability of the pyrolyzing carbon at different current densities between 0.02 V and 3.0 V.

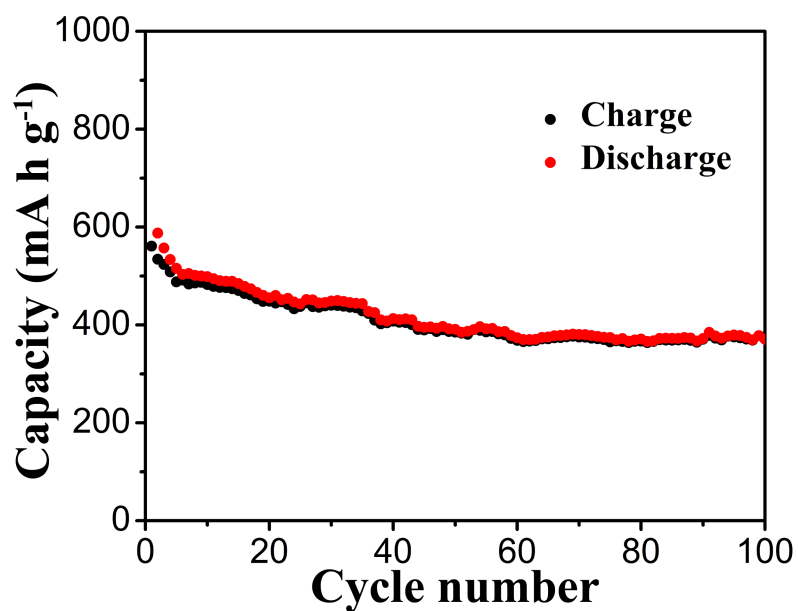


Figure S8. Cycling performance of Sn8@C nanocomposite from the first cycle to the 100th cycle between 0.02 and 1.5 V with a current density of 1000 mA g^{-1} .

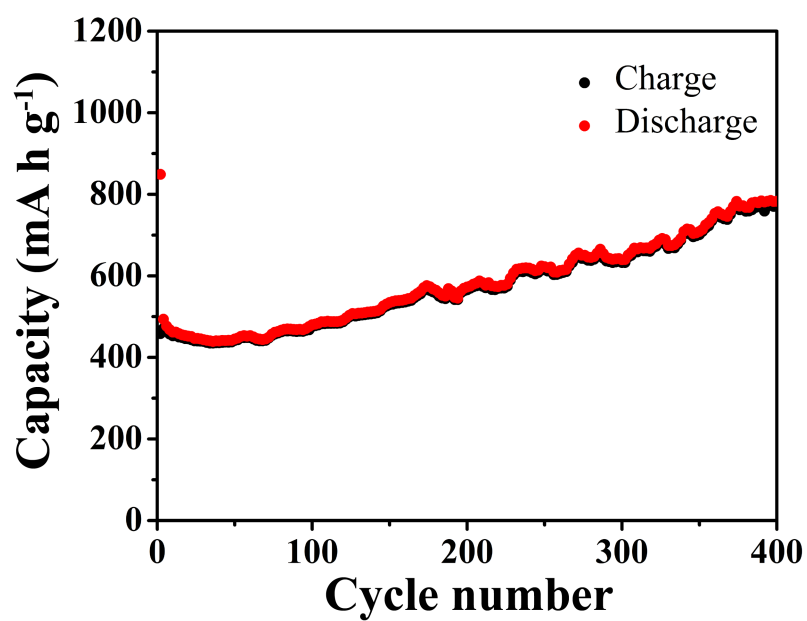


Figure S9. Cycling performance of Sn8@C from the first cycle to the 400th cycle between 0.02 and 3.0 V with a current density of 800 mA g⁻¹.