

## Electronic Supplementary Information

### Yolk-Shell Nb<sub>2</sub>O<sub>5</sub> Microspheres as Intercalation Pseudocapacitive Anode

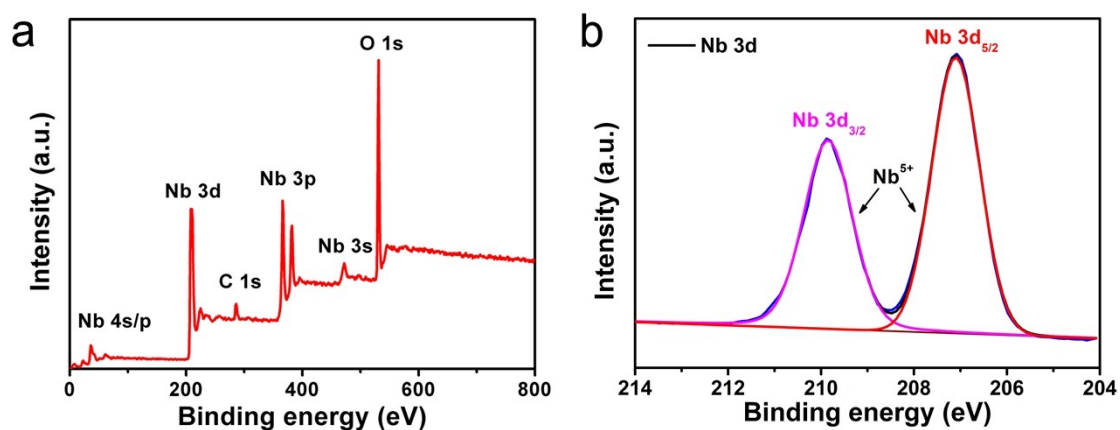
#### Materials for High-Energy Li-ion Capacitors

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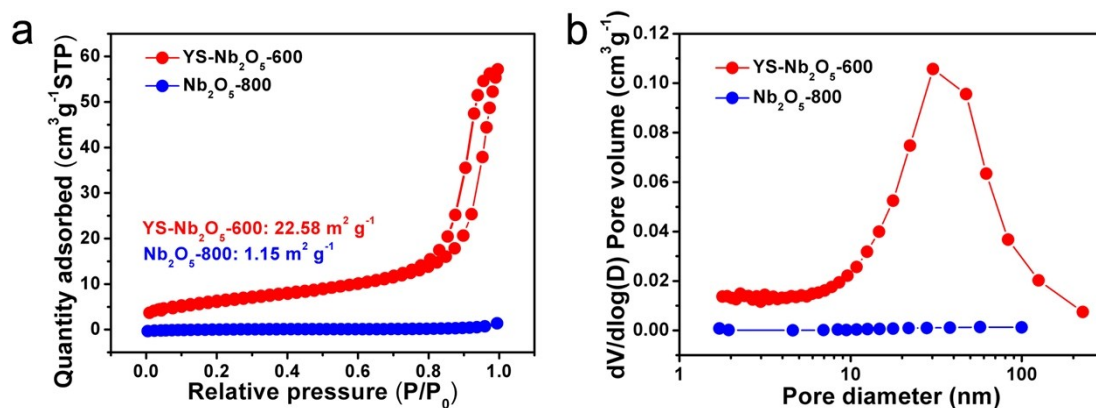
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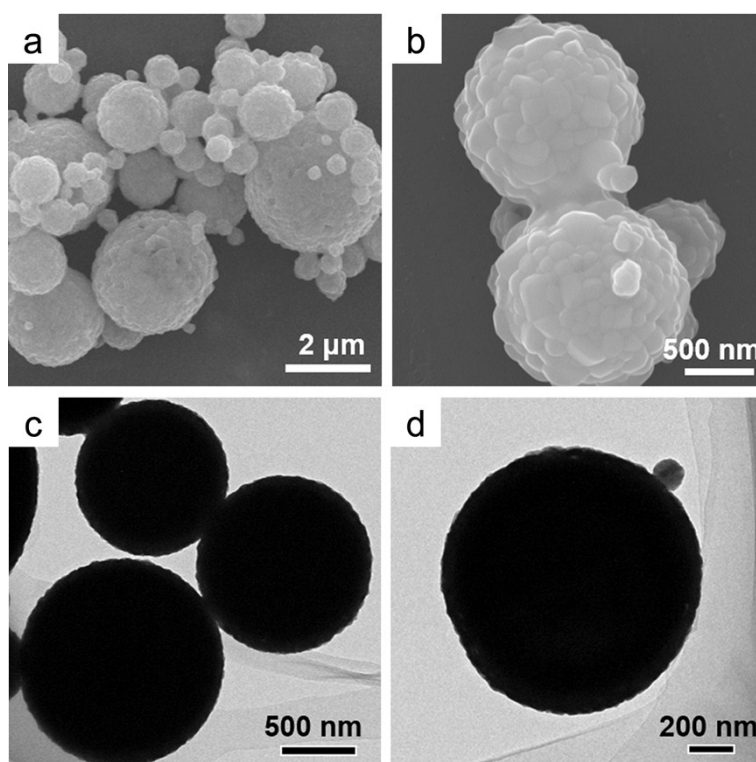
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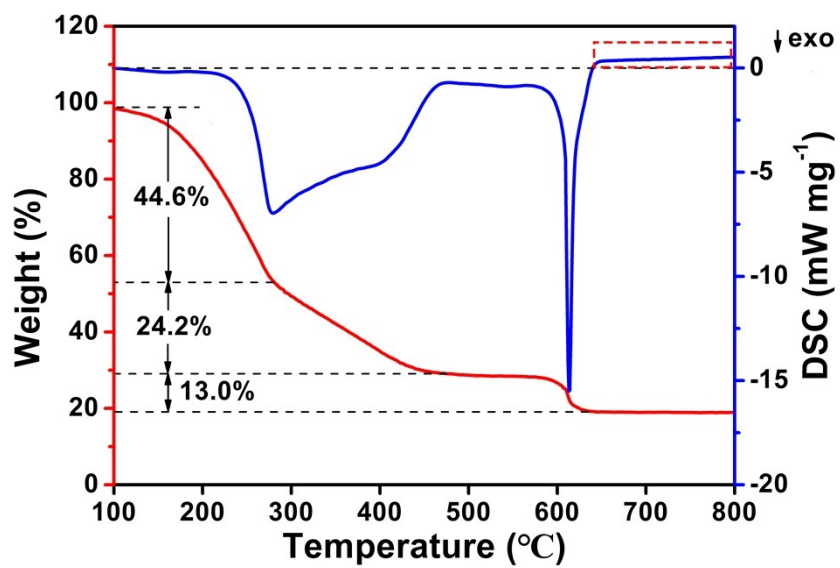
**Figure S1.** (a) XPS survey spectrum and (b) Nb 3d high-resolution XPS spectrum of the YS-Nb<sub>2</sub>O<sub>5</sub>-600.



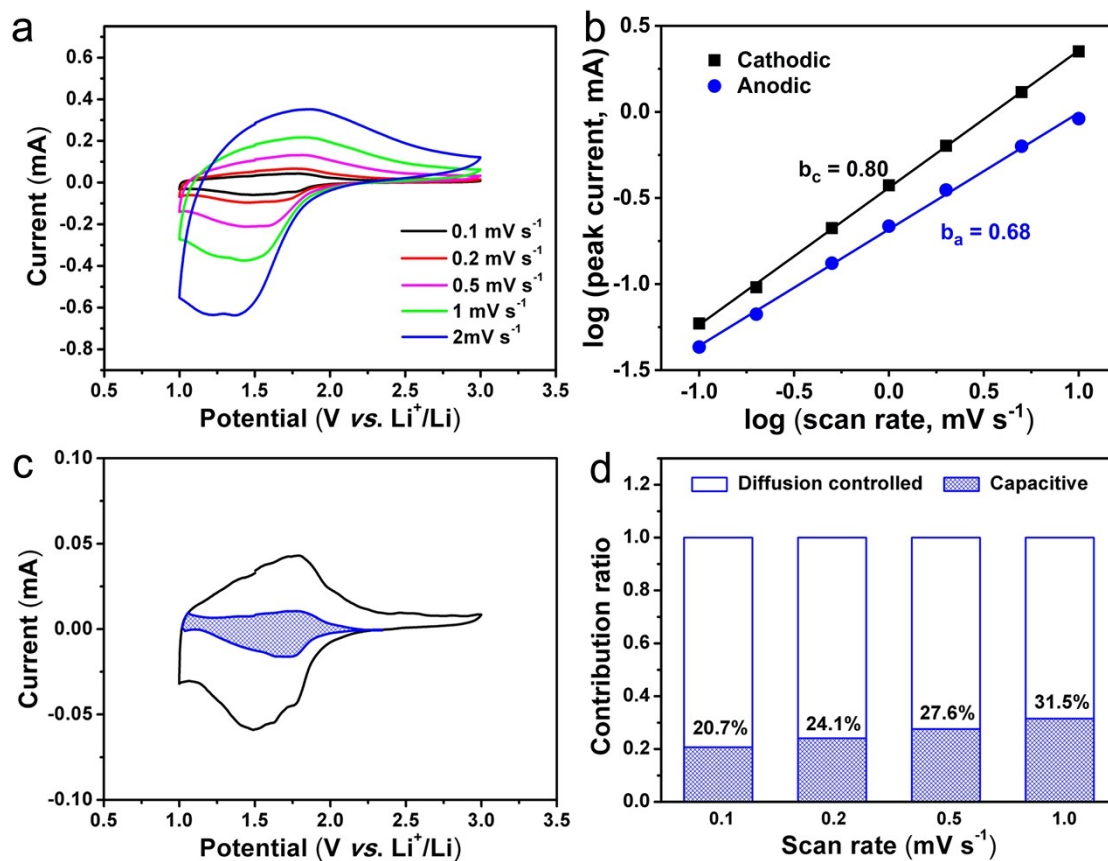
**Figure S2.** (a) Nitrogen adsorption-desorption isotherms and (b) the corresponding pore size distributions of YS-Nb<sub>2</sub>O<sub>5</sub>-600 and Nb<sub>2</sub>O<sub>5</sub>-800.



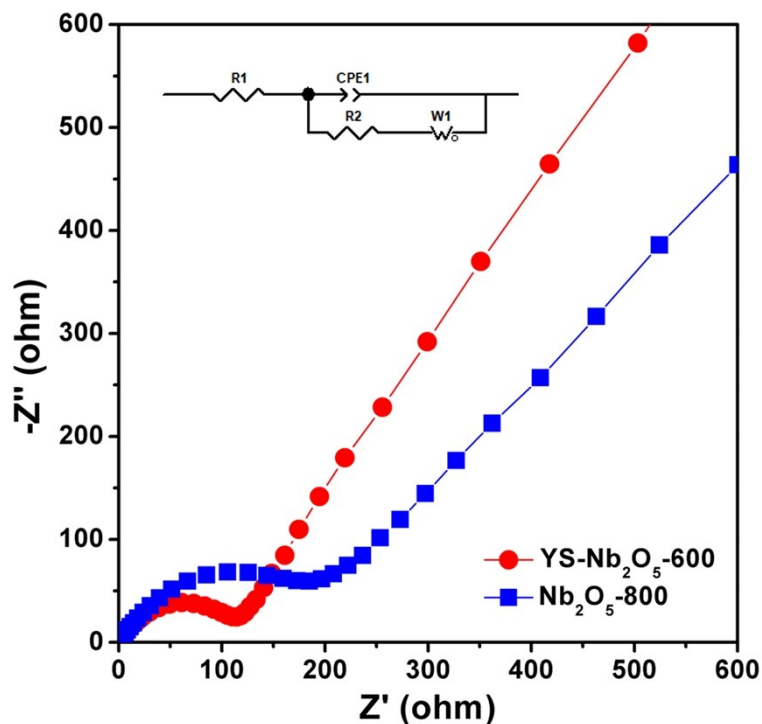
**Figure S3.** (a, b) SEM images and (c, d) TEM images of Nb<sub>2</sub>O<sub>5</sub>-800.



**Figure S4.** TG and DSC curves of the intermediate at 100 – 800 °C.



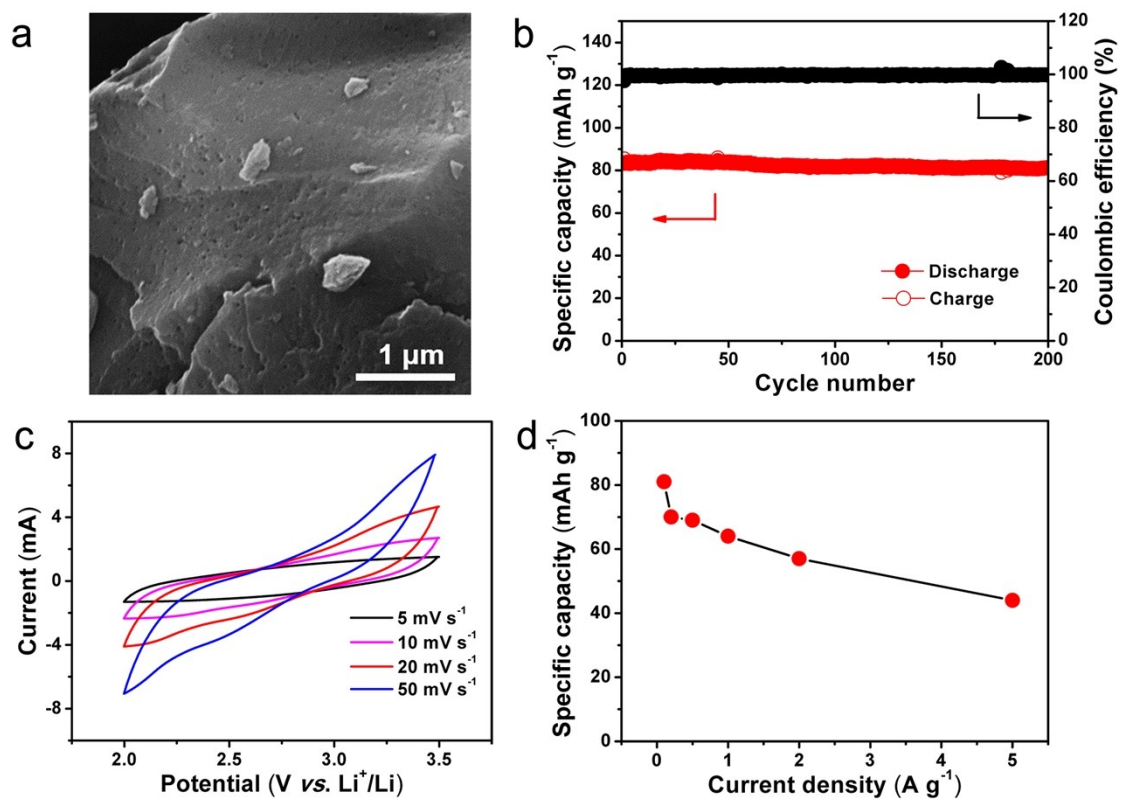
**Figure S5.** (a) CV curves of Nb<sub>2</sub>O<sub>5</sub>-800 at different scan rates (from 0.1 to 2 mV s<sup>-1</sup>), (b) logarithmic relationships between the peak currents and scan rates, (c) CV curves of Nb<sub>2</sub>O<sub>5</sub>-800 with separation between total current (solid line) and capacitive current (shaded regions) at 0.1 mV s<sup>-1</sup>, (d) contribution ratios of capacitive capacities and diffusion-limited capacities at various scan rates.



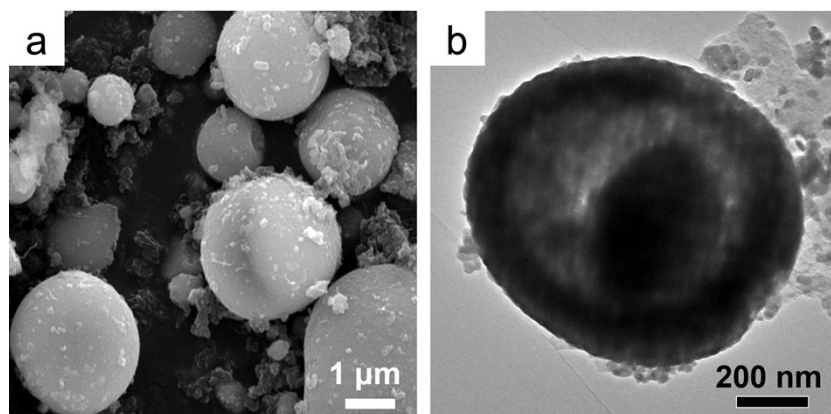
**Figure S6.** Nyquist plots of the YS-Nb<sub>2</sub>O<sub>5</sub>-600 and Nb<sub>2</sub>O<sub>5</sub>-800 based electrodes by applying an AC voltage of 5 mV amplitude at 10 mHz to 100 kHz.

**Table S1.** Specification of the commercial activated carbon (YEC-8B)

Item	YEC-8B
Surface Area	≥ 2000 m <sup>2</sup> g <sup>-1</sup>
Average particle size (D50)	~10 μm
Tap density	0.38 – 0.4 g cc <sup>-1</sup>
Capacitance	~ 200 F g <sup>-1</sup>



**Figure S7.** (a) SEM image of the YEC-8B, (b) cycling performance of YEC-8B at 100  $\text{mA g}^{-1}$  (potential window: 2.0 – 3.5 V), (c) CV curves at different scan rates (potential window: 2.0 – 3.5 V), and (d) rate performances of YEC-8B at various current densities (from 0.1 to 5  $\text{A g}^{-1}$ ).



**Figure S8.** (a) SEM and (b) TEM images of YS-Nb<sub>2</sub>O<sub>5</sub> after 1000 cycles at 0.5 A g<sup>-1</sup> in LICs (voltage window of 1.0 – 3.5 V).