Supporting information

Ultrathin MnO$_2$ nanoflakes grown on N-doped carbon nanoboxes for high-energy asymmetric supercapacitors

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Part I: Figures

**Fig. S1** SEM images of (a) Fe$_2$O$_3$ nanocubes, (b) Fe$_2$O$_3$@PDA nanocubes, (c) Fe$_2$O$_3$@C nanocubes and (d) N-doped carbon nanoboxes.

**Fig. S2** High-magnification SEM image of a representative MnO$_2$/C nanobox.
**Fig. S3** (a) N$_2$ adsorption/desorption isotherms and (b) pore size distribution curves of N-doped carbon nanoboxes and MnO$_2$/C nanoboxes.

**Fig. S4** The galvanostatic charge/discharge curves of (a) the N-doped carbon and (b) the MnO$_2$/C nanoboxes; (c) CV curves at 20 mV s$^{-1}$ and (d) rate performances of the MnO$_2$/C nanoboxes and the pure ultrathin MnO$_2$ nanosheets with a three-electrode configuration in a 1 M Na$_2$SO$_4$ electrolyte. It is obvious that the as-obtained MnO$_2$/C nanoboxes deliver a higher specific capacitance than that of pure MnO$_2$. Furthermore, the CV curve of the MnO$_2$/C nanoboxes also exhibits an almost vertical line between 0-0.2 V and 0.8-1.0 V compared to the pure MnO$_2$, suggesting a higher rate capability, which is verified by the test results (Fig. S4d).
**Fig. S5** Schematic illustration of the as-fabricated ASC device based on MnO$_2$/C nanoboxes as positive electrode and N-doped carbon nanoboxes as negative electrode in 1 M Na$_2$SO$_4$ electrolyte.

### Part II: Calculations

The specific capacitance was calculated from the CV curve according to the following equation:

\[
C = \frac{Q}{(\Delta V m)}
\]

where \( C \) (F g$^{-1}$) is the specific capacitance, \( Q \) (C) is the average charge during charge/discharge process, \( m \) (g) is the mass of active material, and \( \Delta V \) (V) is the potential window of the CV curve. The discharge specific capacitance could also be calculated from the discharge curves by the following equation:

\[
C = \frac{I \Delta t}{(m \Delta V)}
\]

where \( I \) (A), \( \Delta t \) (s), \( m \) (g) and \( \Delta V \) (V) are the discharge current, discharge time, mass of the active materials (or mass of the total electrode materials), and the potential window, respectively.

The energy density \( E \) (W h kg$^{-1}$) and power density \( P \) (W kg$^{-1}$) were calculated by the following equations:

\[
E = C(\Delta V)^2/2
\]

\[
P = E/\Delta t
\]

where \( C \) (F g$^{-1}$) is the specific capacitance of the active materials, and \( \Delta V \) (V) is the potential window, \( \Delta t \) (s) is the discharge time consumed in the potential range of \( \Delta V \).