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Supplementary Information

3D self-supported hierarchical core/shell structured $MnCo_2O_4$@CoS arrays for high-energy supercapacitors

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Capacitance Calculation

The mass ratio of the positive and negative electrodes should be calculated by the following relationship $q_+ = q_-$. The charge balance will according to the following the Equation: $q = C_s \times \Delta E \times m_{ac}$, where C_s is specific capacitance of electrode, ΔE is the potential range of the charge/discharge process, and m_{ac} is the mass of the electroactive material in electrode.

The capacitance values were calculated from GCD curves according to the following equations: $C_s = I \times \Delta t/(\Delta V \times m)$. Energy density ($E$, $Wh \cdot kg^{-1}$) and power density (P, $W \cdot kg^{-1}$) of the supercapacitor were calculated by the following equations: $E = 0.5 \times C_{cell} \times (\Delta V)^2/3.6$ and $P = E \times 3600/(\Delta t)$, where the specific capacitance (C_s, $F \cdot g^{-1}$) applies to a single electrode and the cell capacitance (C_{cell}, $F \cdot g^{-1}$) applies to the full cell only, I (A) is the charge-discharge current, ΔV (V) is the voltage change during the discharge process after potential drop (iR_{drop}), Δt (s) is the discharge time, m (g) is the mass of the electroactive material on the single electrodes and M (g) is the total mass of the electroactive materials on the both the positive and negative electrodes.

The specific capacitance of the electrode can be calculated from the CV curves according to the following equation:

$$C_s = (\int I \mathrm{d}V)/(v m_{ac} V),$$

where I (A) is the response current, V (V) is the potential, v is the potential scan rate ($mV \cdot s^{-1}$), and m_{ac} (g) is the mass of the electroactive material in electrode.

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Figures

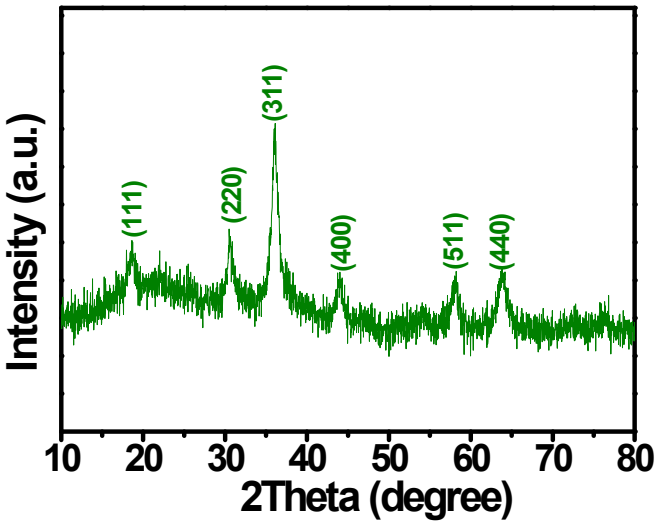

Fig. S1† The typical XRD pattern of the $MnCo_2O_4$ nanosheet arrays scratched from Ni foam.

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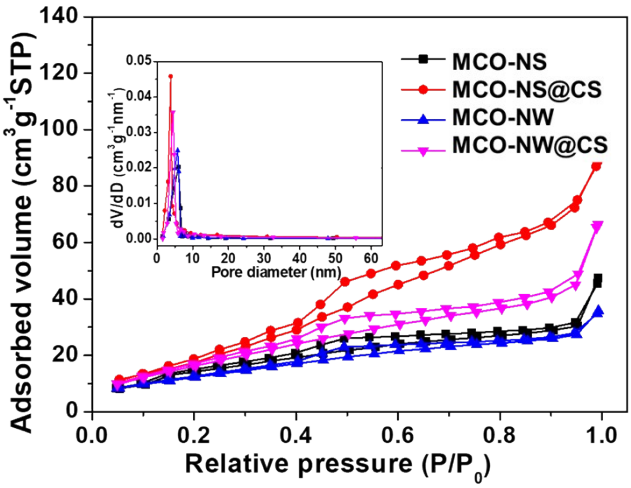

Fig. S2† The N_2 adsorption-desorption isotherm of MCO-NS, MCO-NS @CS, MCO-NW, and MCO-NW @CS and the inset shows the BJH pore size distribution.

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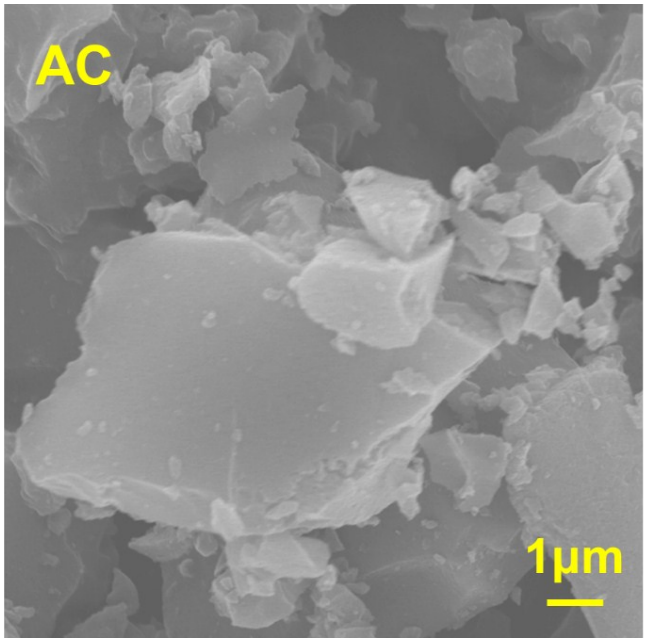

Fig. S3† SEM image of the active carbon (AC).

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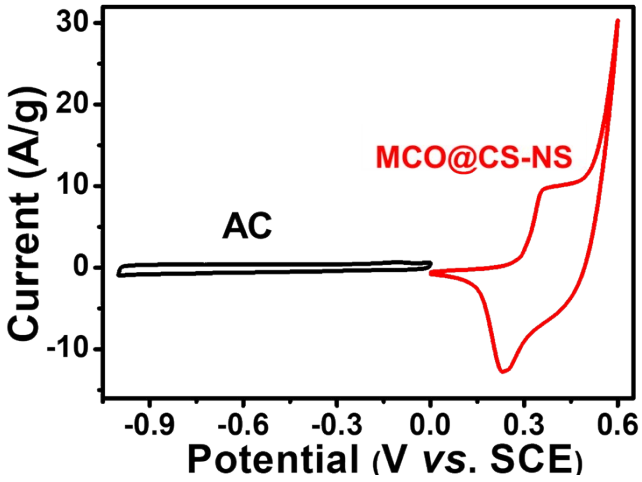

Fig. S4† CV curves of supercapacitor based on AC and MCO@CS-NS at a 5 $mV \cdot s^{-1}$ scan rate.

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Tables

Table. S1† Elemental composition of the MCO-NW@CS determined using XPS.

Element	Mn	Co	O	S
at%	9.14	23.40	43.68	3.28

From the data of XPS, the mass percentages of CoS in MCO-NW@CS could be confirmed to be about 11.11 wt.%.