Design and Synthesis of 3D Interconnected Mesoporous NiCo$_2$O$_4$@Co$_x$Ni$_{1-x}$(OH)$_2$ Core-Shell Nanosheet Arrays with Large Areal Capacitance and High Rate Performance for Supercapacitors

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Calculations: The discharge specific capacitance ($C_{sp}$) or areal capacitance ($C_a$) in the three-electrode was calculated from the discharge curves using the following equation:\cite{[1]} $C_{sp} = \frac{It}{m\Delta V}$ and $C_a = \frac{It}{S\Delta V}$, where I (A) is the current used for the charge/discharge, t (s) is the discharge time, m (g) is the total weight of the active electrode, $\Delta V$ (V) is the voltage interval of the discharge, and S is the geometrical area of the electrode.

The power density and energy density are calculated from the following equations, respectively:\cite{[2]} $E = 0.5C\Delta V^2$, $P = \frac{E}{t}$, where $E$ (Wh/kg) is the energy density, $P$ (kW/kg) is the power density, $C$ (F/g) is the specific capacitance, $\Delta V$ (V) is the potential window of discharge, and t (s) is the discharge time.
Figure S1. (a) SEM image of the treated Ni foam by HCl.

Figure S2. TEM image of the NiCo₂O₄ ultrathin nanosheet.
In order to reduce the impact of the NiCo$_2$O$_4$ nanosheets and Ni foam, we deposited pure Co$_x$Ni$_{1-x}$(OH)$_2$ on carbon cloth, the XRD shows that the pure Co$_x$Ni$_{1-x}$(OH)$_2$ material contains $\alpha$-Co(OH)$_2$ and $\alpha$-Ni(OH)$_2$ phase (JCPDS 74-1057 and 38-0715), which is consistent with previously reports.$^{[3,4]}$
Figure S4. CD curves of the hierarchical mesoporous NiCo$_2$O$_4$@Co$_x$Ni$_{1-x}$(OH)$_2$ core-shell nanosheet electrodes at different current densities, (a) $x = 0.67$, (b) $x = 0.5$, (c) $x = 0.33$.

Figure S5. (a) CD curves and (b) specific capacitance of the hierarchical mesoporous NiCo$_2$O$_4$@Co$_{0.5}$Ni$_{0.5}$(OH)$_2$ core-shell nanosheet arrays as a function of the Co$_{0.5}$Ni$_{0.5}$(OH)$_2$ electrodeposition time.
Figure S6. (a) CV curves of the NiCo$_2$O$_4$@Co$_{0.33}$Ni$_{0.67}$(OH)$_2$//CMK-3-ASC device with different masses. (b) The corresponding specific capacitances as a function of total mass.

Figure S7. CV curves of the NiCo$_2$O$_4$@Co$_{0.33}$Ni$_{0.67}$(OH)$_2$//CMK-3-ASC device at different scan voltage windows.

References

