Electronic Supplementary Information

In-Situ Embedding of Cobaltous Sulfide Quantum Dots among Transition Metal Layered Double Hydroxide for High Performance All-Solid-State Asymmetric Supercapacitors

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Figure S1. SEM micrographs of (a-c) Ni$_1$Mn$_3$Co-LDH/NF at different magnifications, (d-i) EDS elemental mapping images of Ni$_1$Mn$_3$Co-LDH/NF.

Figure S2. SEM micrographs of (a-c) Ni$_2$Mn$_2$Co-LDH/NF at different magnifications, (d-i) EDS elemental mapping images of Ni$_2$Mn$_2$Co-LDH/NF.
Figure S3. CV curves of Ni$_{1-x}$Mn$_4$Co-LDH composited with various Ni/Co ratios at
50 mV s\(^{-1}\).

**Figure S4.** XRD patterns of the Co-MOF and nickel foam.

**Figure S5.** (a) N\(_2\) adsorption-desorption isotherms and (b) pore size distribution patterns of Ni\(_3\)Mn\(_1\)Co-LDH/NF and Ni\(_3\)Mn\(_1\)Co@Co\(_9\)S\(_8\)-QDs/NF.
Figure S6. CV curves of the (a) Co-MOF/NF and (b) Ni$_1$Mn$_3$Co-LDH/NF and (c) Ni$_2$Mn$_2$Co-LDH/NF and (d) Ni$_3$Mn$_1$Co-LDH/NF electrode at different scan rates ranging from 5 to 100 mV s$^{-1}$. 
Figure S7. GCD curves of the (a) Co-MOF/NF and (b) Ni$_1$Mn$_3$Co-LDH/NF and (c) Ni$_2$Mn$_2$Co-LDH/NF and (d) Ni$_3$Mn$_1$Co-LDH/NF electrode at different current densities ranging from 1 to 20 A g$^{-1}$. 
Figure S8. A comparison of the specific capacitances of our Ni$_3$Mn$_1$Co@Co$_9$S$_8$-QDs/NF electrode with those previously reported cobalt sulfide electrode materials.
Figure S9. (a) XRD patterns of the Fe$_2$O$_3$@C/CC. The narrow spectra of (b) Fe 2p, (c) O 1s and (d) C 1s for Fe$_2$O$_3$@C/CC.

Figure S10. (a) CV curves of the Fe$_2$O$_3$@C/CC electrode at different scan rates ranging from 5 to 100 mV s$^{-1}$ (b) GCD curves of the Fe$_2$O$_3$@C/CC electrode at different current densities ranging from 1 to 20 A g$^{-1}$. 
Figure S11 (a, b) TEM images of Co$_9$S$_8$-QDs synthesized from different concentrations of TAA (c-h) CV and GCD curves of Co$_9$S$_8$-QDs synthesized from different concentrations of TAA.

<table>
<thead>
<tr>
<th>Active material</th>
<th>Electrolyte</th>
<th>Capacitance</th>
<th>Energy density</th>
<th>Ref.</th>
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<tr>
<td>Ni$_3$Mn$_1$Co@Co$_9$S$_8$-QDs/NF</td>
<td>6 M KOH</td>
<td>492.1 mAh g$^{-1}$ (3534 F g$^{-1}$) at 1 A g$^{-1}$</td>
<td>71.48 Wh kg$^{-1}$</td>
<td>This work</td>
</tr>
<tr>
<td>CoS-NiO</td>
<td>3 M KCl</td>
<td>1527 F g$^{-1}$ at 1 A g$^{-1}$</td>
<td>39 Wh kg$^{-1}$</td>
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<tr>
<td>Co$_3$O$_4$/CoS NSs</td>
<td>2 M KOH</td>
<td>1658 F g$^{-1}$ at 1 A g$^{-1}$</td>
<td>23.6 Wh kg$^{-1}$</td>
<td>[4]</td>
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<tr>
<td>5-NiS@CoS</td>
<td>2 M KOH</td>
<td>1210 F g$^{-1}$ at 1 A g$^{-1}$</td>
<td>24.1 Wh kg$^{-1}$</td>
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<td>KCu$_7$S$_4$@NiMn LDHs</td>
<td>1 M LiOH</td>
<td>879 F g$^{-1}$ at 1 mV s$^{-1}$</td>
<td>15.9 Wh kg$^{-1}$</td>
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<td>CC@NiCo-LDH/Co$_9$S$_8$</td>
<td>6 M KOH</td>
<td>2438 F g$^{-1}$ at 5 A g$^{-1}$</td>
<td>38 Wh kg$^{-1}$</td>
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<td>MC@CF-LDH-3</td>
<td>6 M KOH</td>
<td>903.15 C g$^{-1}$ at 1 A g$^{-1}$</td>
<td>60.82 Wh kg$^{-1}$</td>
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<td>NiCoP/NiCo-OH30</td>
<td>3 M KOH</td>
<td>1100 F g$^{-1}$ at 1 A g$^{-1}$</td>
<td>34 Wh kg$^{-1}$</td>
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</table>

Table S1 Compared the performances reported in our work and those recently reported on LDHs and cobalt sulfide related materials for supercapacitors.

References


