Supporting Information

Facile synthesis of hierarchical $CoMoO_4$@$NiMoO_4$ core-shell nanosheet arrays on nickel foam as an advanced electrode for asymmetric supercapacitors

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Table S1 The comparison results of electrochemical performance for $CoMoO_4$ and $CoMoO_4$@$NiMoO_4$ composite electrodes.

Samples	Mass loading (mg cm^{-2})	Ca (F cm^{-2})	Cs (F g^{-1})	Rate capability (%)
$CoMoO_4$	1.27	1.16	913.4	35.7
CMNM-2	1.68	1.74	1035.7	44.3
CMNM-4	2.01	3.30	1639.8	66.7
CMNM-6	2.45	2.61	1065.3	50.4

Table S2 The comparison results of electrochemical performance for CMNM-4 and other similar core-shell structure composite electrodes.

Electrode materials	Specific capacitance	Ref.
$CoMoO_4$@$NiMoO_4$ core/shell nanosheet arrays	1639.8 F g^{-1} at 10 mA cm^{-2}	This work
Co_3O_4@$CoMoO_4$ core/shell nanowire arrays	1040 F g^{-1} at 1 A g^{-1}	32
$NiCo_2O_4$ nanowire@$CoMoO_4$ nanoplate core/shell arrays	1347.3 F g^{-1} at 10 mA cm^{-2}	33
$NiCo_2O_4$@$Co_xNi_{1-x}(OH)_2$ core/shell nanosheet arrays	1045 F g^{-1} at 1 A g^{-1}	34

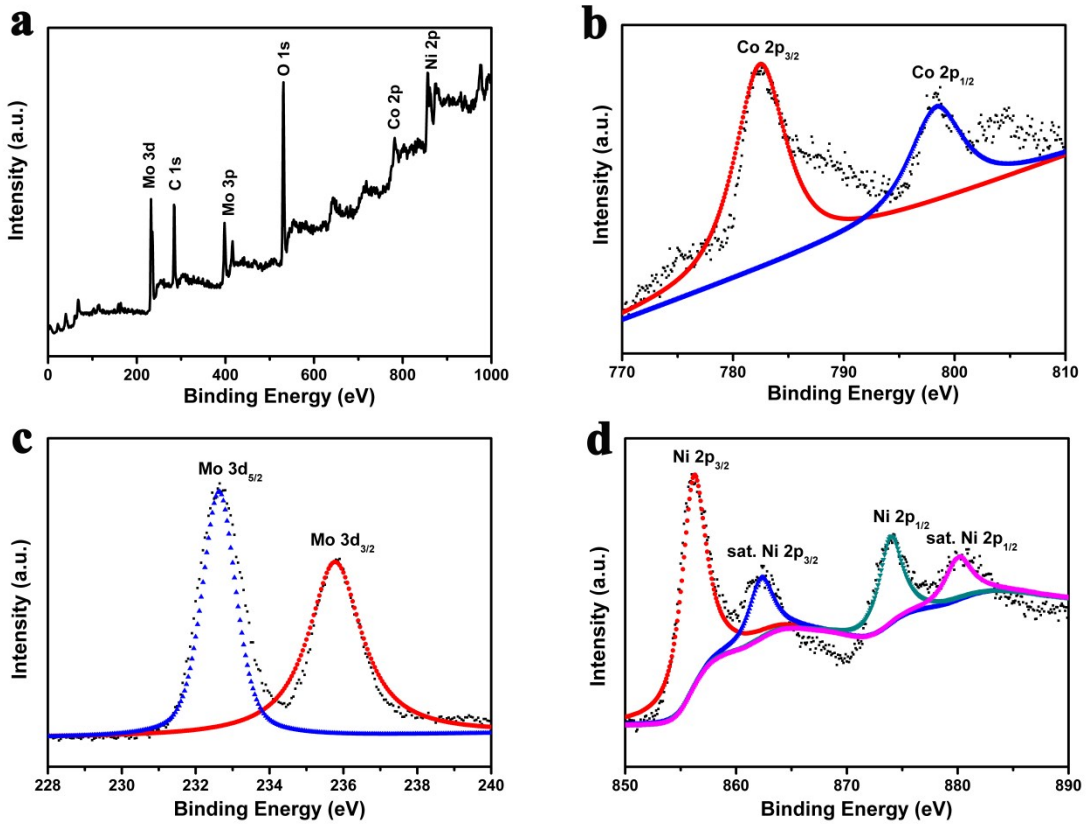

Fig. S1. XPS spectra of (a) survey spectrum, (b) Co 2p, (c) Mo 3d and (d) Ni 2p for $CoMoO_4$@$NiMoO_4$ nanosheet arrays.

A survey scan (Fig. S1a) showed the presence of Co, Mo, Ni, O elements in the composite. The Co 2p core level spectrum (Fig. S1b) showed two main peaks at 782.5 and 798.3 eV, corresponding to the Co $2p_{3/2}$ and Co $2p_{1/2}$ energy level respectively, which is a signature of Co^{2+}. Fig. S1c of Mo 3d region exhibited two peaks with binding energies of 232.6 and 235.8 eV, which can be assigned to the Mo $3d_{5/2}$ and Mo $3d_{3/2}$ energy level, respectively. The binding energy separation of Mo 3d is 3.2 eV, which is best ascribed to a Mo^{6+} oxidation state. As shown in Fig. S1d, the binding energy peak at 856.2 eV and its satellite peak at 862.4 eV corresponded to Ni $2p_{3/2}$ level, whereas the binding energy peaks at 874 eV and its satellite peak at 880.2 eV corresponded to the Ni $2p_{1/2}$ level. The main binding energy peaks of Ni $2p_{3/2}$ and Ni $2p_{1/2}$ are separated by 17.8 eV, which is a signature of the Ni^{2+} oxidation state.

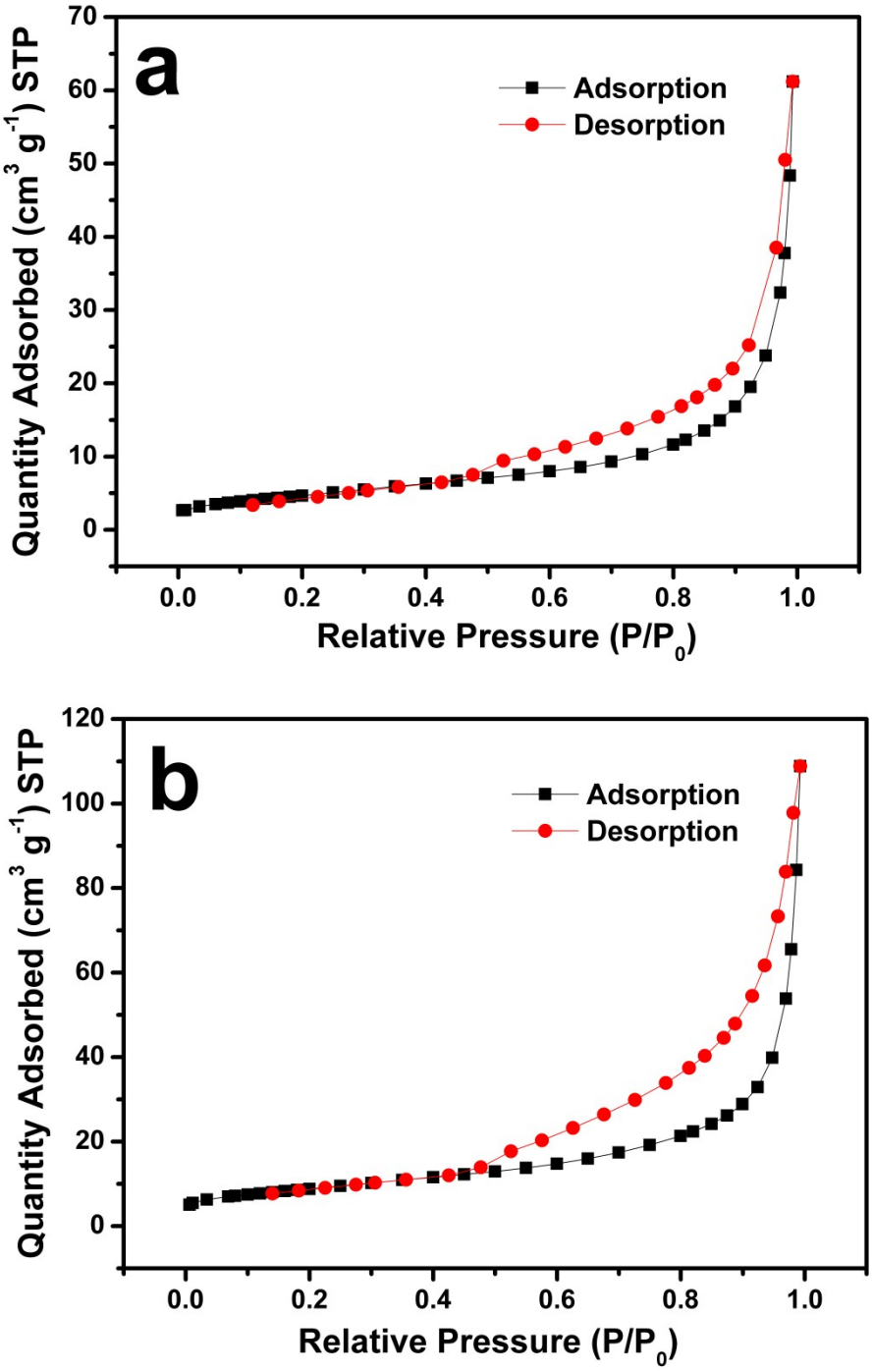

Fig. S2. N_2 adsorption-desorption isotherms at 77 K of (a) $CoMoO_4$ and (b) $CoMoO_4$@$NiMoO_4$ nanosheet arrays.

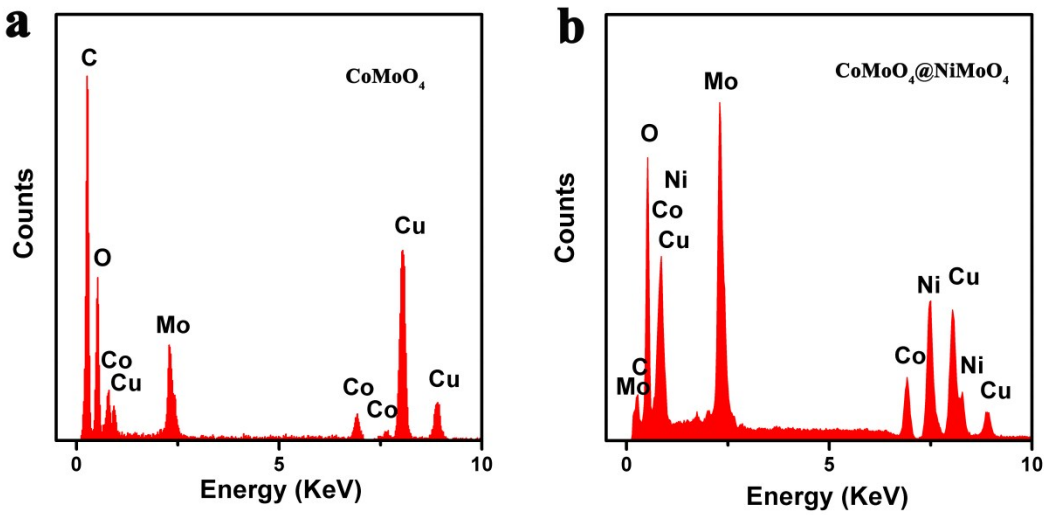

Fig. S3. EDS spectra of (a) $CoMoO_4$ and (b) $CoMoO_4$@$NiMoO_4$ nanosheet arrays.

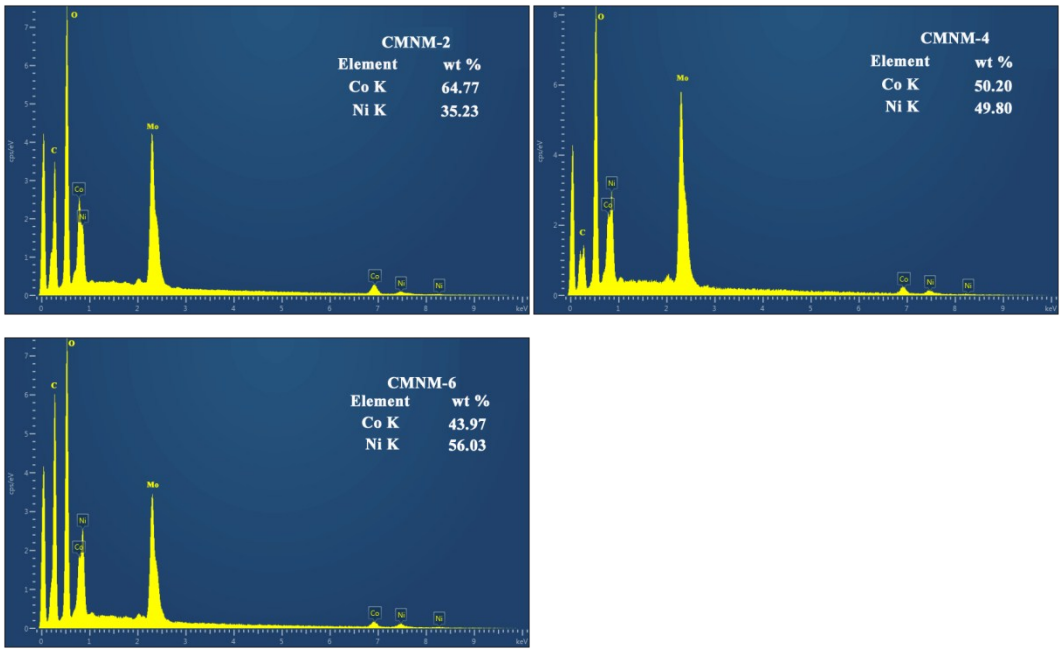

Fig. S4. EDS spectra of CMNM-2, CMNM-4 and CMNM-6.

We have obtained the Co/Ni atomic ratios of the CMNM-2, CMNM-4 and CMNM-6 are about 1.83:1, 1:1 and 1:1.28, respectively.

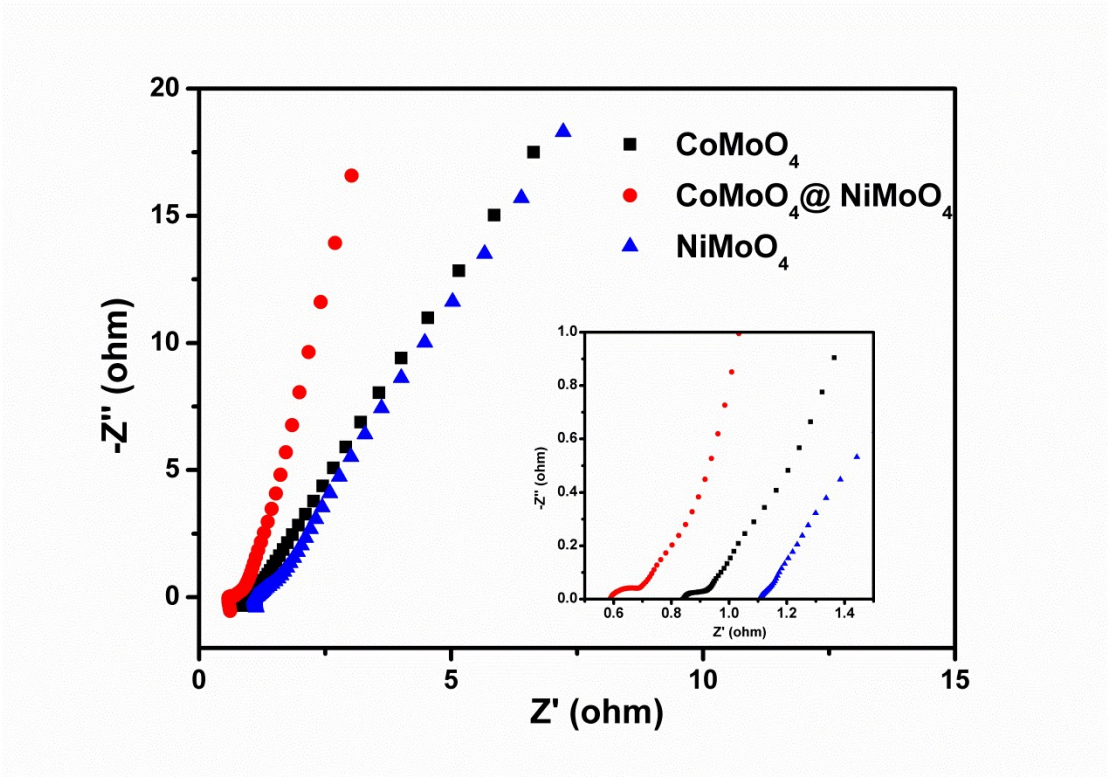

Fig. S5. Nyquist plots of $CoMoO_4$, $NiMoO_4$ and CMNM-4 nanosheet arrays.

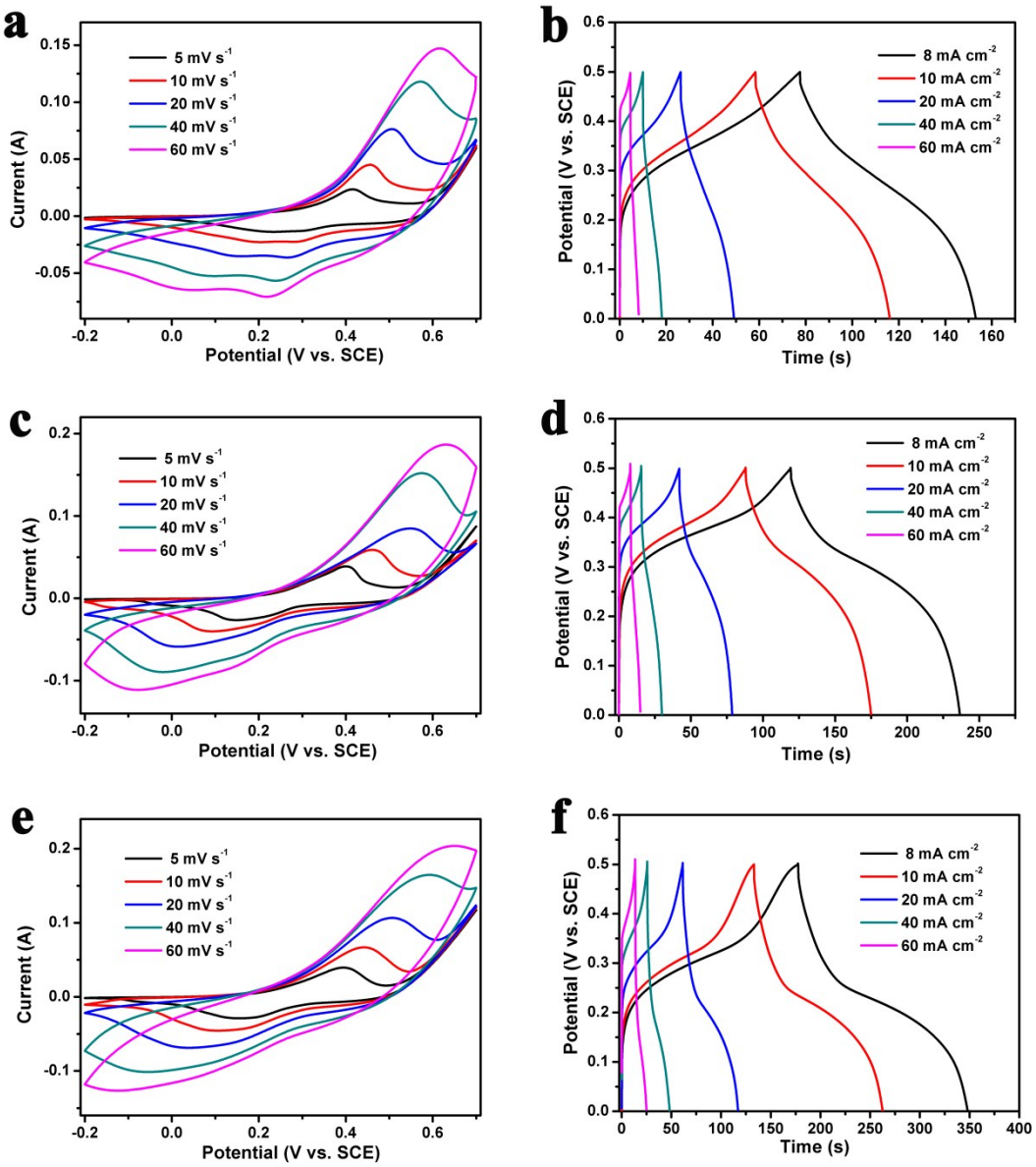

Fig. S6. CV curves of (a) $CoMoO_4$, (c) CMNM-2, (e) CMNM-6 electrode at various scan rates ranging from 5 to 80 mV s^{-1}; CD curves of (b) $CoMoO_4$, (d) CMNM-2, (f) CMNM-6 electrode at different current densities.

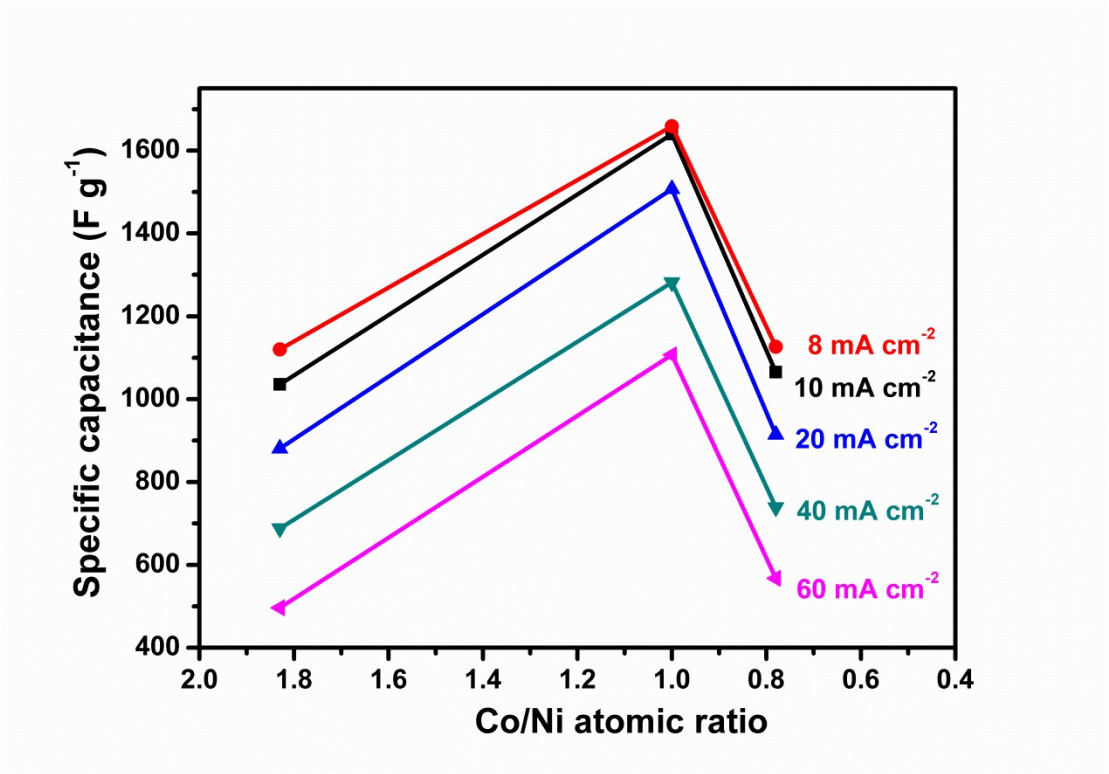

Fig. S7 Specific capacitances of $CoMoO_4$@$NiMoO_4$ composite electrodes at different Co/Ni atomic ratios.

The relationship between Co/Ni atomic ratios and electrochemical properties of composite electrodes was shown in Fig. S7. It was noted that the capacitances of core-shell hybrid materials increased with the decreasing Co/Ni atomic ratio at first, and then reached the highest capacitance (1639.8 F g^{-1} at 10 mA cm^{-2}) at the atomic ratio 1:1. The capacitance began to fall as the atomic ratio continued to decline. So the Co/Ni ratio has influence on the electrochemical properties, but the influence of density and size of $NiMoO_4$ nanosheets was greater.