Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

Unusual Formation of $NiCo_2O_4$@MnO_2/Nickel Foam/MnO_2 Sandwich as Advanced Electrodes for Hybrid Supercapacitors

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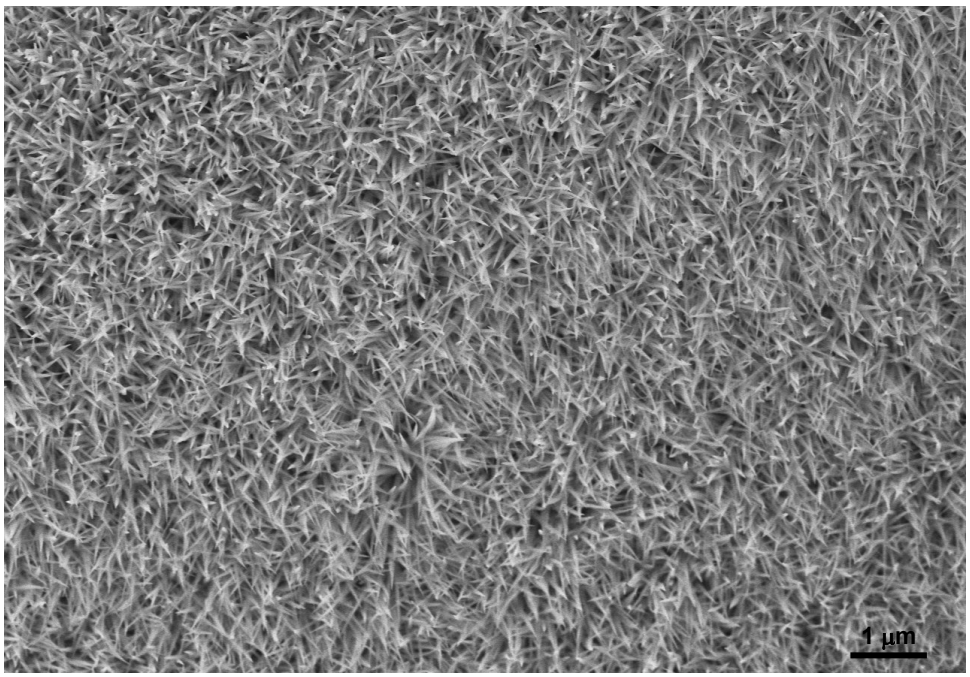

Fig. S1 FESEM images of the as-synthesized cobalt-nickel hydroxide precursor nanowire arrays grown on NF.

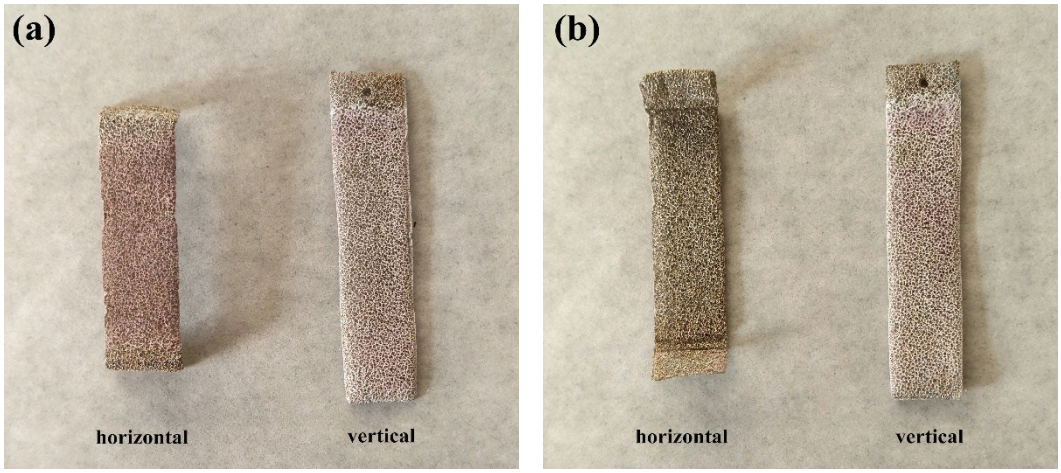

Fig. S2 (a, b) The different distributions of cobalt-nickel hydroxide precursors on NF.

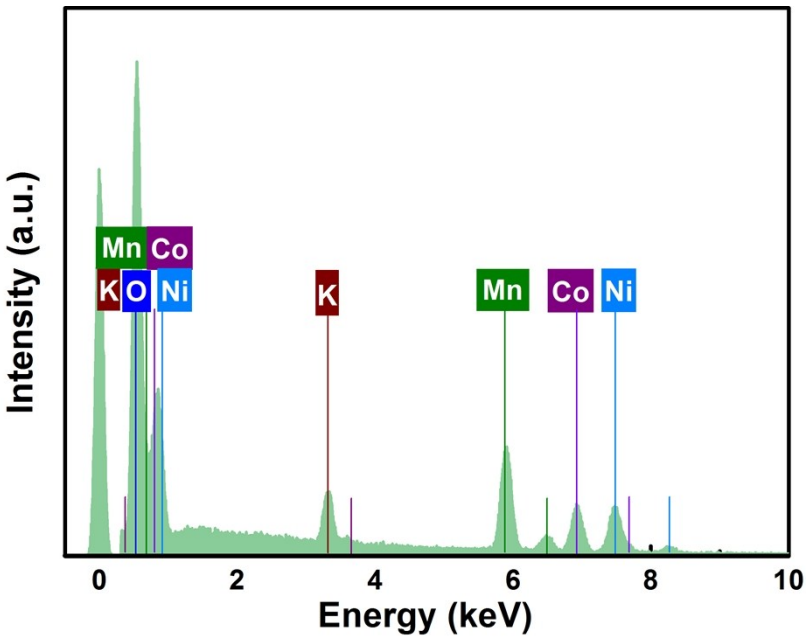

Fig. S3 EDX spectrum of the $NiCo_2O_4$@MnO_2/NF/MnO_2 sandwiches.

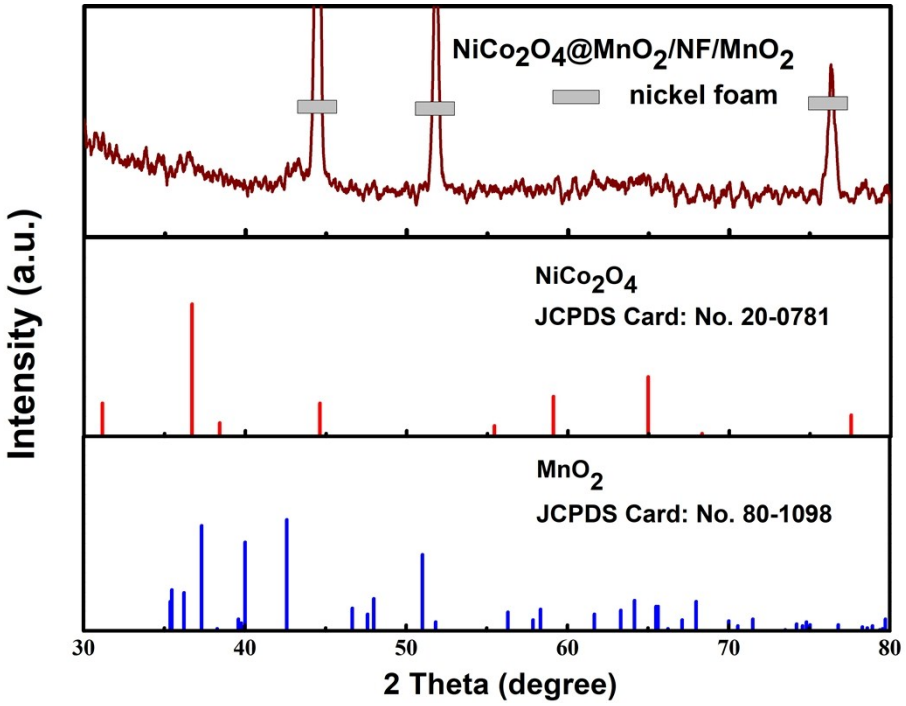

Fig. S4 XRD patterns of the $NiCo_2O_4$@MnO_2/NF/MnO_2 sandwiches.

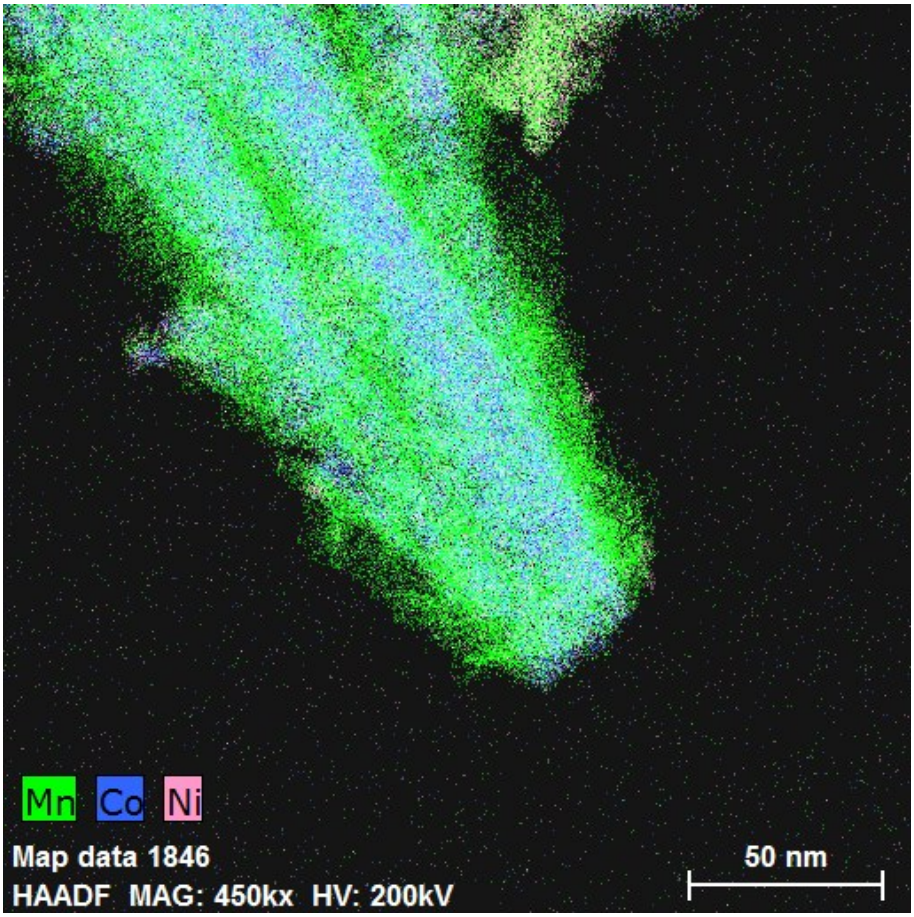

Fig. S5 The corresponding EDX mapping image showing the distribution of Mn, Co, and Ni for $NiCo_2O_4$@MnO_2 core-shell structures.

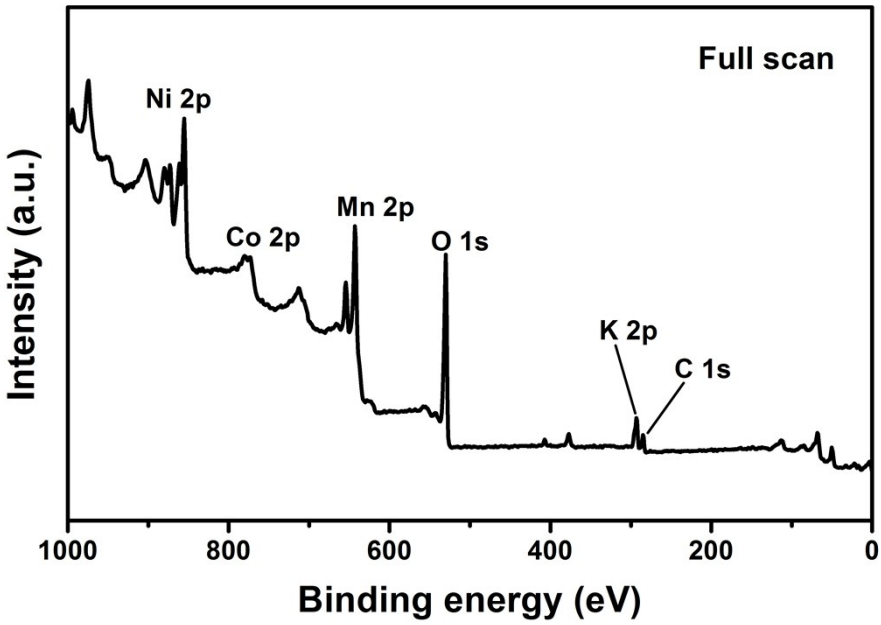

Fig. S6 XPS spectrum of survey for the as-fabricated $NiCo_2O_4$@MnO_2/NF/MnO_2 sandwiches.

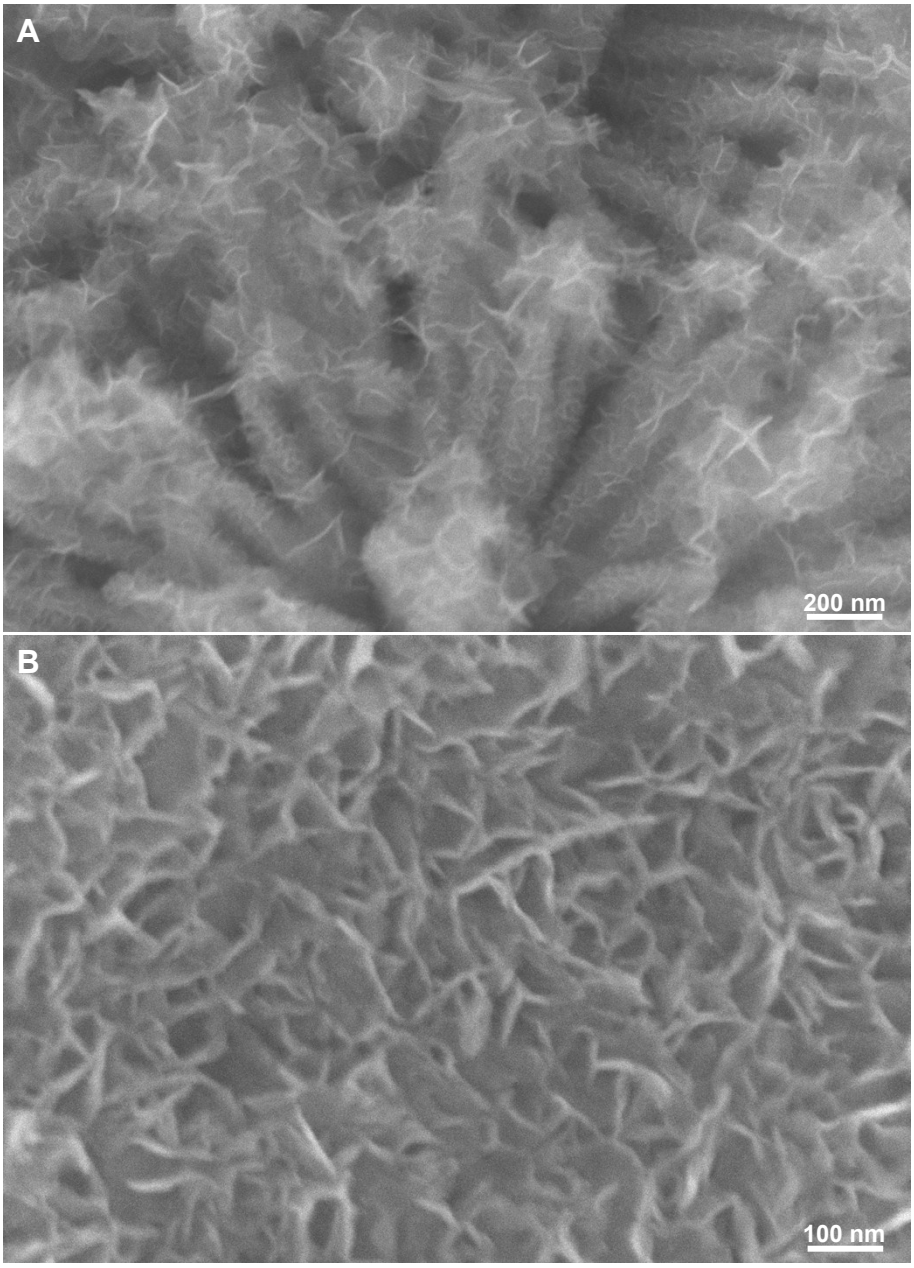

Fig. S7 FESEM images of the side A (A) and side B (B) of $NiCo_2O_4$@MnO_2/NF/MnO_2 sandwiches after 30,000 cycles.

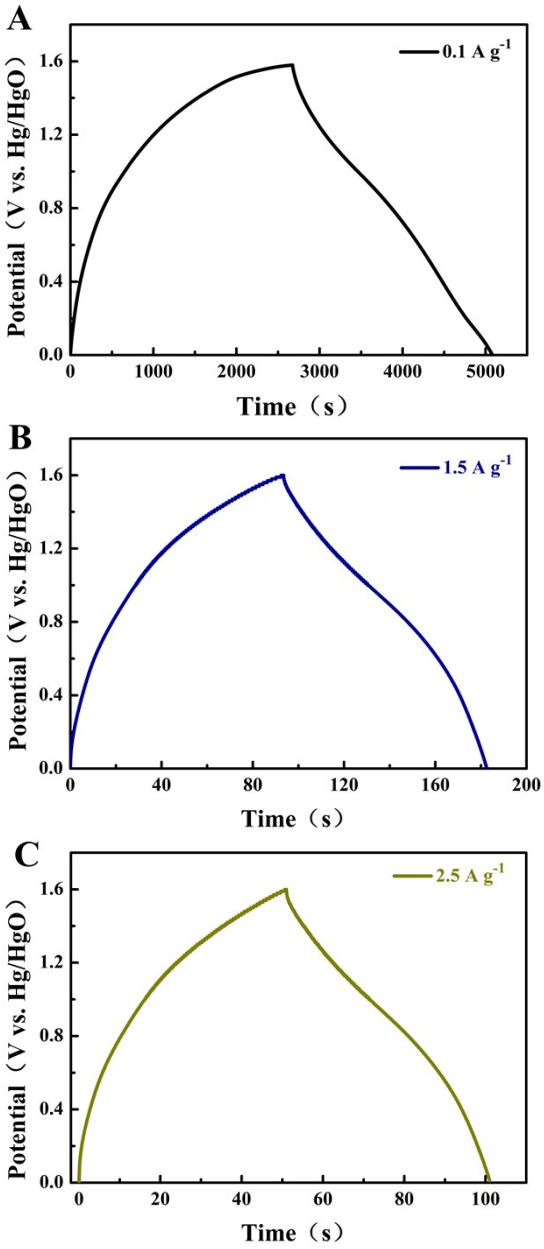

Fig. S8 the GCD curves of HSC at 0.1 A g^{-1} (A), 1.5 A g^{-1} (B) and 2.5 A g^{-1} (C).

Table S1. Electrochemical performance of the $NiCo_2O_4$@MnO_2/NF/MnO_2 sandwich electrode in this study, compared with some other $NiCo_2O_4$-based electrodes reported in previous literature.

Electrode materials	Specific capacity	Electrolyte	Cycling stability	Refs.
$NiCo_2O_4$ nanosheets	404.6 C g^{-1} at 1 A g^{-1}	6 M KOH	93.2% after 6000 cycles	[48]
3D network-like mesoporous $NiCo_2O_4$	465.5 C g^{-1} at 3 A g^{-1}	2 M KOH	125.2% after 1000 cycles	[49]
$NiCo_2O_4$-decorated porous carbon nanosheets	238.7 C g^{-1} at 2 A g^{-1}	6 M KOH	98.0% after 3000 cycles	[50]
$NiCo_2O_4$@MnO_2 core-shell nanosheets	1.08 C cm^{-2} at 3 mA cm^{-2}	1 M NaOH	92.6% after 2000 cycles	[27]
$NiCo_2O_4$/MnO_2 heterostructured nanosheet	0.44 C cm^{-2} at 2 mA cm^{-2}	2 M KOH	110.0% after 6000 cycles	[51]
$NiCo_2O_4$@MnO_2 core–shell nanowire	1.01 C cm^{-2} at 2 mA cm^{-2}	1 M NaOH	113.6% after 8000 cycles	[23]
$NiCo_2O_4$@MnO_2/NF/MnO_2	1.70 C cm^{-2} at 2 mA cm^{-2}	6 M KOH	90.0% after 30,000 cycles	**Our work**

Table S2. the discharge time, specific capacity, energy densities and power densities of the HSC at various current densities.

Current density ($A\ g^{-1}$)	Discharge time (s)	Specific capacity ($C\ g^{-1}$)	Energy density ($Wh\ kg^{-1}$)	Power density ($W\ kg^{-1}$)
0.1	2407.0	240.6	53.5	80.0
0.5	322.5	161.3	35.8	400.0
1.0	149.2	149.3	33.2	801.1
1.5	89.0	133.4	29.7	1201.3
2.0	64.6	129.3	28.7	1599.4
2.5	50.0	125.0	27.8	2001.6
3.0	40.4	121.3	27.0	2405.9
5.0	22.0	110.1	24.5	4009.1
10.0	9.3	93.0	20.7	8012.9