## **Supporting Information**

## A high-performance hybrid supercapacitor by encapsulating binder-less FeCoSe<sub>2</sub> nanosheets@NiCoSe<sub>2</sub> nanoflowers in graphene network

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**Fig. S1** (A) Photograph of pure NF. (B, C) FE-SEM images of the pure NF. (D) Photograph of FC-LDH@NF. (E, F) FE-SEM images of the of FC-LDH@NF. (G) Photograph of FC-LDH@NC-LDH10@NF. (H, I) FE-SEM images of the of FC-LDH@NF.



**Fig. S2** (A) Photograph of FCS@NCS2@NF. (B-D) FE-SEM images of the FCS@NCS2@NF. (E-E4) FE-SEM mapping of the FCS@NCS2@NF.



Fig. S3 XRD patterns of the NiCo-LDH, FeCo-LDH, and FeCo-LDH@NiCo-LDH.



**Fig. S4** (A) CV curves of the FC-LDH@NC-LDH5@NF, FC-LDH@NC-LDH10@NF, and FC-LDH@NC-LDH15@NF electrodes at 50 mV/s. (B) GCD curves of the FC-LDH@NC-LDH5@NF, FC-LDH@NC-LDH10@NF, and FC-LDH@NC-LDH15@NF electrodes at 1 A/g. (C) Specific capacities of FC-LDH@NC-LDH5@NF, FC-LDH@NC-LDH10@NF, and FC-LDH@NC-LDH15@NF electrodes at 1 A/g.



**Fig. S5** (A) CV curves of the FCS@NCS1@NF, FCS@NCS2@NF, and FCS@NCS3@NF electrodes at 50 mV/s. (B) GCD curves of the FCS@NCS1@NF, FCS@NCS2@NF, and FCS@NCS3@NF electrodes

at 1 A/g. (C) Specific capacities of FCS@NCS1@NF, FCS@NCS2@NF, and FCS@NCS3@NF electrodes at 1 A/g.



**Fig. S6** (A) CV curves of the FCS@NCS-G1@NF, FCS@NCS-G2@NF, and FCS@NCS-G3@NF electrodes at 50 mV/s. (B) GCD curves of the FCS@NCS-G1@NF, FCS@NCS-G2@NF, and FCS@NCS-G3@NF electrodes at 1 A/g. (C) Specific capacities of FCS@NCS-G1@NF, FCS@NCS-G2@NF, and FCS@NCS-G3@NF electrodes at 1 A/g.



**Fig. S7** (A) CV curves of the FC-LDH@NF at various scan rates from 10 to 80 mV/s. (B) CV curves of the FC-LDH@NC-LDH5@NF at various scan rates from 5 to 80 mV/s. (C) CV curves of the FC-LDH@NC-LDH10@NF at various scan rates from 5 to 80 mV/s. (D) CV curves of the FC-LDH@NC-LDH@NF15@NF at various scan rates from 5 to 80 mV/s. (E) CV curves of the FCS@NCS1@NF at various scan rates from 5 to 80 mV/s. (G) CV curves of the FCS@NCS3@NF at various scan rates from 5 to 80 mV/s. (I) CV curves of the FCS@NCS-G1@NF at various scan rates from 5 to 80 mV/s. (I) CV curves of the FCS@NCS-G3@NF at various scan rates from 5 to 80 mV/s. (I) CV curves of the FCS@NCS-G3@NF at various scan rates from 5 to 80 mV/s.



**Fig. S8** (A) Capacitive contributions and diffusion-controlled contributions of FCS@NCS-G2@NF electrode at various scan rates from 5 to 80 mV/s. (B) Capacitive contributions and diffusion-controlled contributions of FCS@NCS2@NF electrode at various scan rates from 5 to 80 mV/s.



**Fig. S9** (A) GCD curves of the FC-LDH@NF at various current densities from 1 to 30 A/g. (B) GCD curves of the FC-LDH@NC-LDH5@NF at various current densities from 1 to 30 A/g. (C) GCD curves of the FC-LDH@NC-LDH10@NF at various current densities from 1 to 30 A/g. (D) GCD curves of the FC-LDH@NC-LDH@NF15@NF at various current densities from 1 to 30 A/g. (E) GCD curves of the FCS@NCS1@NF at various current densities from 1 to 30 A/g. (F) GCD curves of the FCS@NCS1@NF at various current densities from 1 to 30 A/g. (F) GCD curves of the FCS@NCS2@NF at various current densities from 1 to 30 A/g. (F) GCD curves of the FCS@NCS2@NF at various current densities from 1 to 30 A/g. (F) GCD curves of the FCS@NCS2@NF at various current densities from 1 to 30 A/g. (G) GCD curves of the FCS@NCS3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G1@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g. (I) GCD curves of the FCS@NCS-G3@NF at various current densities from 1 to 30 A/g.



**Fig. S10** (A) Specific capacities vs. current densities of the FCS@NCS-G1@NF, FCS@NCS-G2@NF, and FCS@NCS-G3@NF electrodes. (B) Specific capacities vs. current densities of the FCS@NCS1@NF, FCS@NCS2@NF, and FCS@NCS3@NF electrodes. (C) Specific capacities vs. current densities of the FC-LDH@NC-LDH5@NF, FC-LDH@NC-LDH10@NF, and FC-LDH@NC-LDH15@NF electrodes.



**Fig. S11** (A) Durability of the FCS@NCS-G1@NF and FCS@NCS-G3@NF electrodes at 10 A/g. (B) Durability of the FCS@NCS1@NF, FCS@NCS2@NF, and FCS@NCS3@NF electrodes at 10 A/g. (C) Durability of the FC-LDH@NC-LDH10@NF, FC-LDH@NC-LDH15@NF, FC-LDH@NC-LDH5@NF, and FC-LDH@NF electrodes at 10 A/g.



**Fig. S12** (A-C) FE-SEM images of the FCS@NCS-G2@NF after 11,000 GCD cycles. (D, E) FE-SEM images of the FCS@NCS2@NF after 11,000 GCD cycles.



**Fig. S13** (A) XRD patterns of the FCS@NCS-G2 sample before and after 11000 GCD cycles. (B) Raman patterns of the FCS@NCS-G2 sample before and after 11,000.



**Fig. S14** (A) CV plots of the AC@NF electrode from 10 to 80 mV/s. (B) GCD plots of the AC@NF from 1 to 30 A/g. (c) Specific capacities vs. current densities of the AC@NF electrode.

**Table S1.** Comparison of the electrochemical performance of the FCS@NCS-G2@NF in three and two electrode systems with other previously reported electrode materials.

## References

Composition	Capacity 3 and 2 electrodes (C/g)	Cycles, retention 2 and 3 electrode	Rate capabilit y, 2 and 3 electrod es	ED (W h kg <sup>-1</sup> ) 2 Electrode	Reference
Ni <sub>0.85</sub> Se@MoSe <sub>2</sub>	387 at 1 A/g (3 E)	1000, 95% (3 E 5000, 88% (2 E)	63% at 15 A/g (3 E)	25.5	1
NiCoSe4	504 at 0.5 A/g (3 E) 156.48 at 0.5 A/g (2 E)	5000, 80% (3 E) 10000, 65% (2 E)	85.2% at 20 A/g (3 E)	34.8	2
CuCo <sub>2</sub> Se <sub>4</sub>	265 at 1 A/g (3 E) 37.75 at 1 A/g (2 E)	6000, 83.7% (3 E) 6000, 88% (3 E)	70.8% at 6 A/g (3 E)	9.45	3
NiCo2Se4	881.05 at 1 A/g (3 E) 107.7 at 1 A/g (2 E)	10000, 82% (3 E) 10000, 94% (3 E)	62.5% at 20 A/g (3 E)	24.03	4
Ni <sub>0.95</sub> Co <sub>2.05</sub> Se <sub>4</sub>	519.4 at 1 A/g(3 E)	5000, 85% (3 E) 10000, 78.6% (2 E)	67% at 20 A/g (3 E)	37.22	5
NiSe-graphene	512 at 1 A/g (3 E) 225.6 at 1 A/g (2 E)	2500, 98% (3 E) 3000, 84.4% (2 E)	80% at 10 A/g (2 E) 70% at 10 A/g (2 E)	50.1	6
NiMn-LDH	1082 at 1 A/g (3 E)	10000, 91.4% (3 E) 10000, 90.8% (2 E)	-	48.9	7
Cu <sub>2</sub> Se@Co <sub>3</sub> Se	502.5 at 1 A/g (3 E) 139.2 at 1 A/g (2 E)	10000, 94.2% (3 E) 10000, 85.8% (3 E)	83.4% at 10 A/g (3 E)	30.9	8
NiCo <sub>2</sub> Al <sub>0.5</sub> -LDH	630 at 1 A/g (3 E)	6000, 91.7% (3 E)		39	9
CoNi-LDH2	1031.4 at 1 A/g (3 E)	5000, 60.7% (2 E)	71% at 25 A/g (3 E)	49	10
FCS@NCS- G@NF	1156C/g at 1 A/g (3 E) 280 C/g at 1 A/g (2 E)	11000, 92.3 (3 E) 11000, 90.8 (2 E)	81% at 48 A/g (3 E)	62.2	This study

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