

Supporting Information for

**Carbon-Encased Mixed-metal Selenide Rooted with Carbon Nanotubes for
High-Performance Hybrid Supercapacitors**

Yu Yuan¹, Panpan Cui¹, Jie Liu¹, Wei Ding¹, Yong Wang^{*1,2}, Li-Ping Lv^{*1,2}

¹*School of Environmental and Chemical Engineering, Shanghai University, 99 Shangda Road, Shanghai,
P. R. China, 200444*

²*Key Laboratory of Organic Compound Pollution Control Engineering (MOE),
Shanghai University, 99 Shangda Road, Shanghai, P. R. China, 200444*

*Corresponding authors: Tel: +86-21-66137723; fax: +86-21-66137725.

Email address: yongwang@shu.edu.cn; liping_lv@shu.edu.cn

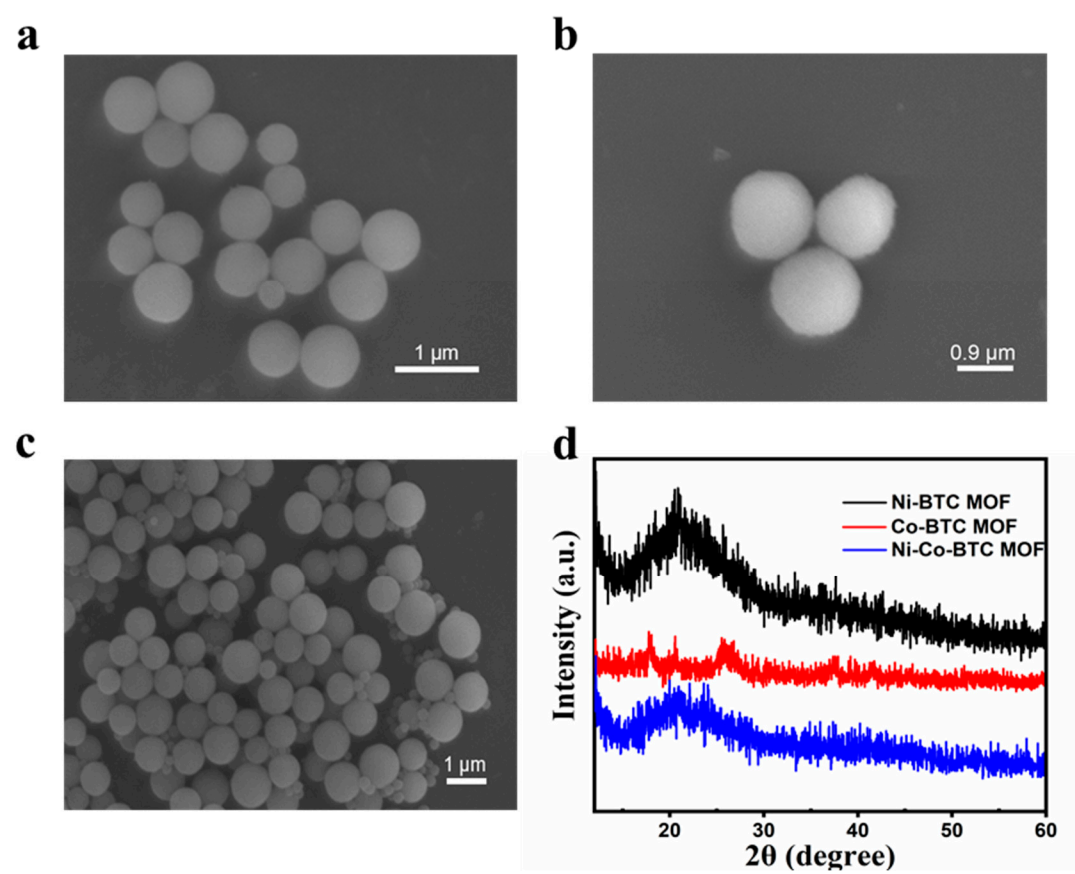


Figure S1. SEM images of (a) Ni-BTC MOF, (b) Co-BTC MOF, and (c) Ni-Co-BTC MOF; (d) XRD patterns of Ni-BTC MOF, Co-BTC MOF, and Ni-Co-BTC MOF.

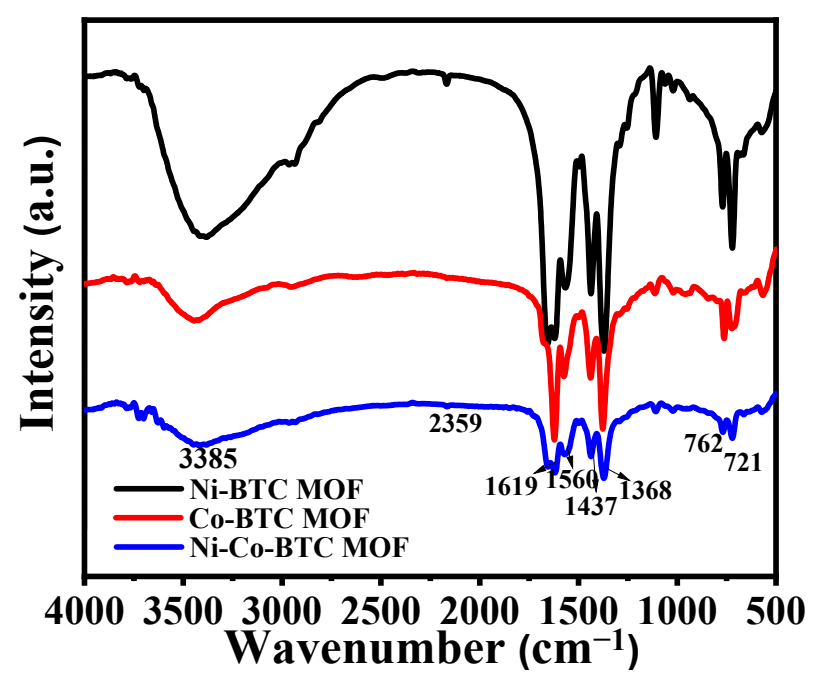


Figure S2. FTIR spectra of Ni-BTC MOF, Co-BTC MOF, and Ni-Co-BTC MOF.

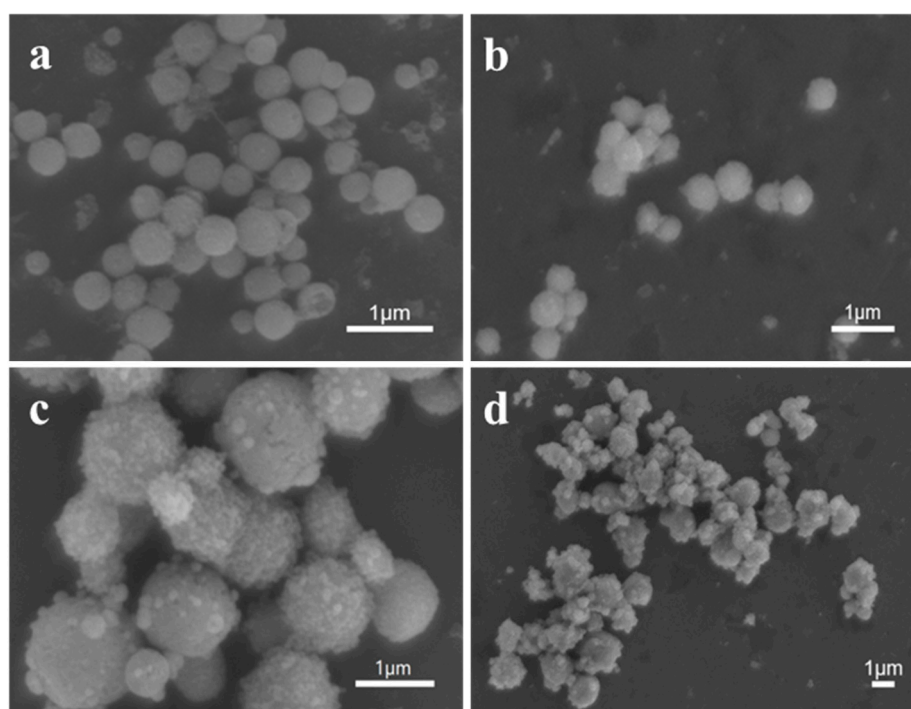


Figure S3. SEM images of (a) Ni@C-CNT, (b) Ni-Se@C-CNT, (c) Co@C-CNT, and (d) Co-Se@C-CNT.

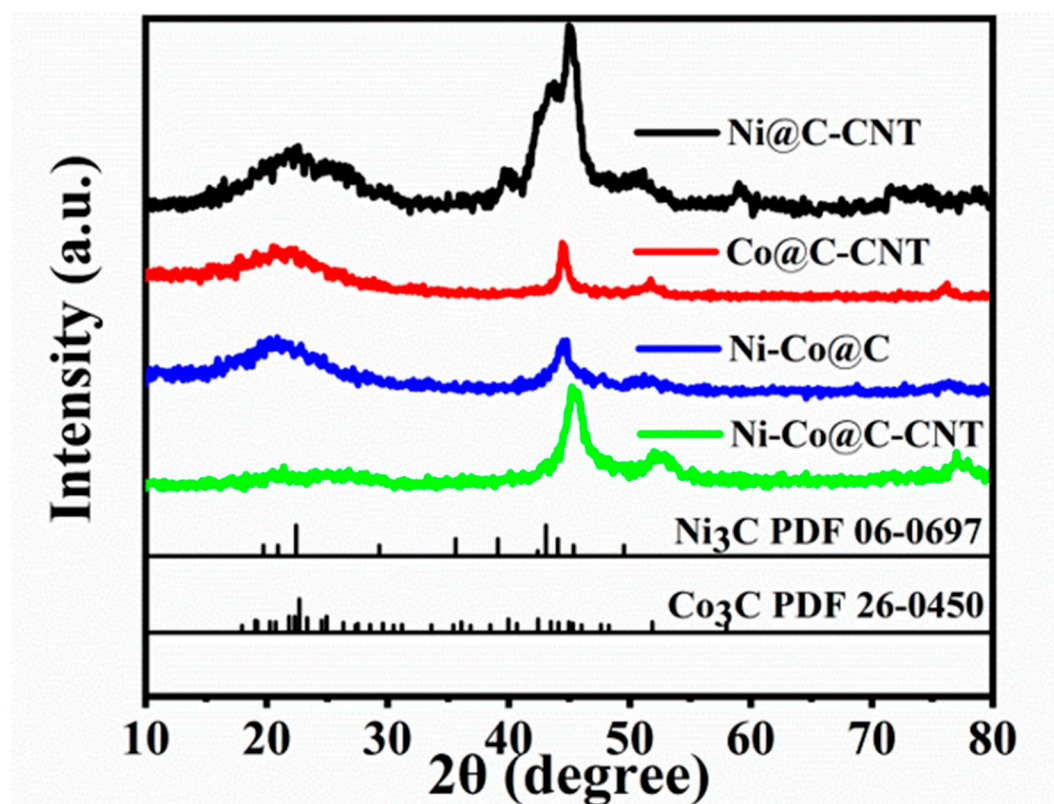


Figure S4. XRD patterns of Ni@C-CNT, Co@C-CNT, Ni-Co@C, and Ni-Co@C-CNT.

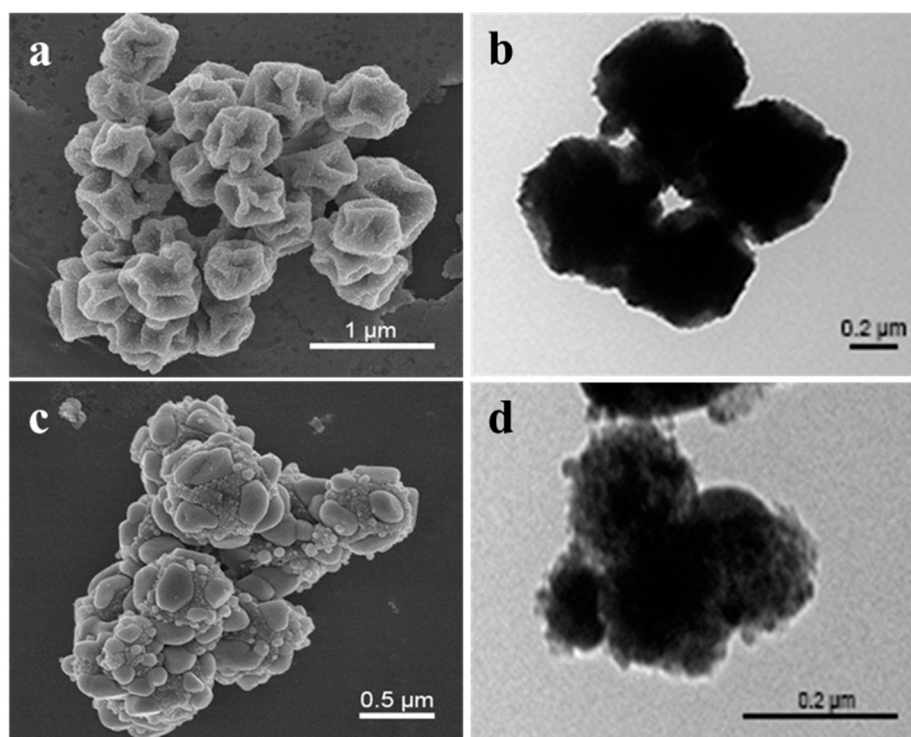


Figure S5. SEM images of (a) Ni-Co@C, (c) Ni-Co-Se@C; TEM images of (b) Ni-Co@C, (d) Ni-Co-Se@C.

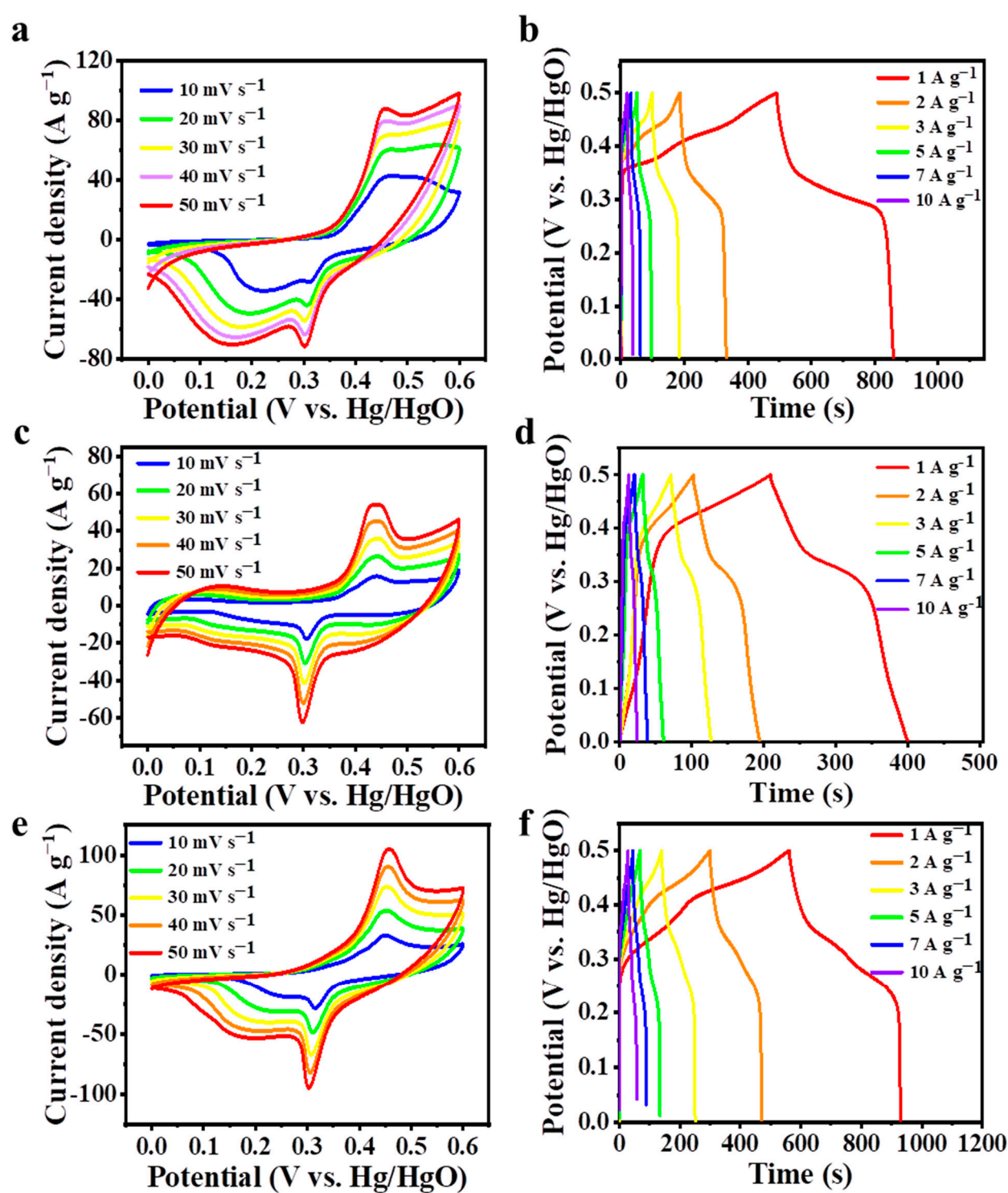


Figure S6. CV curves of (a) Ni-Se@C-CNT, (c) Co-Se@C-CNT, (e) Ni-Co-Se@C electrodes at various scan rates; GCD curves of (b) Ni-Se@C-CNT, (d) Co-Se@C-CNT, (f) Ni-Co-Se@C electrodes.

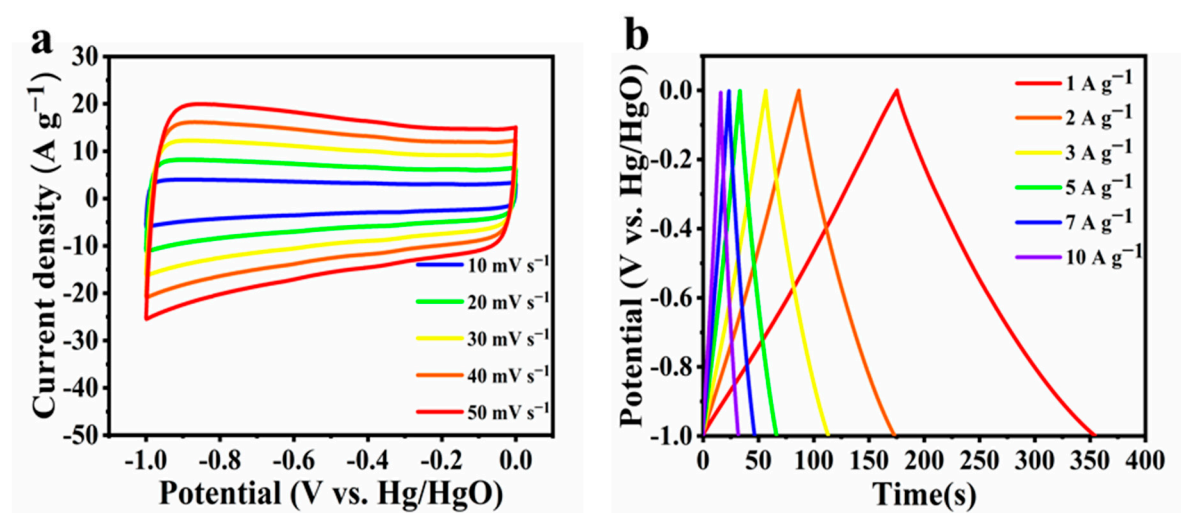


Figure S7. Electrochemical properties of AC: CV curves; (b) GCD curves.

Table. S1 Results of the elemental content measurements of Ni-Co-Se@C-CNT

Element	Mass content (%)
Ni	14.98
Co	7.36
Se	54.49

Table S2. Electrochemical performance comparison of bimetallic metal-selenide based supercapacitor electrodes. (SC: specific capacitance; RP: rate performance; CP: cycling performance.)

Ref.	Composite	SC	RP	CP
This work	Ni-Co-Se@C-CNT	554.1 C g⁻¹ (1108.2 F g⁻¹) (1 A g⁻¹)	89.9% (10 A g⁻¹)	96.4 % (5000 cycles)
1	(Ni,Co)Se ₂ @rGO ^[43]	649.1C g ⁻¹ (1 A g ⁻¹)	75.5% (20 A g ⁻¹)	90.5 % (5000 cycles)
2	(Ni,Co)Se ₂ -T ^[44]	636.2C g ⁻¹ (1 A g ⁻¹)	66.1% (20 A g ⁻¹)	/
3	(Ni,Co)Se ₂ @MoNiCoP ^[45]	797C g ⁻¹ (2mA cm ⁻²)	77.3% (50mA cm ⁻²)	79.2 % (3000 cycles)
4	CuCo ₂ Se ₄ Microspheres ^[41]	512 F g ⁻¹ (1 A g ⁻¹)	70.8% (24 A g ⁻¹)	83.7 % (6000 cycles)
5	((CuCo)Se/NC) ^[49]	121.4 C g ⁻¹ (1 A g ⁻¹)	82% (10 A g ⁻¹)	129.9 % (1200 cycles)
6	CF@ (Ni,Co)Se-2 ^[46]	188.8 mAh g ⁻¹ (1 A g ⁻¹)	58 % (20 A g ⁻¹)	/
7	NiCo ₂ Se ₄ /Mxene ^[42]	953.8 F g ⁻¹ (1 A g ⁻¹)	86.1% (9 A g ⁻¹)	93.9% (3000 cycles)
8	Ni-Co-Se-2 ^[40]	461 F g ⁻¹ (1 A g ⁻¹)	76% (20 A g ⁻¹)	86.5 % (2000 cycles)
9	NiCoSe ₂ spheres ^[39]	685 F·g ⁻¹ (1 A g ⁻¹)	50.9% (30A g ⁻¹)	/
10	(Ni,Co)Se ₂ microspheres ^[12]	106 mAh g ⁻¹ (1 A g ⁻¹)	75% (10 A g ⁻¹)	78 % (5000 cycles)
11	NiCu(OH) ₂ @Ni-Cu-Se ^[47]	264.91 F g ⁻¹ (1 A g ⁻¹)	41.3% (10 A g ⁻¹)	75.8% (3000 cycles)
12	Ni-Co-Se nano-polyhedrons ^[6]	1668 F g ⁻¹ (1 A g ⁻¹)	82.8% (20 A g ⁻¹)	87.2 % (5000 cycles)
13	Zn-Co-Se/NF ^[51]	313.45 C g ⁻¹ (0.5 A g ⁻¹)	95% (10 A g ⁻¹)	93% (3000 cycles)
14	(Ni,Co)Se ₂ /Ni(OH) ₂ ^[48]	178.8 mAh g ⁻¹ (3 mA cm ⁻²)	76.4% (30A g ⁻¹)	84.6% (3000 cycles)
15	Co-Mo-Se nanosheet arrays ^[50]	221.7 mAh g ⁻¹ (1 A g ⁻¹)	72% (20 A g ⁻¹)	95% (8000 cycles)