Supporting information

Ni_3Se_2 thin films deposited on CuO nanomaterials as electrode materials for supercapacitors

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Table S1 Current status of impedance comparison of electrode materials for supercapacitors

electrodes	Rs (Ω)	Rct (Ω)	Reference
CuO/NiO/N-rGO	19.6	20.69	[1]
NiO	5.2	--	[2]
CW@Ni_3S_2-10	2.09	2.49	[3]
NiSe/Ni_3Se_2	--	4.33	[4]
$Co_{0.85}Se$	1.52	8.51	
Ni_3Se_2	1.72	15.2	[5]
$Co_{0.85}Se/Ni_3Se_2$	1.66	7.19	
CuO@Ni_3Se_2-0.4	1.1	0.297	This work

[1] V. Kakani, S. Ramesh, H.M. Yadav, A. Kumar K, S. Shinde, S. Sandhu, L.N. Dang Quang, H.S. Kim, H.-S. Kim, H. Kim, C. Bathula, Facile synthesis of CuO/NiO/nitrogen doped rGO by ultrasonication for high performance supercapacitors, Journal of Alloys and Compounds, 847 (2020) 156411.https://doi.org/https://doi.org/10.1016/j.jallcom.2020.156411
[2] H. S, A.F. Samson V, V.A. Raj M, M. J, Fabrication of NiO/TiO_2/rGO nanocomposites as a quasi-solid-state asymmetric supercapacitor: Paving the way for PhotoSupercapacitor application, Materials Today Sustainability, 28 (2024) 100972.https://doi.org/https://doi.org/10.1016/j.mtsust.2024.100972
[3] K. Dong, Z. Sun, J. Wang, G. Jing, B. Tang, L. Kong, S. Wu, X. Huang, X. You, F. Guo, Self-supporting composite electrode modified with Ni_3S_2 nanosheets: For high performance supercapacitors, Journal of Energy Storage, 104 (2024) 114477.https://doi.org/https://doi.org/10.1016/j.est.2024.114477
[4] W. Dong, S. Yang, E. Ye, Y. Wang, S. Li, D. Shen, S. Yang, KOH-mediated controllable synthesis of $NiSe/Ni_3Se_2$ composites for high-performance supercapacitors, Journal of Energy Storage, 134 (2025) 118236.https://doi.org/https://doi.org/10.1016/j.est.2025.118236
[5] M. Mathankumar, H. Chang, P. Hasin, M.-N. Lu, C.-K. Hsieh, J.-Y. Lin, Electrodeposited $Co_{0.85}Se/Ni_3Se_2$ heterostructure as an efficient binder-free cathode for fast electrochemical energy storage devices, Journal of Energy Storage, 101 (2024) 113726.https://doi.org/https://doi.org/10.1016/j.est.2024.113726

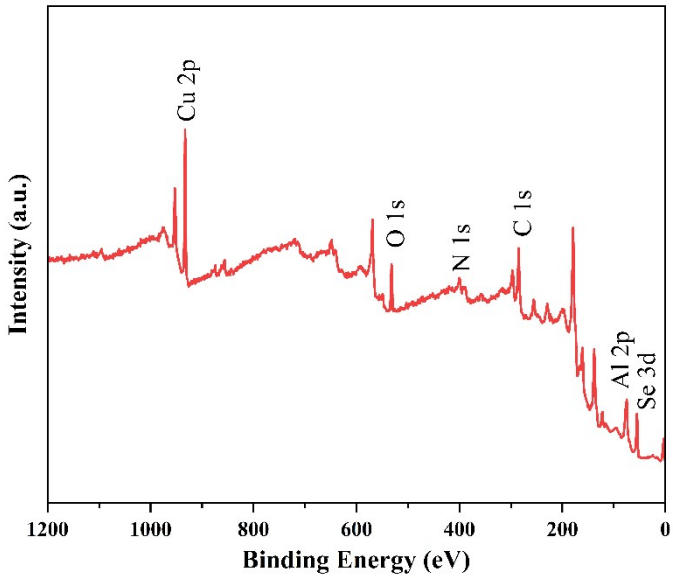

Fig. S1 XPS full spectrum diagram

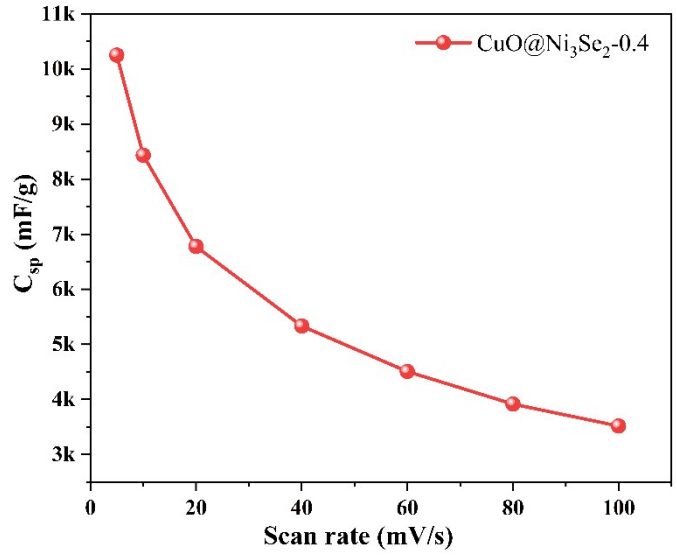

Fig. S2 CV of Cs plot profile vs sweep rate

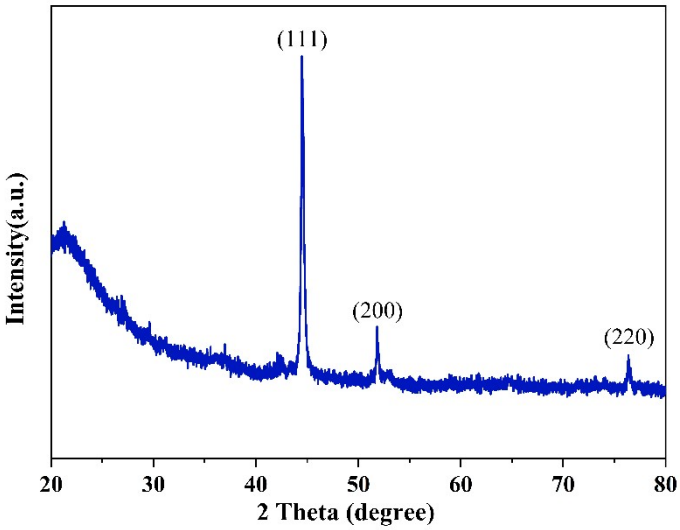

Fig. S3 XRD pattern after 5000 cycles of $CuO@Ni_3Se_2$-0.4

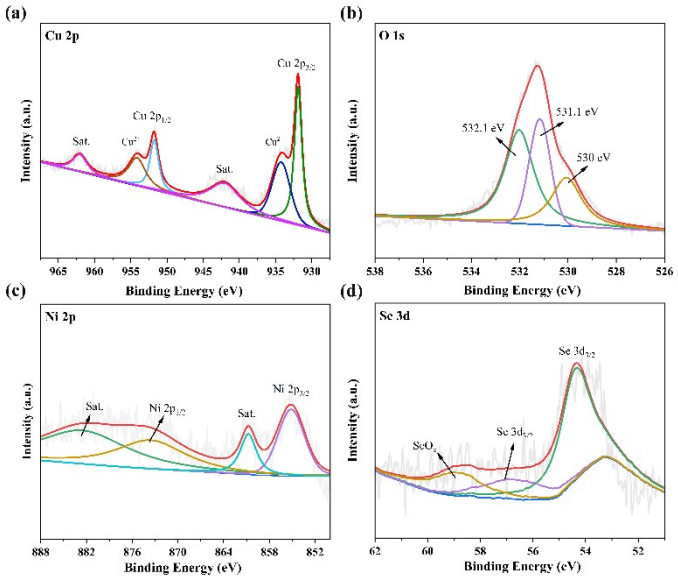

Fig. S4 CuO@Ni_3Se_2-0.4 spectra of XPS after 5000 cycles (a)Cu 2p; (b) O 1s; (c) Ni 2p; (d) Se 3d

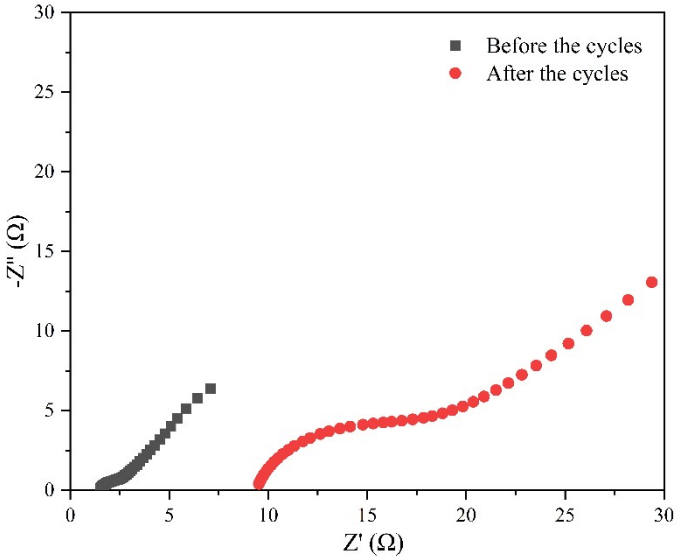

Fig. S5 Comparison of EIS before and after the cycle