

Supporting information

Designing an asymmetric device based on graphene wrapped yolk-double shell NiGa₂S₄ hollow microspheres and graphene wrapped FeS₂-FeSe₂ core-shell cratered spheres with outstanding energy density

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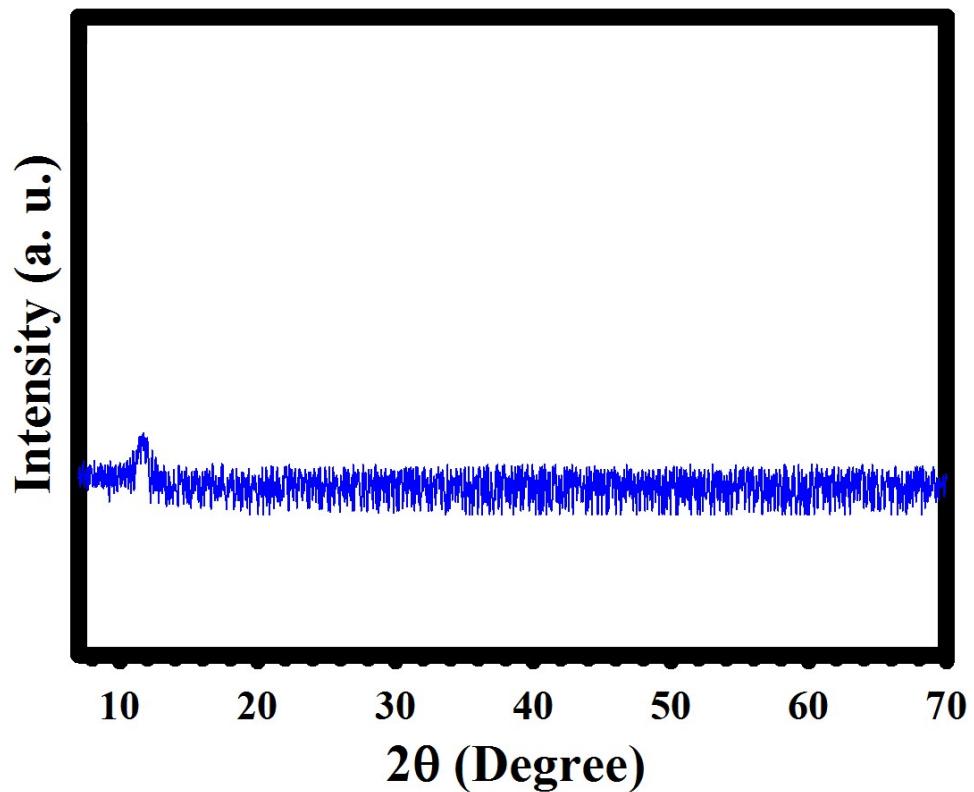


Figure S1. XRD pattern of NiGa-glycerate precursor

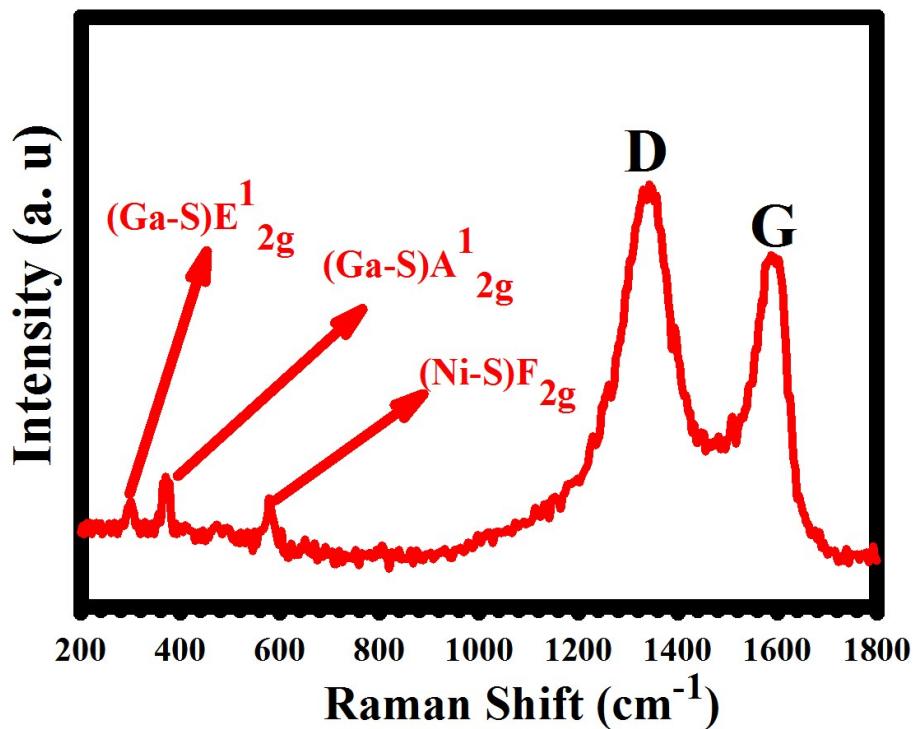


Figure S2. Raman spectrum of GW@YDSNGSHM sample

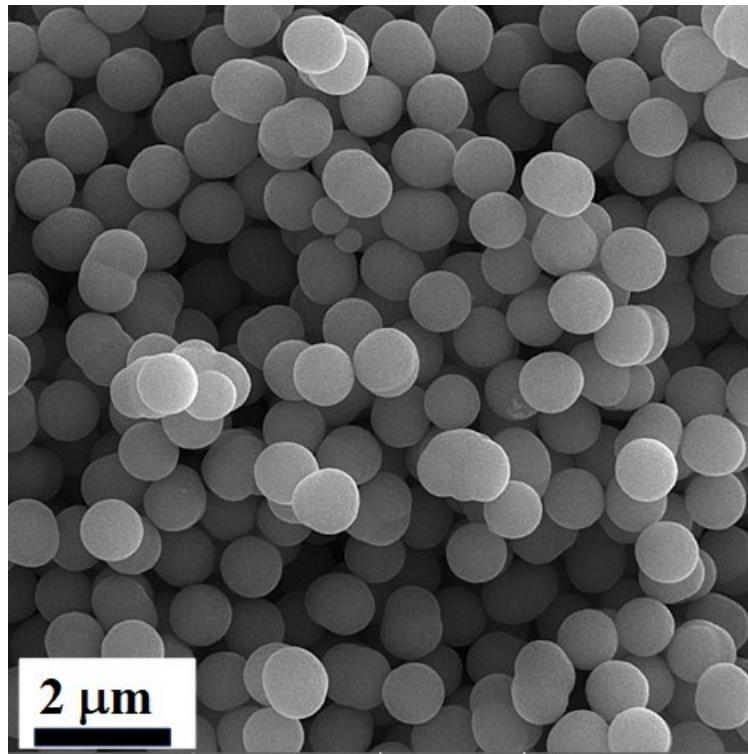


Figure S3. FE-SEM image of NiGa-glycerate precursor

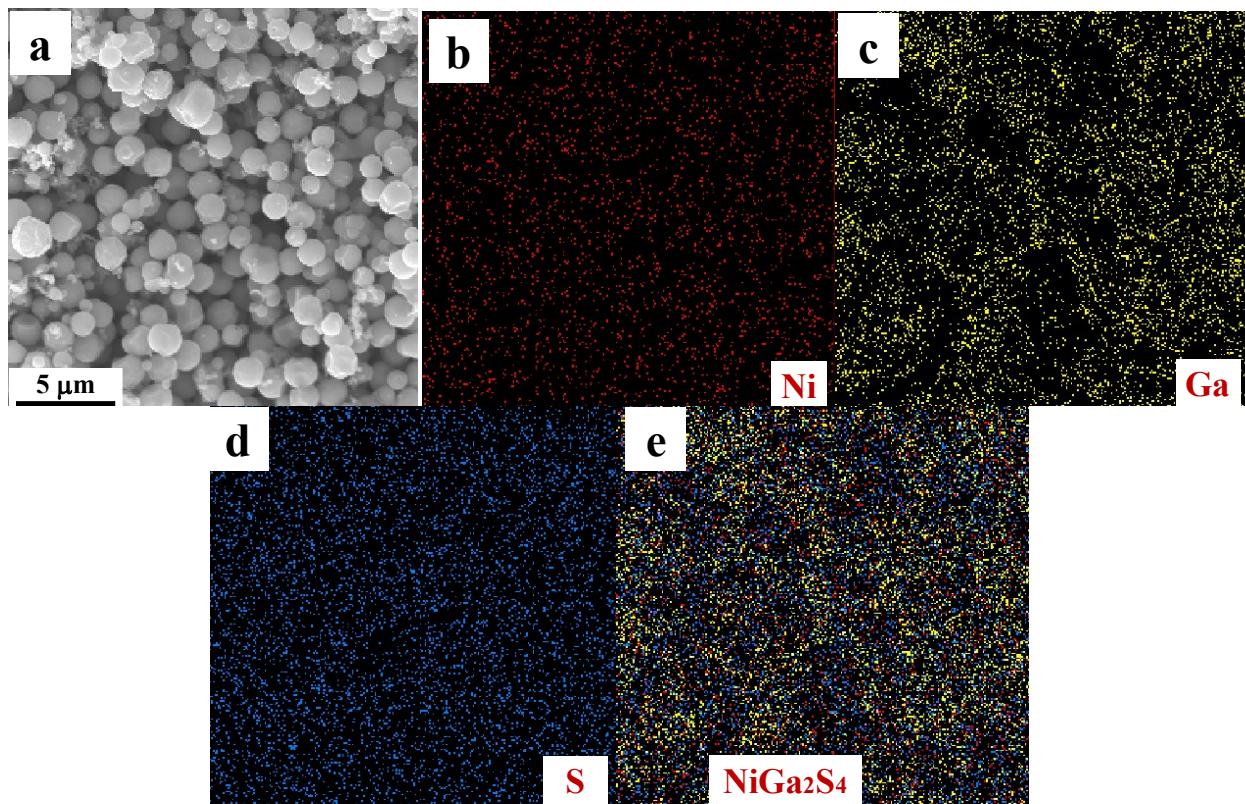


Figure S4. Elemental mapping image of YDSNGSHM sample

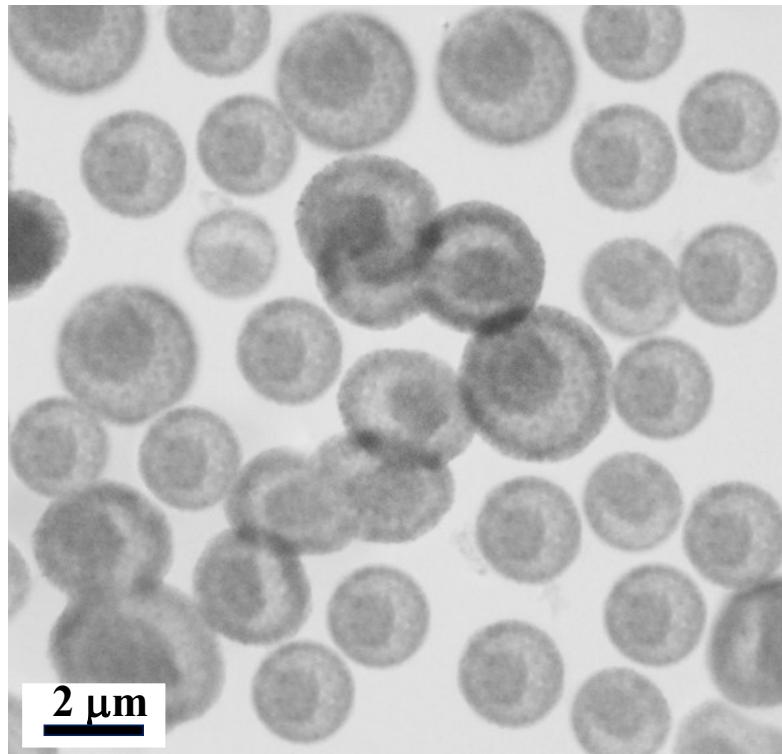


Figure S5. Large scale TEM image of YDSNGSHM sample

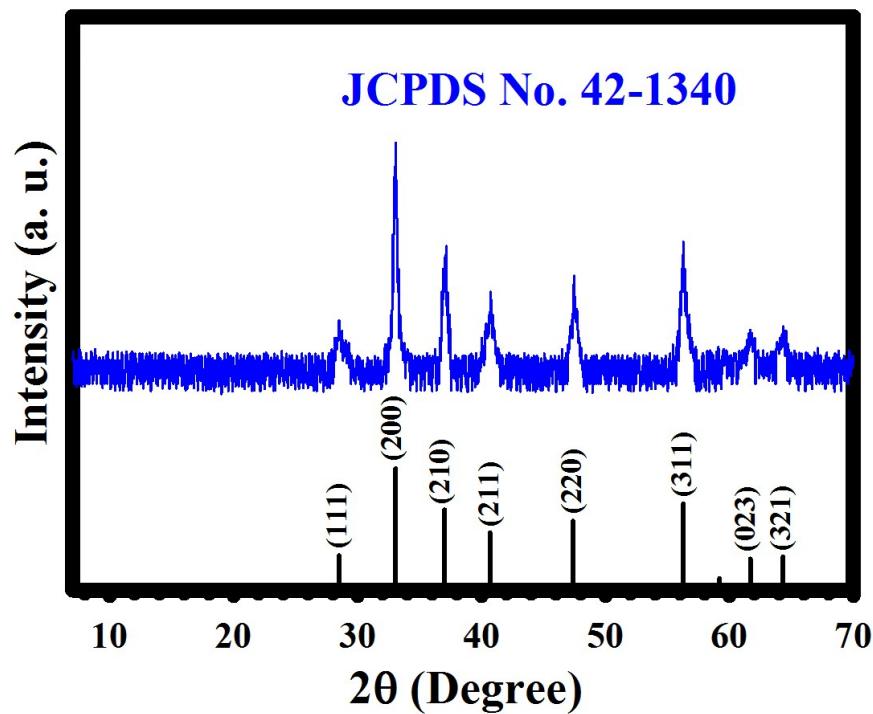


Figure S6. XRD pattern of FeS₂ sample.

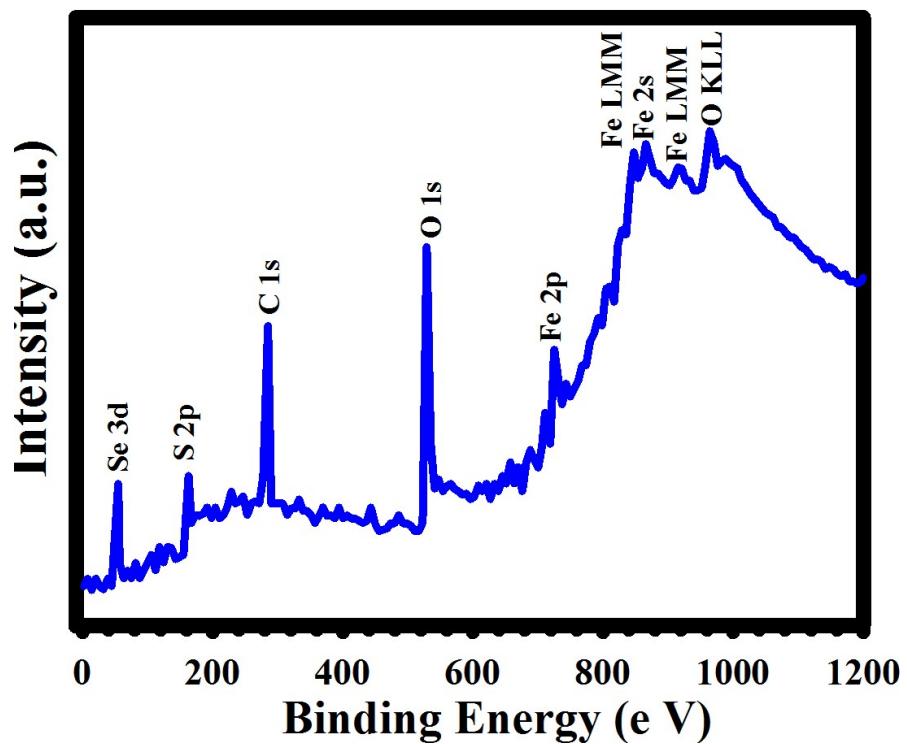


Figure S7. Survey spectrum of the FeS₂-FeSe₂-CSS sample.

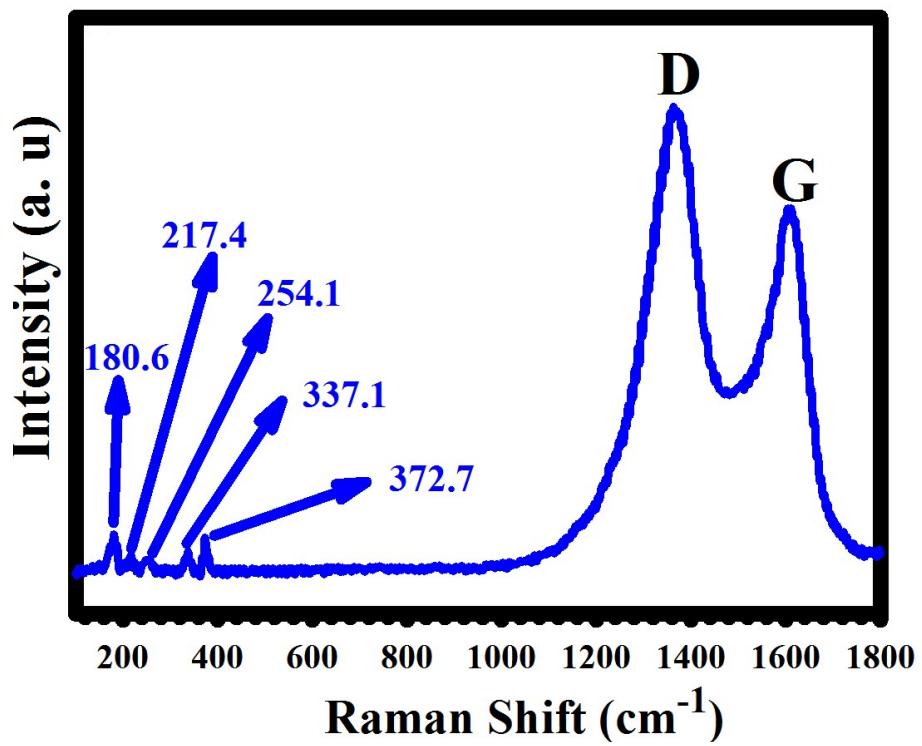


Figure S8. Raman spectrum of GW@FeS₂-FeSe₂-CSS sample.

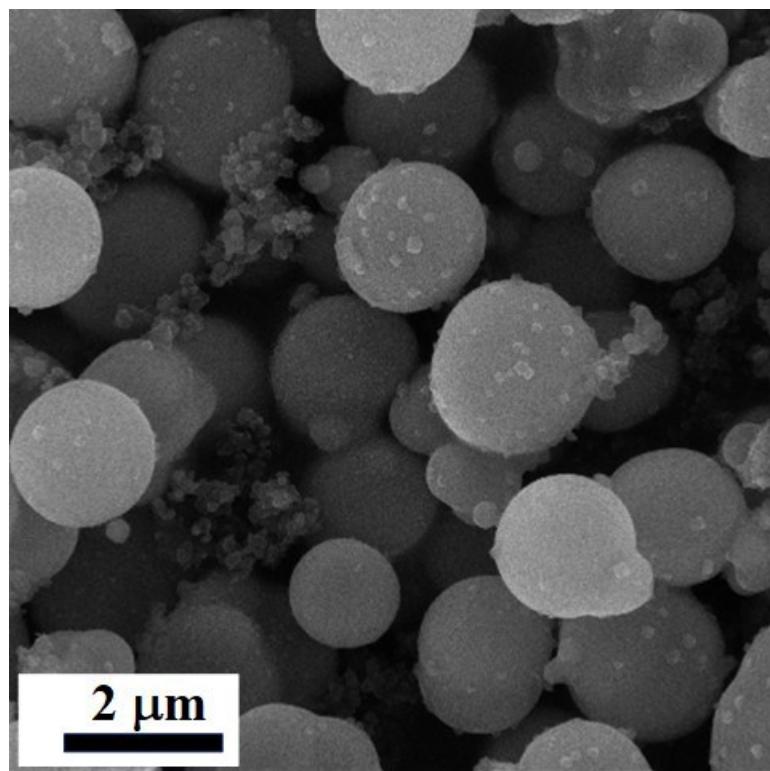


Figure S9. FE-SEM image of FeS_2 sample.

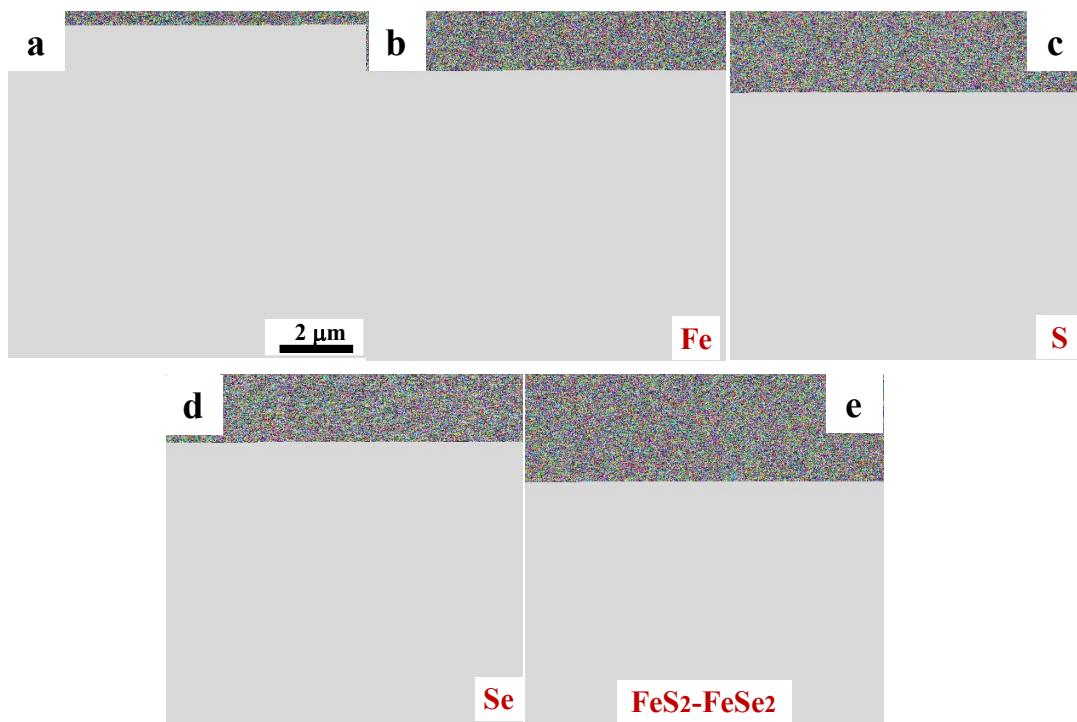


Figure S10. Elemental mapping image of $\text{FeS}_2\text{-FeSe}_2\text{-CSS}$ sample.

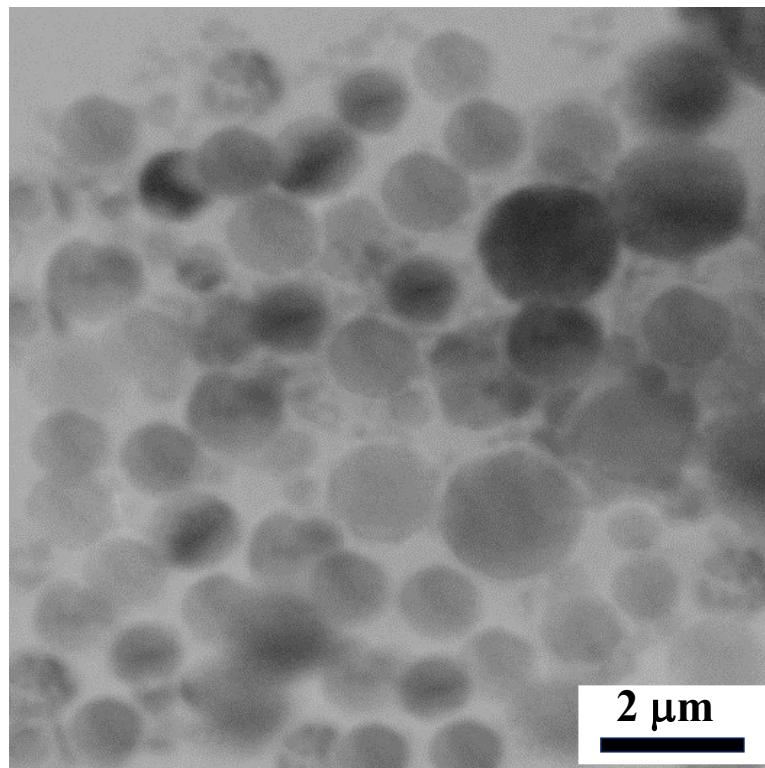


Figure S11. Large scale TEM image of FeS₂-FeSe₂-CSS sample.

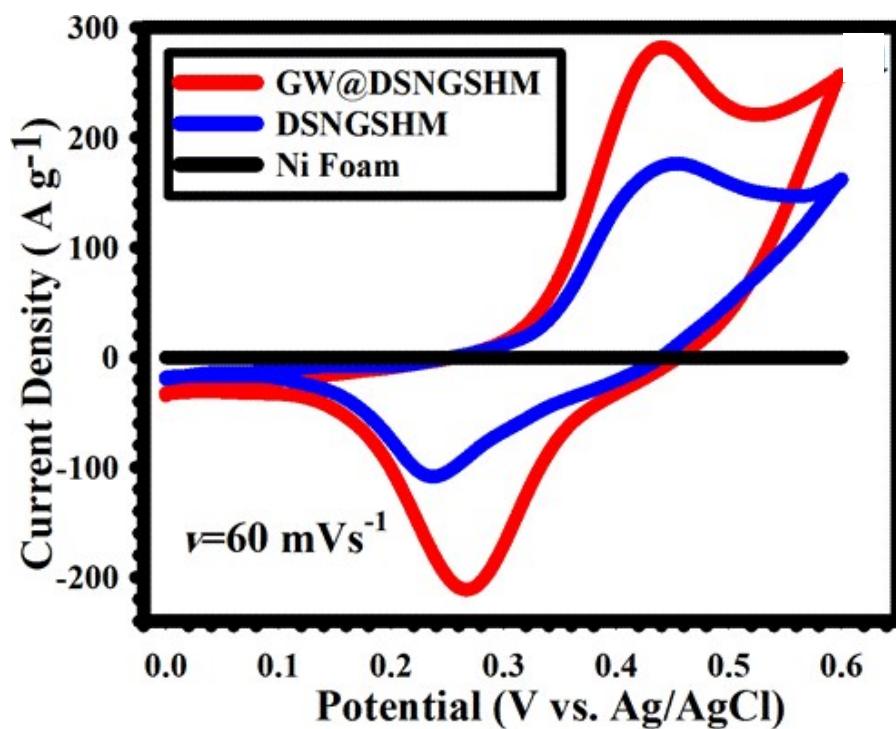


Figure S12. CV plots of GW@YDSNGSHM, YDSNGSHM, and bare nickel foam electrodes

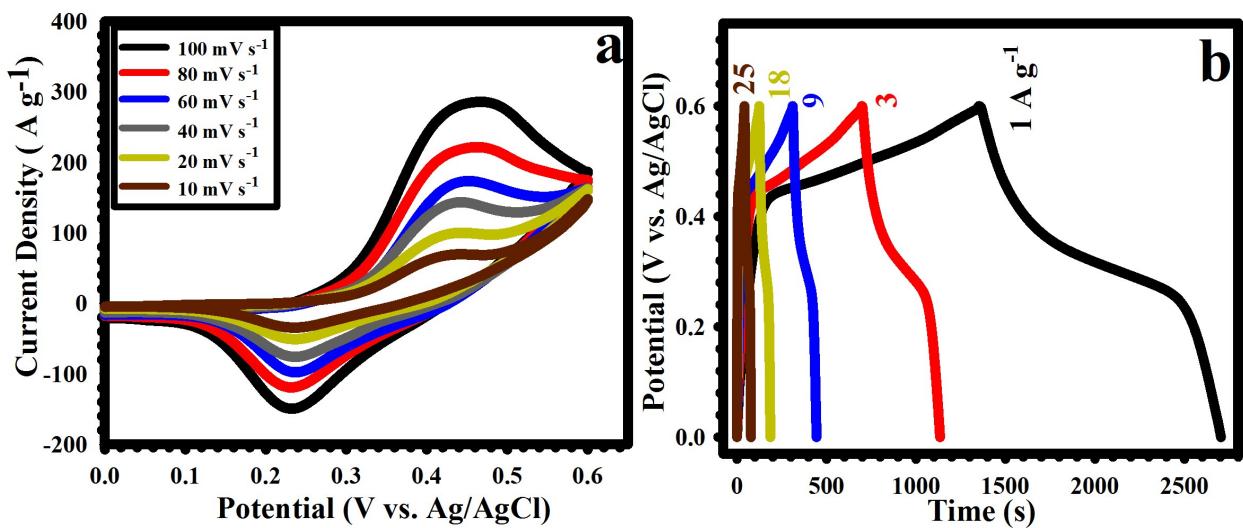


Figure S13. (a) CV plots of YDSNGSHM electrode at different scan rates. (b) CD plots of YDSNGSHM electrode at various current densities.

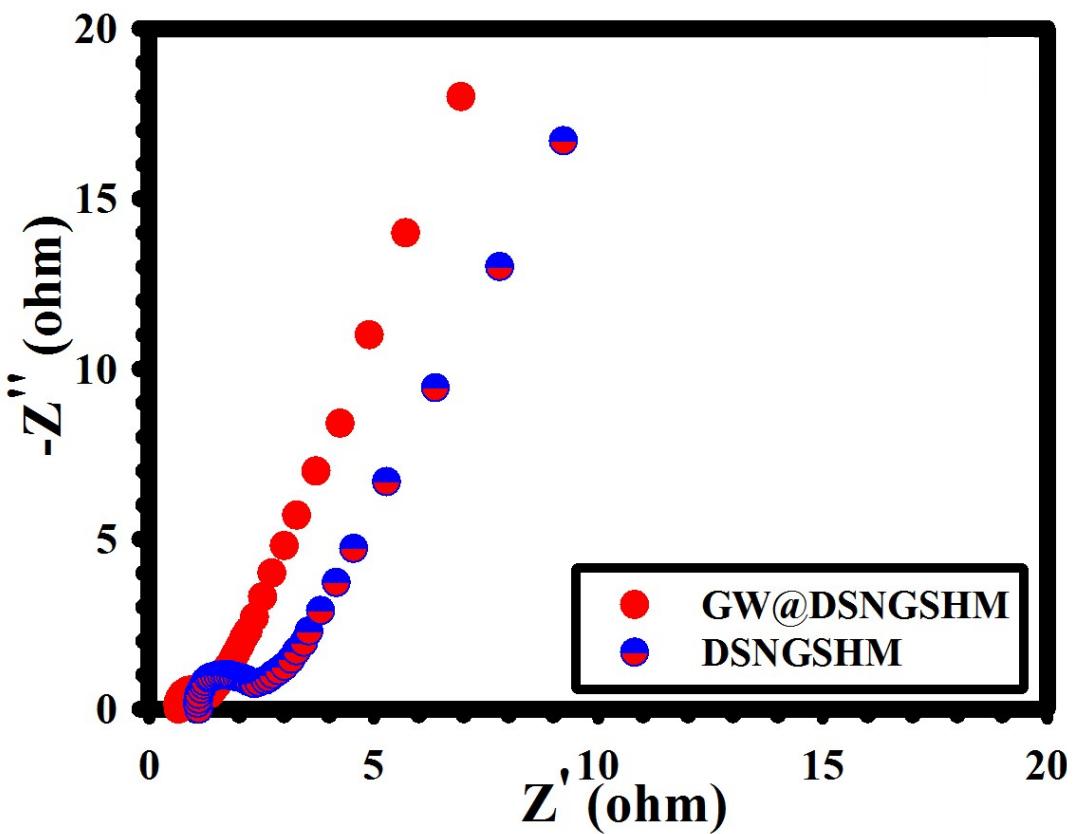


Figure S14. Nyquist plots of GW@YDSNGSHM and YDSNGSHM electrodes.

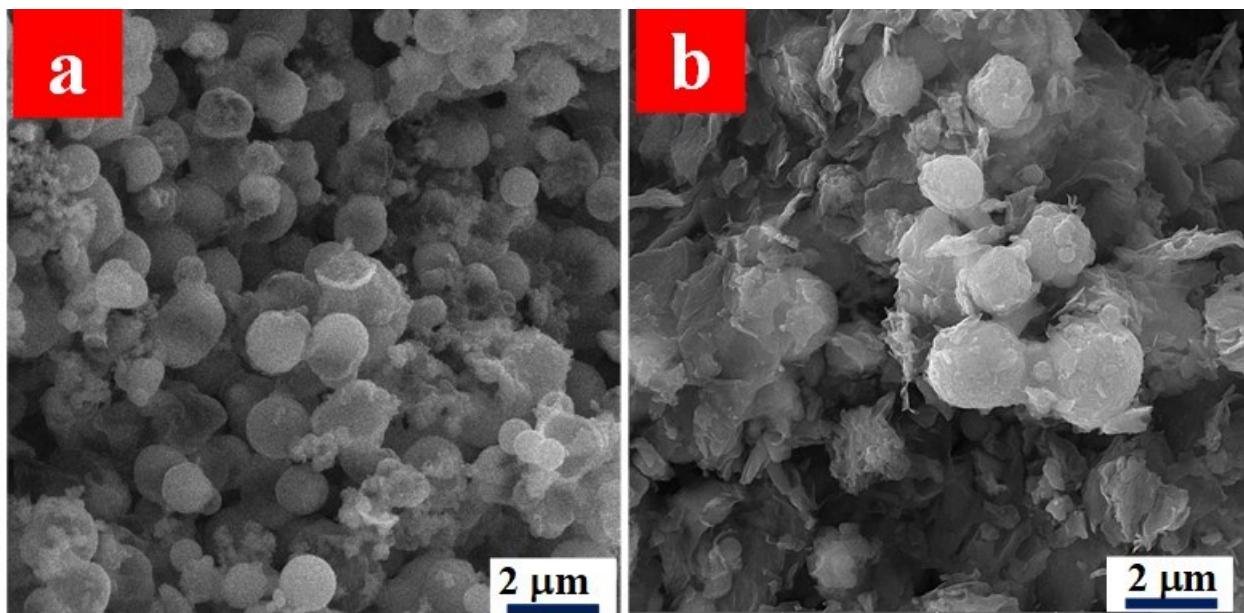


Figure S15. (a) FE-SEM image of YDSNGSHM electrode after 5000 cycles. (b) FE-SEM image of GW@YDSNGSHM electrode after 5000 cycles

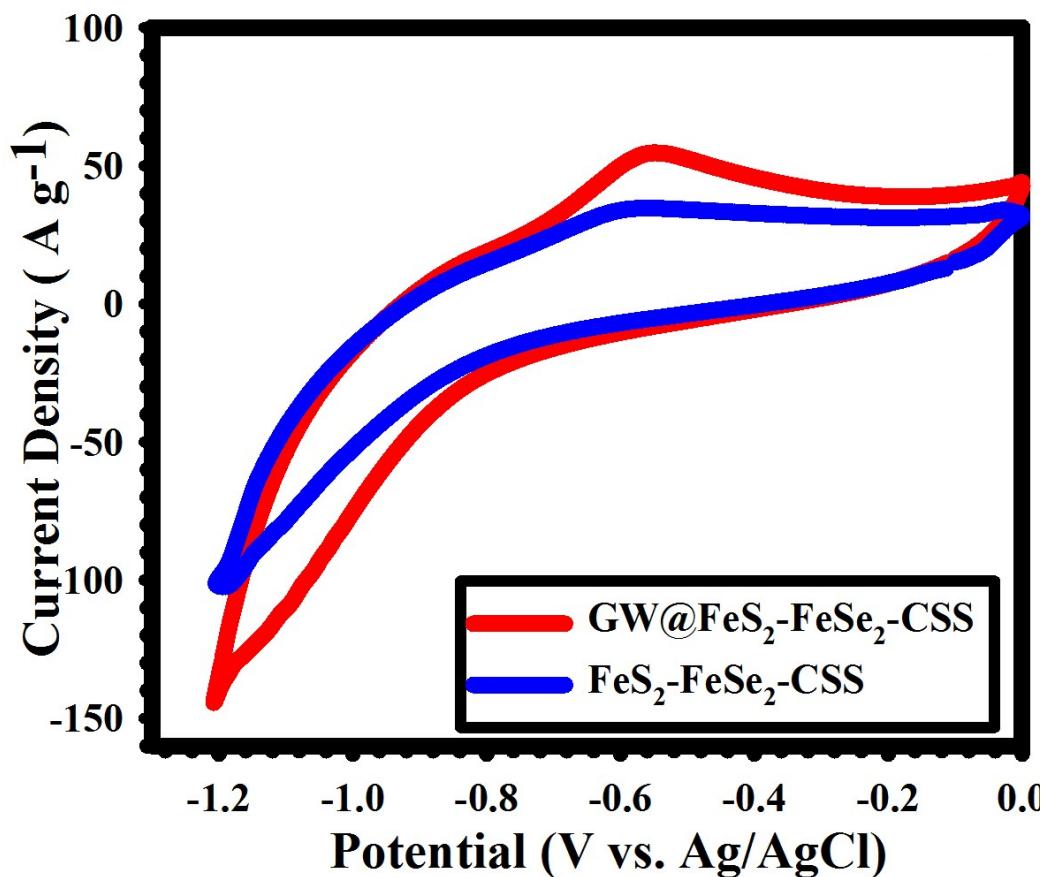


Figure S16. CV plots of GW@FeS₂-FeSe₂-CSS and FeS₂-FeSe₂-CSS electrodes

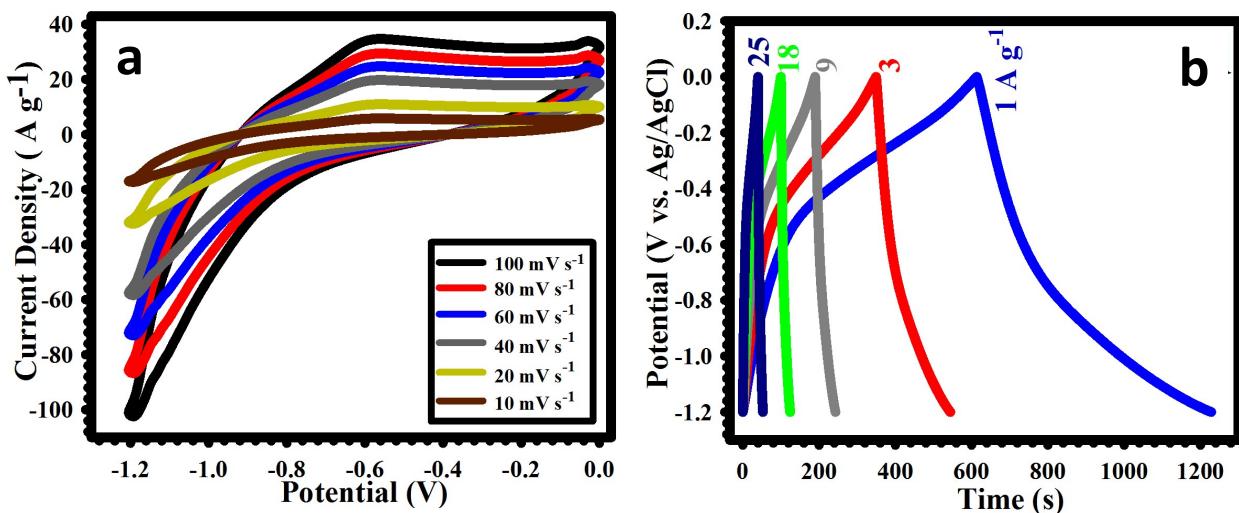


Figure S17. (a) CV plots of FeS₂-FeSe₂-CSS electrode at different scan rates. (b) CD plots of FeS₂-FeSe₂-CSS electrode at various current densities.

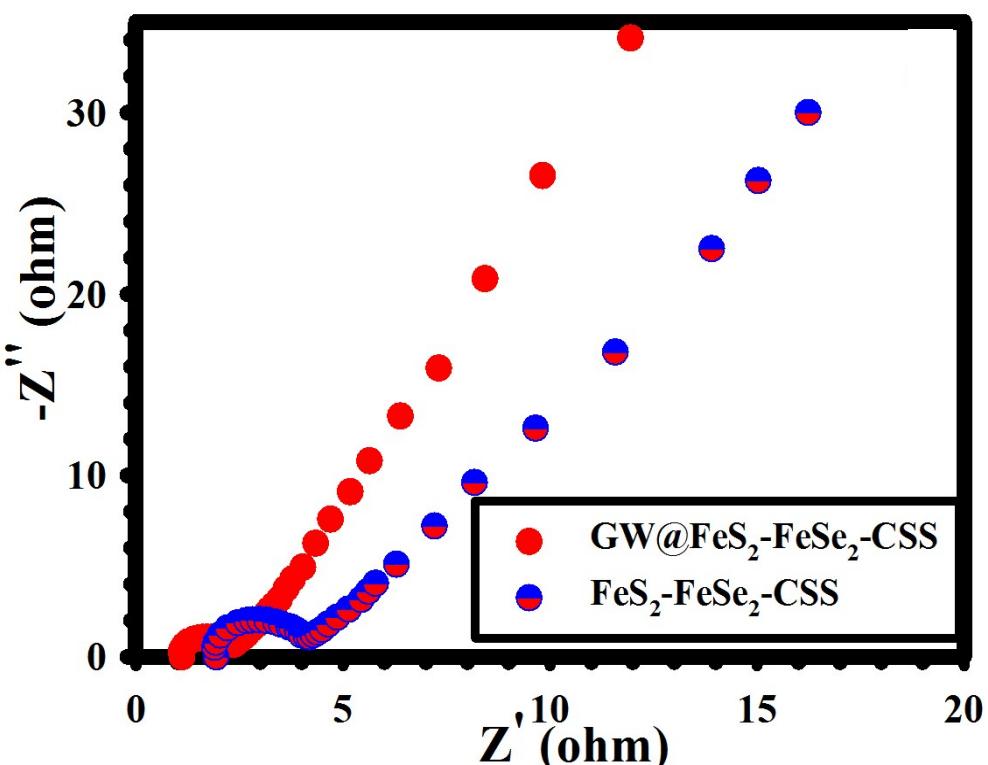


Figure S18. Nyquist plots of GW@FeS₂-FeSe₂-CSS and FeS₂-FeSe₂-CSS electrodes.

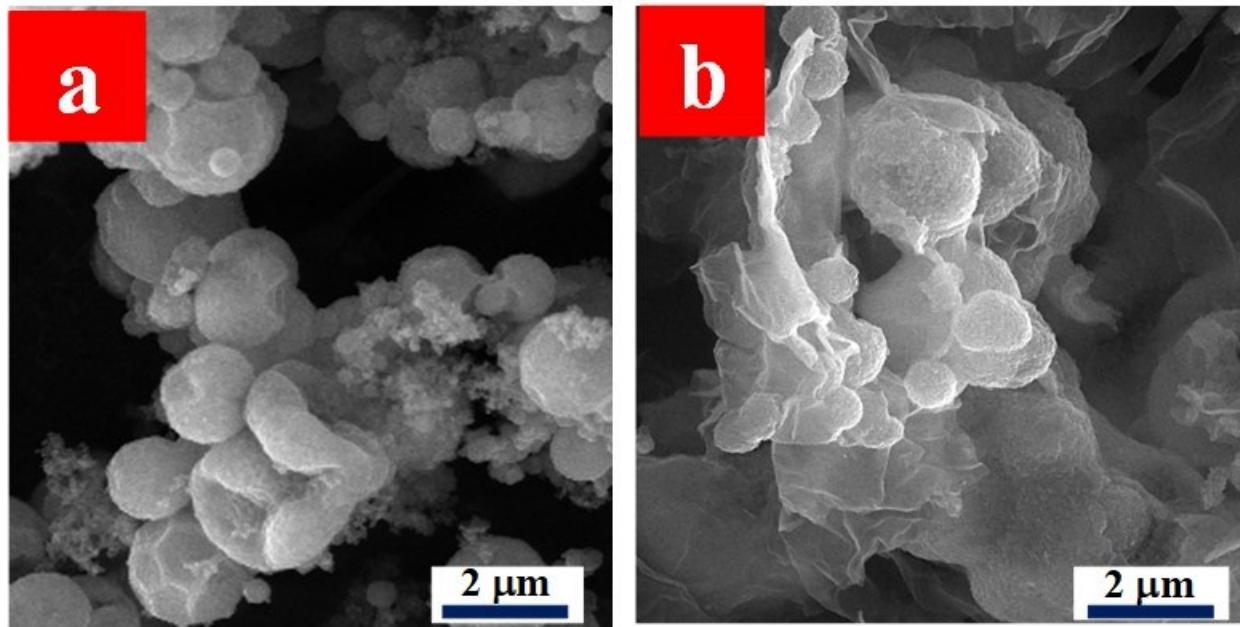


Figure S19. FE-SEM image of FeS₂-FeSe₂-CSS electrode after 5000 cycles (d) FE-SEM image of GW@FeS₂-FeSe₂-CSS electrode after 5000 cycles.

Table S1. Comparison of the electrochemical performance of GW@FeS₂-FeSe₂-CSS electrode in three- and two-electrode systems with other previously reported electrodes.

Sample	Capacitance (F g ⁻¹)	Cycles, retention	Operating potential window	Reference
CNT@Fe ₂ O ₃	300	1000, 60 % (3 E)	-1 to 0	1
Fe ₂ O ₃ @GF	527.7	-	-1 to 0	2
FeSe ₂	304	-	-1 to 0	3
GA-FeS ₂	313.6	2000,88.2	-.9 to -.3	4
FeS ₂	317.8	1000, 81.1	-1 to 0	5
Fe ₂ O ₃ /VACNTs	248	5000, 91.3% (3 E) 5000, 92.7% (2 E)	-1.2 to 0	6
GW@FeS ₂ -FeSe ₂ -CSS	634.6	5000, 90.7	-1.2 to 0	This work

Table S2. Comparison of the electrochemical performance of GW@YDSNGSHM electrode in three- and two-electrode systems with other previously reported electrodes.

Composition	Capacitance 3- and 2-electrode (F g ⁻¹)	Cycles, retention 2 and 3 electrode	ED (W h kg ⁻¹) 2 Electrode	Reference
NiCo₂S₄ NSNW	1777 (3 E)	3000, 83 % (3 E)	-	7
Nickel-cobalt sulfide	1304 (3 E) 92 (2 E)	6000, 93.5 % (3 E) 6000, 79.1% (2 E)	41.4	8
Nickel-cobalt sulfide	1036 440 (3 E) 119.1 (2 E)	2000, 87% (3 E) 10000, 87.6% (2 E)	42.3	9
Nickel-cobalt sulfide	1492 (3 E) 304 (2 E)	10000, 76% (3 E) 20000, 91% (2 E)	48.4	10
NCS-HL	1682 (3 E) 190 (2 E)	3000, 90.1 (3 E) 5000, 82.88% (2 E)	49.38	11
PCs/NiCo₂S₄	605.2 (3 E) 190 (2 E)	5000, 91.3% (3 E) 5000, 92.7% (2 E)	23.3	12
GW@YDSNGSHM	2868.40 (3 E) 352.30 (2 E)	5000, 95.7 (3 E) 5000, 93.9 (2 E)	158.53	This work

References

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