

Supporting Information for

Enhanced Electrochemical Performance of NiSbS/NiSb/NiS Nanocomposites Anchored on Graphite Nanosheets for Sodium-Ion Battery Applications

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Table S1 The final energy/atom of some reactants.

Materials	Ni	Sb ₂ S ₃	NiSbS	NiSb
Crystal ID	mp-23	mp-2809	mp-3679	mp-810
Energy eV/atom	-5.7798	-4.3828	-4.9969	-5.2253
Materials	NiS	NiS ₂	Ni ₃ S ₄	Ni ₃ S ₂
Crystal ID	mp-1547	mp-1180046	mp-1050	mp-362
Energy eV/atom	-5.3168	-4.9412	-5.2125	-5.4933
Materials	NiSb ₂	Sb	Ni ₃ Sb	Ni ₅ Sb ₂
Crystal ID	mp-19895	mp-104	mp-672371	mp-2409
Energy eV/atom	-4.8767	-4.129	-5.5154	-5.4786
Materials	Na ₂ S	Na ₃ Sb	Na	S
Crystal ID	mp-648	mp-7956	mp-10172	mp-96
Energy eV/atom	-3.3241	-2.4524	-1.3122	-4.1364

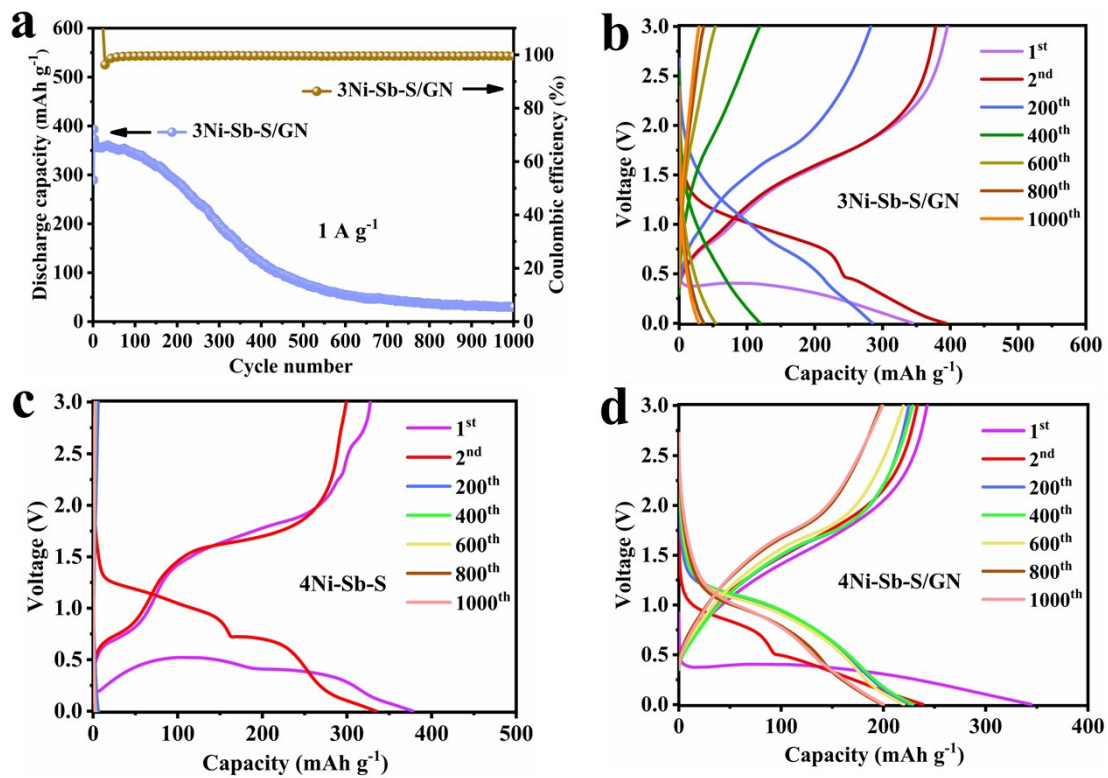


Fig. S1. (a) Cycling stability of 3Ni-Sb-S/GN at a current density of 1.0 A g⁻¹; Discharge/charge profiles of (b) 3Ni-Sb-S/GN, (c) 4Ni-Sb-S and (d) 4Ni-Sb-S/GN at a current density of 1.0 A g⁻¹.

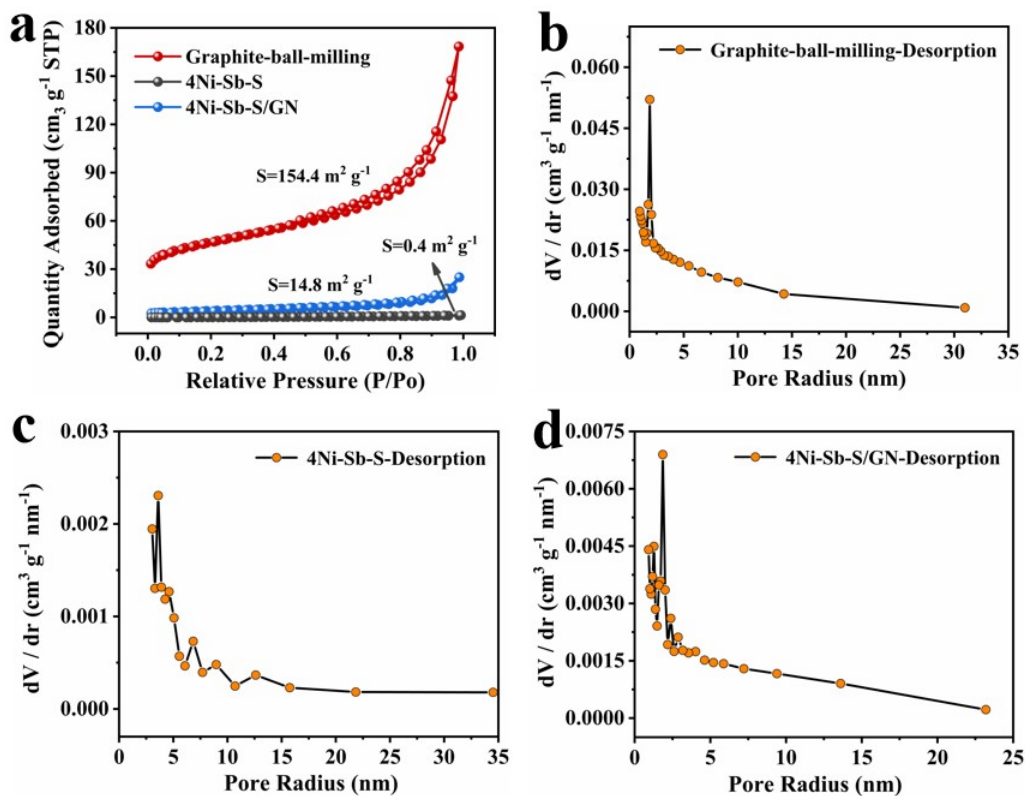


Fig. S2. Nitrogen adsorption isotherms of Graphite-ball-milling, 4Ni-Sb-S, and 4Ni-Sb-S/GN (a); Corresponding pore size distribution of (b) Graphite-ball-milling, (c) 4Ni-Sb-S, and (d) 4Ni-Sb-S/GN.

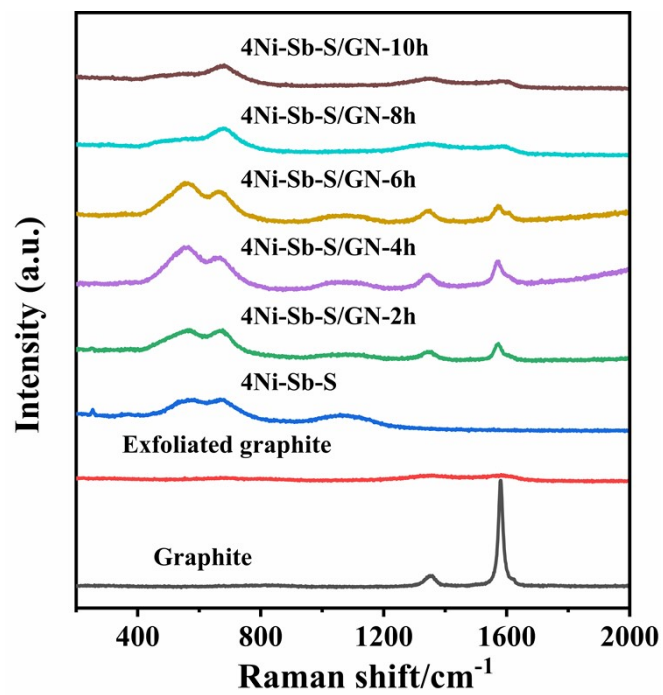


Fig. S3. Raman patterns of Graphite, Exfoliated graphite, 4Ni-Sb-S, and 4Ni-Sb-S/GN at different milling times.

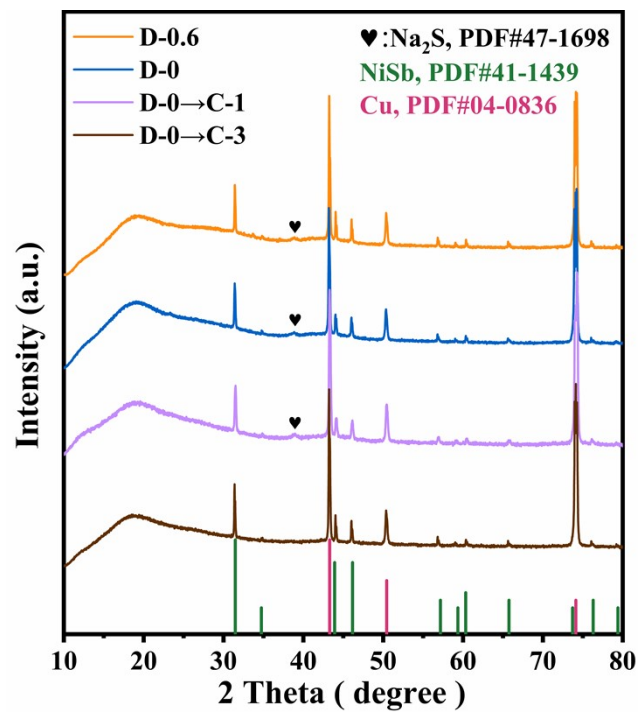


Fig. S4. *Ex-situ* XRD patterns of Ni-Sb-S during the discharge/charge processes.

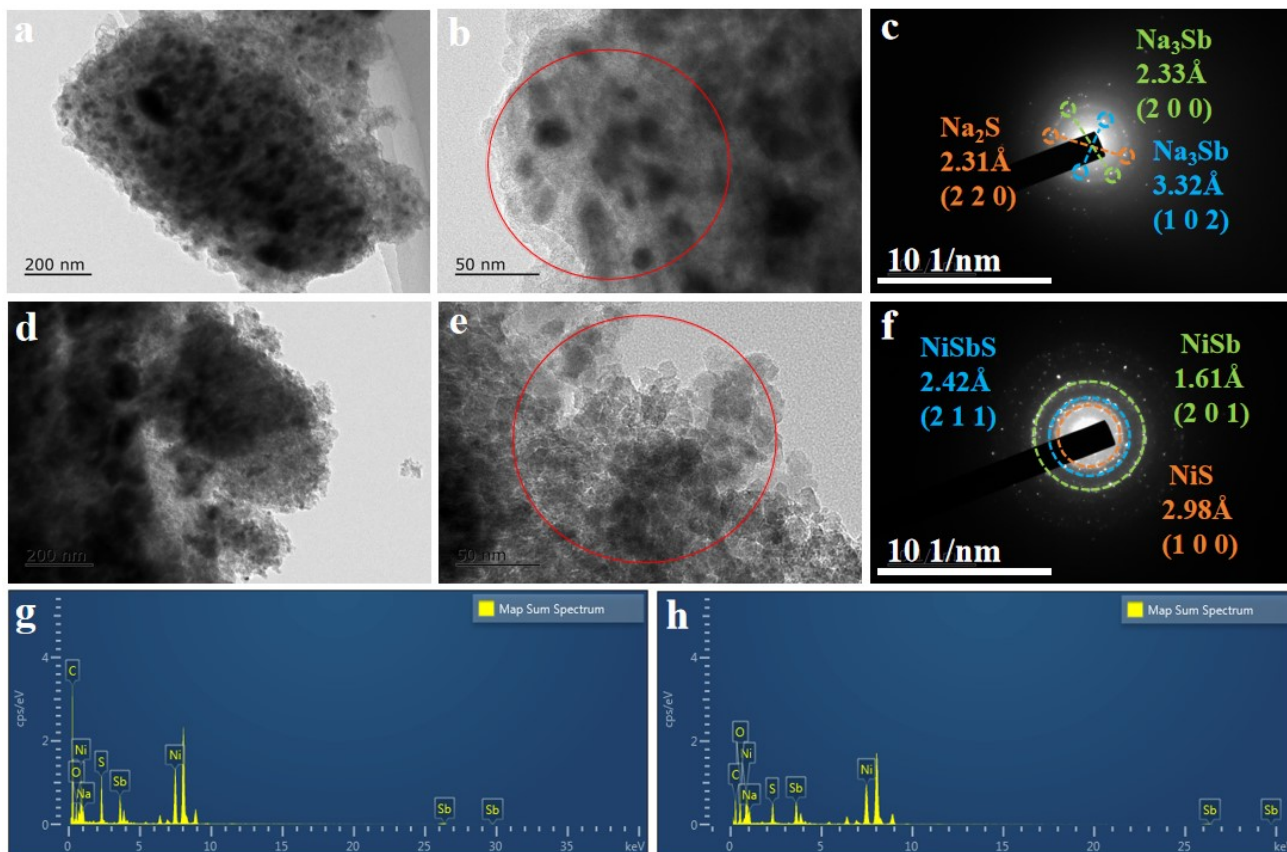


Fig. S5. (a, b) Supplemented TEM image of Ni-Sb-S/GN electrode after discharging to 0V; (c) SAED images of Ni-Sb-S/GN in image (b); (d, e) supplemented TEM images of Ni-Sb-S/GN after discharging to 0V followed by charging to 3V; (f) SAED images of Ni-Sb-S/GN in image (e). (g) The elementary distributions of image (b); (h) The elementary distributions of image (e).

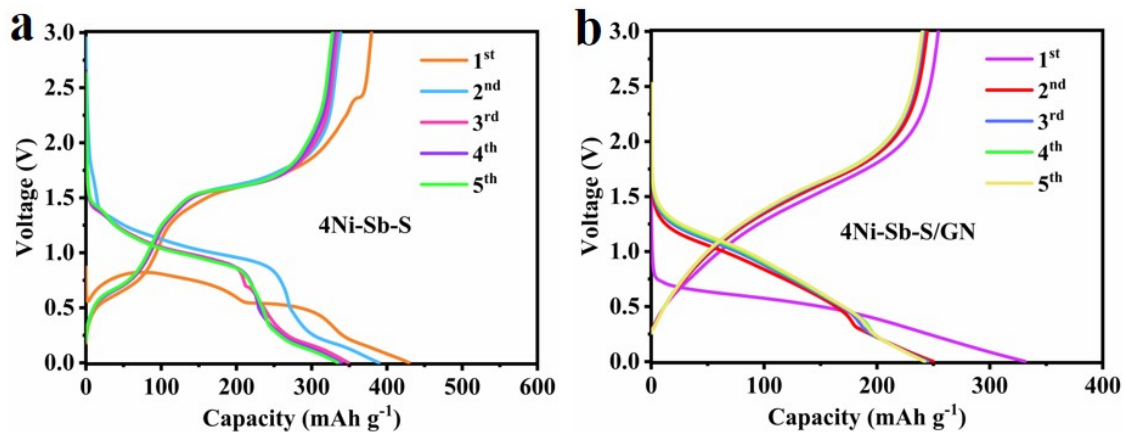


Fig. S6. Discharge/charge profiles of (a) 4Ni-Sb-S and (b) 4Ni-Sb-S/GN.

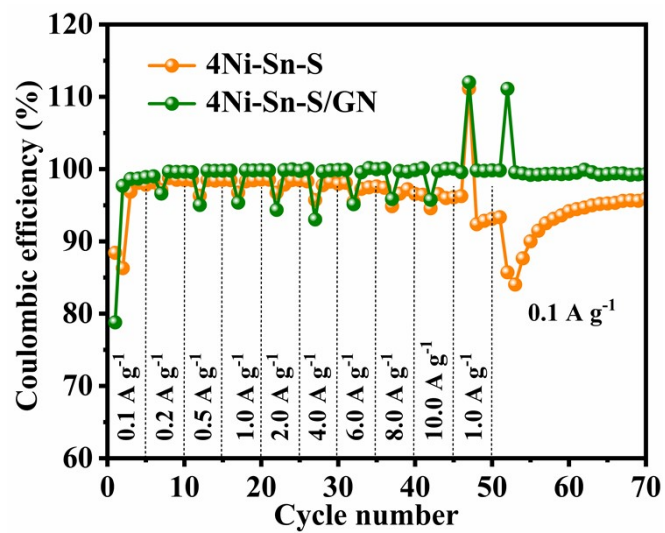


Fig. S7. Coulombic efficiency of 4Ni-Sb-S and 4Ni-Sb-SGN tested from 0.1~10.0 $A g^{-1}$.

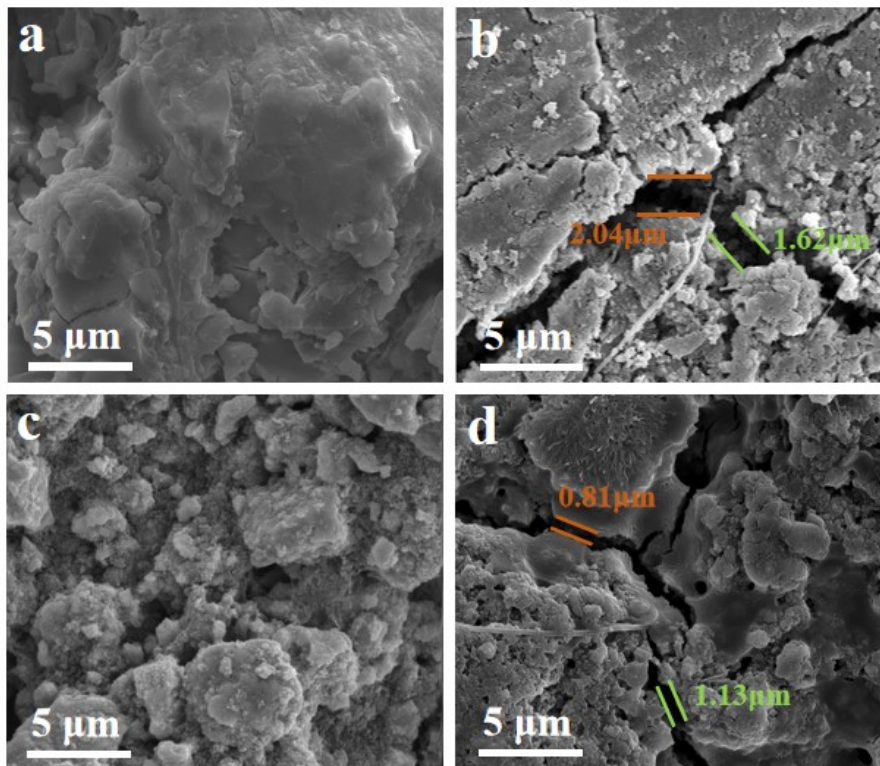


Fig. S8. SEM images of (a, b) Ni-Sb-S, and (c,d) Ni-Sb-S/GN before and after 1000 cycles at 1.0 A g⁻¹.

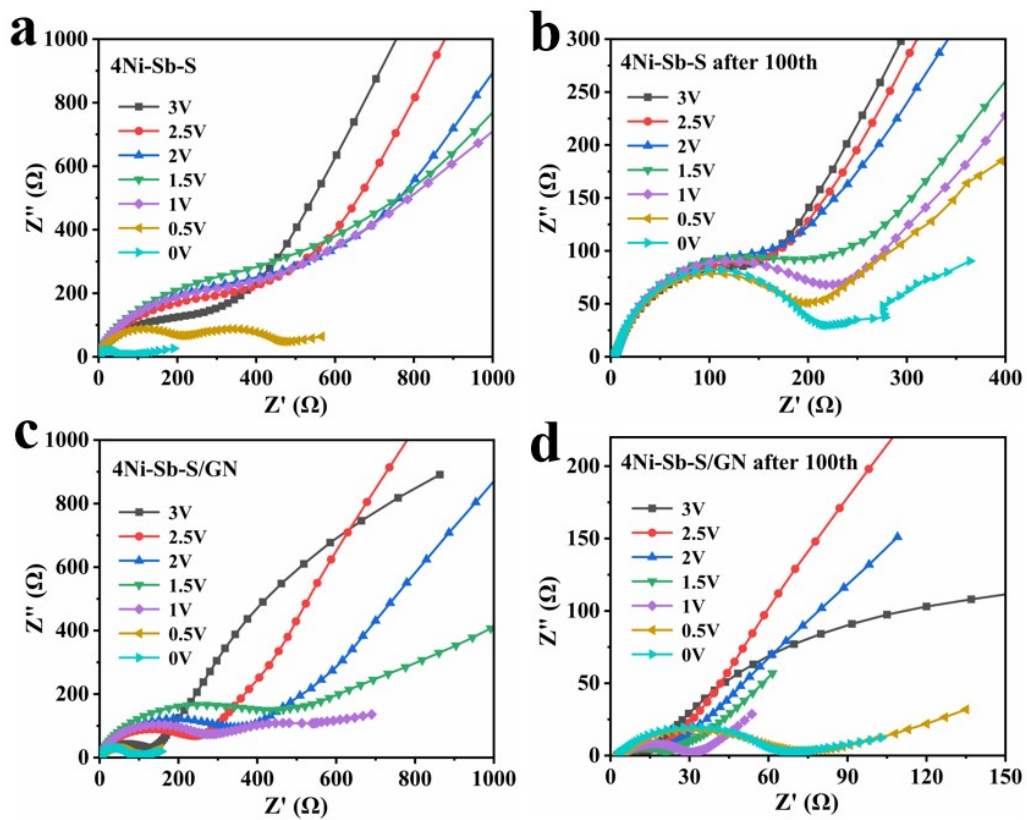


Fig. S9. Nyquist plots of the bare 4Ni-Sb-S, and 4Ni-Sb-S/GN electrodes before(a, c) and after cycling 100 cycles(b, d).

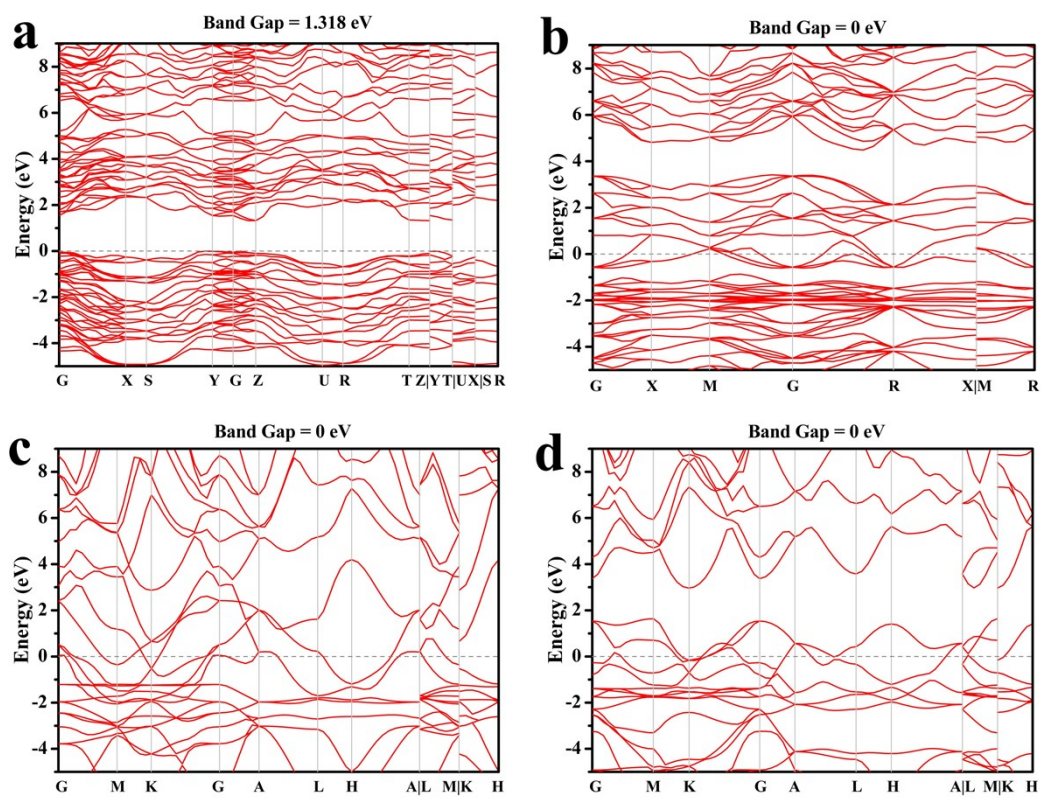


Fig. S10. Band gap values of (a) Sb₂S₃, (b) NiSbS, (c) NiSb, and (d) NiS.

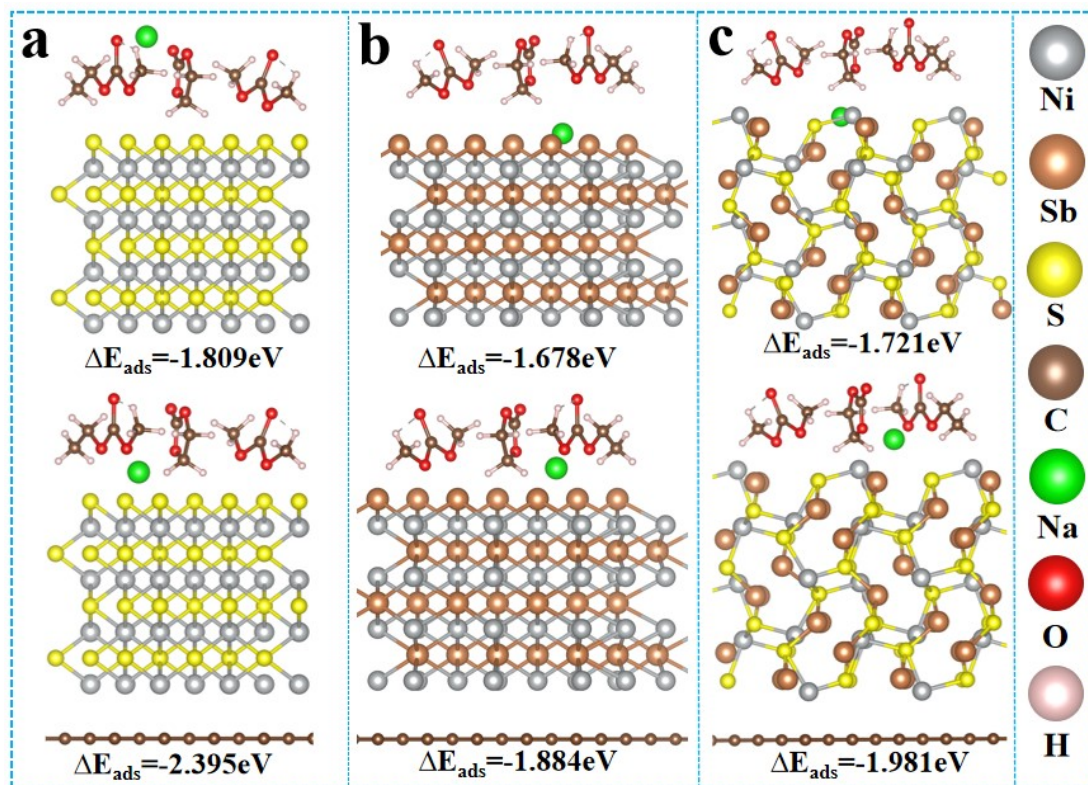


Fig. S11. Adsorption models and energies of adding (EC:DMC:EMC) (a) NiS, NiS/GN, (b) NiSb, NiSb/GN, and (c) NiSbS, NiSbS/GN.

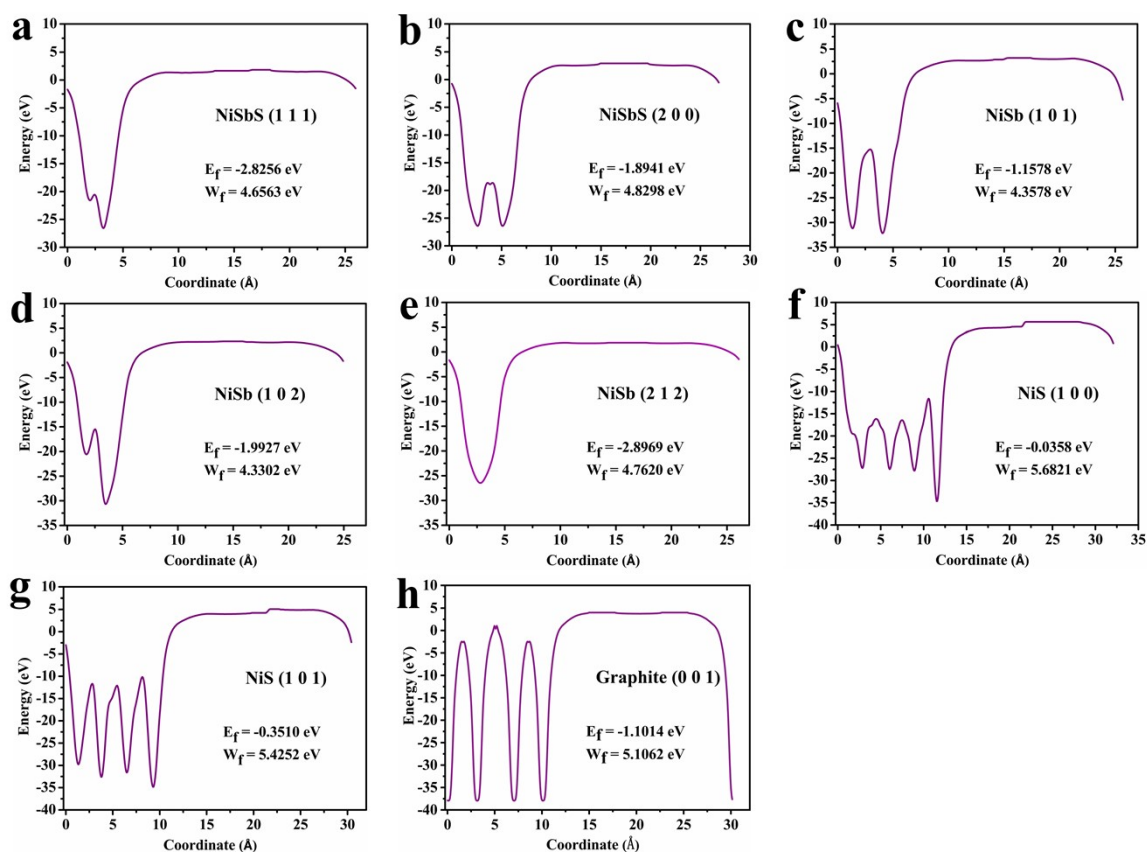


Fig. S12. The work functions of Graphite, NiSbS, NiSb, and NiS based on the observed lattice planes (*i.e.*, (0 0 1) of Graphite; (1 1 1) and (2 0 0) of NiSbS; (1 0 1), (1 0 2), and (2 1 2) of NiSb; (1 0 0) and (1 0 1) of NiS).

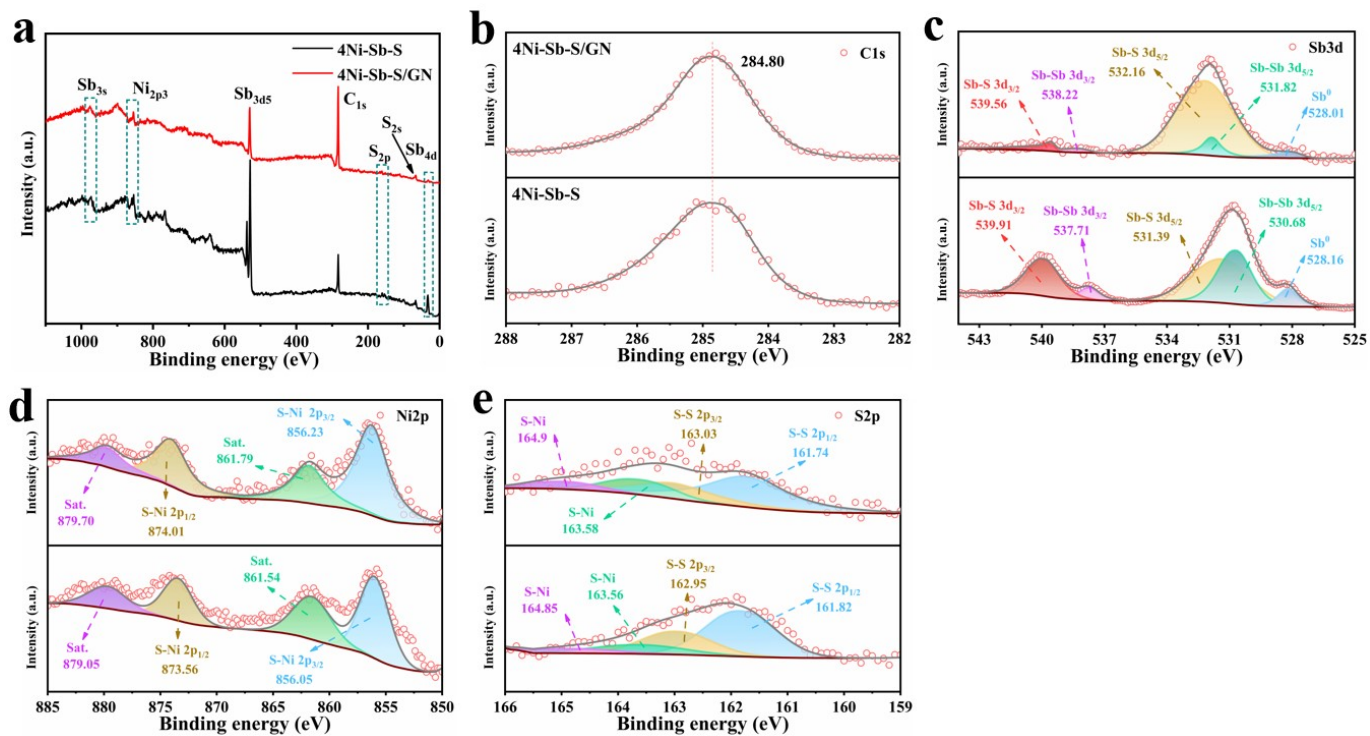


Fig. S13. The XPS spectra of 4Ni-Sb-S and 4Ni-Sb-S/GN. (a) survey spectra, (b) C 1s spectra, (c) Sb 3d spectra, (d) Ni 2p spectra, and (e) S 2p spectra.

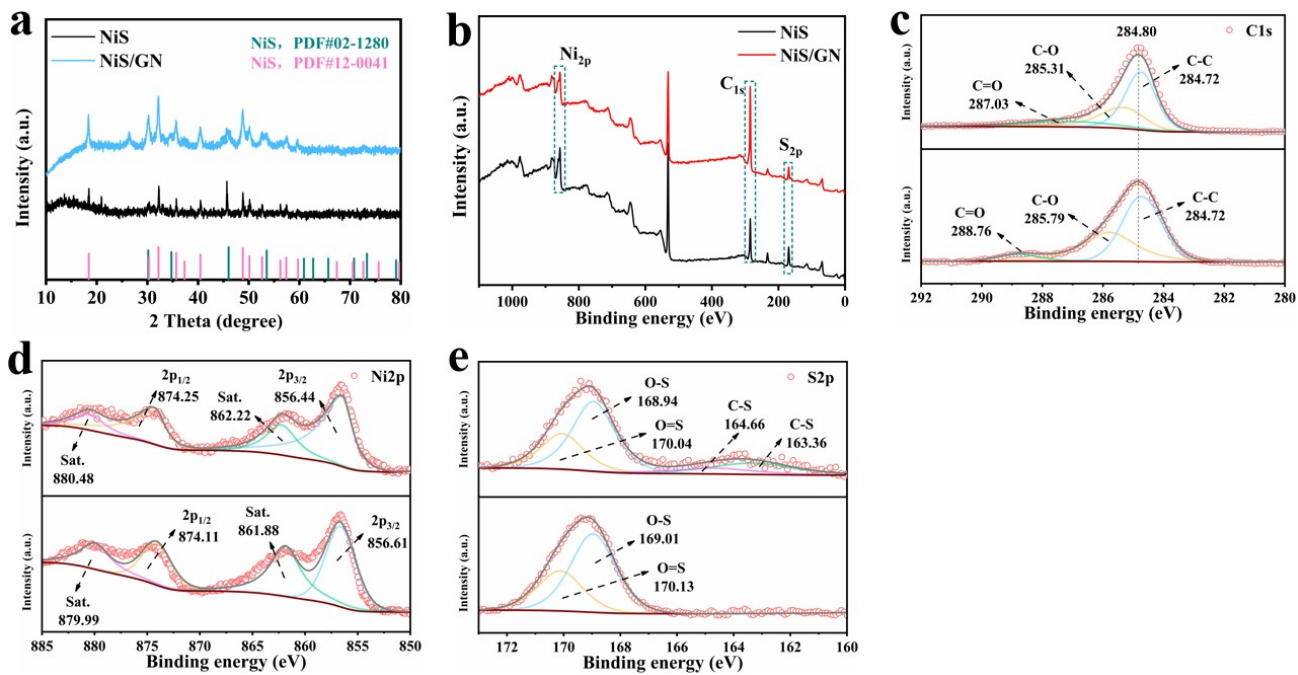


Fig. S14. (a) XRD patterns, and XPS spectra of NiS and NiS/GN. (b) survey spectra, (c) C 1s spectra, (d) Ni 2p spectra, and (e) S 2p spectra.

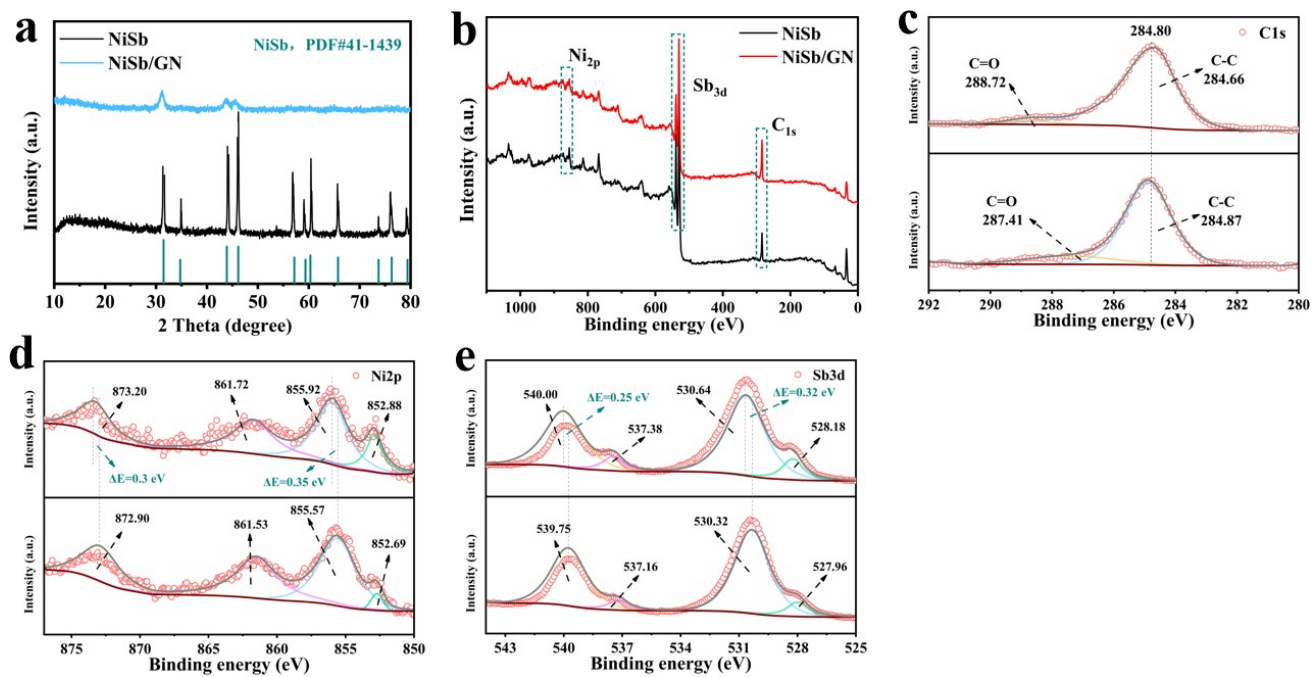


Fig. S15. (a) XRD patterns, and XPS spectra of NiSb and NiSb/GN. (b) survey spectra, (c) C 1s spectra, (d) Ni 2p spectra, and (e) Sb 3d spectra.

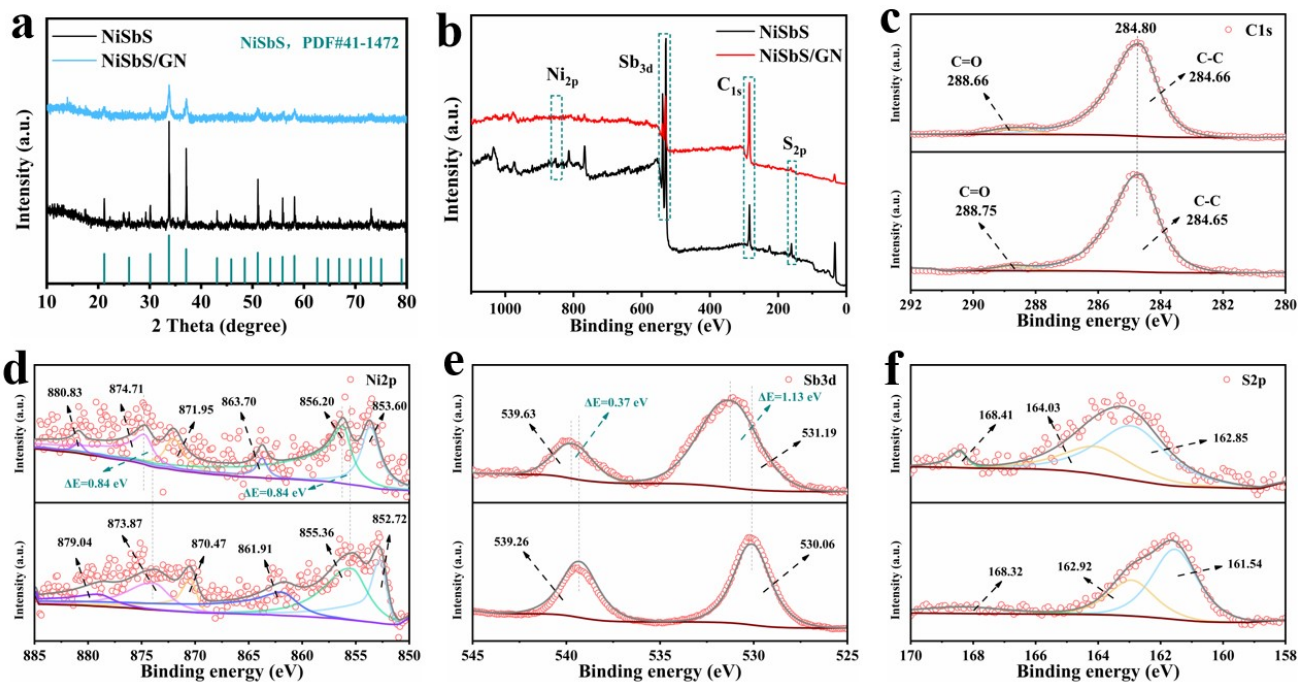


Fig. S16. (a) XRD patterns, and XPS spectra of NiSbS and NiSbS/GN. (b) survey spectra, (c) C 1s spectra, (d) Ni 2p spectra, (e) Sb 3d spectra, and (f) S 2p spectra.

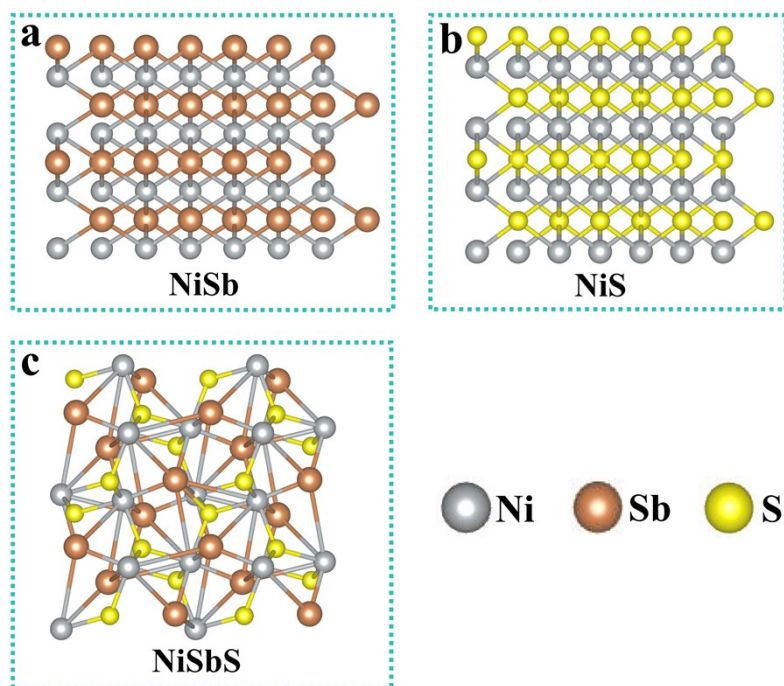


Fig. S17. The crystal structure of (a) NiSb, (b) NiS, and (c) NiSbS.