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Electronic Supplementary Information for

Advancing Lithium-Sulfur Battery Efficiency: Utilizing a 2D/2D g-C_3N_4@MXene Heterostructure to Enhance Sulfur Evolution Reactions and Regulate Polysulfides in Lean Electrolyte Conditions

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Table S1: Results obtained from Nyquist plot for fresh and cycled cells.

Electrode	Condition	R_e	R_{ct}
$g\text{-}C_3N_4$-Mx/S	Fresh cell	4.0	34.9
	After 190 cycles	4.9	30.1
$g\text{-}C_3N_4$/S	Fresh cell	8.1	58.3
	After 105 cycles	8.6	45.7

Table S2: Comparison of Li-S battery performance with previously published works.

Host material	Specific surface area (m^2/g)	Sulfur content (%)	Initial capacity (mAh/g) [a]	Retained capacity (mAh/g) [b]	Rate	Cycle number	Capacity retention (%) = $\frac{b}{a}$ x 100	Ref
$g\text{-}C_3N_4$ nanosheets	209	70.4	870	578	0.5 C	750	66.43	1
$g\text{-}C_3N_4$ spheres	931	69.8	934	775	0.5 C	100	82.97	2
Porous $g\text{-}C_3N_4$	83	68.67	734	620	1 C	300	84.46	3
$g\text{-}C_3N_4$/C porous cages	428	67	1240	729	1 C	200	58.79	4
Hierarchically porous $g\text{-}C_3N_4$/C	498	64.5	1150	1128	0.2 C	100	98.08	5
3D porous $g\text{-}C_3N_4$/ graphene sponge	827	731	1132	974	0.2 C	800	86.04	6
3D porous $g\text{-}C_3N_4$/ CNT	202	80	1023	583	1 C	500	56.98	7
3D $g\text{-}C_3N_4$/rGO/CNT microspheres	225	70.8	730	620	1 C	500	84.93	8
g-CN + MXene	**54**	**69.5**	**1061**	**73**	**C/8**	**190**	**73**	This work

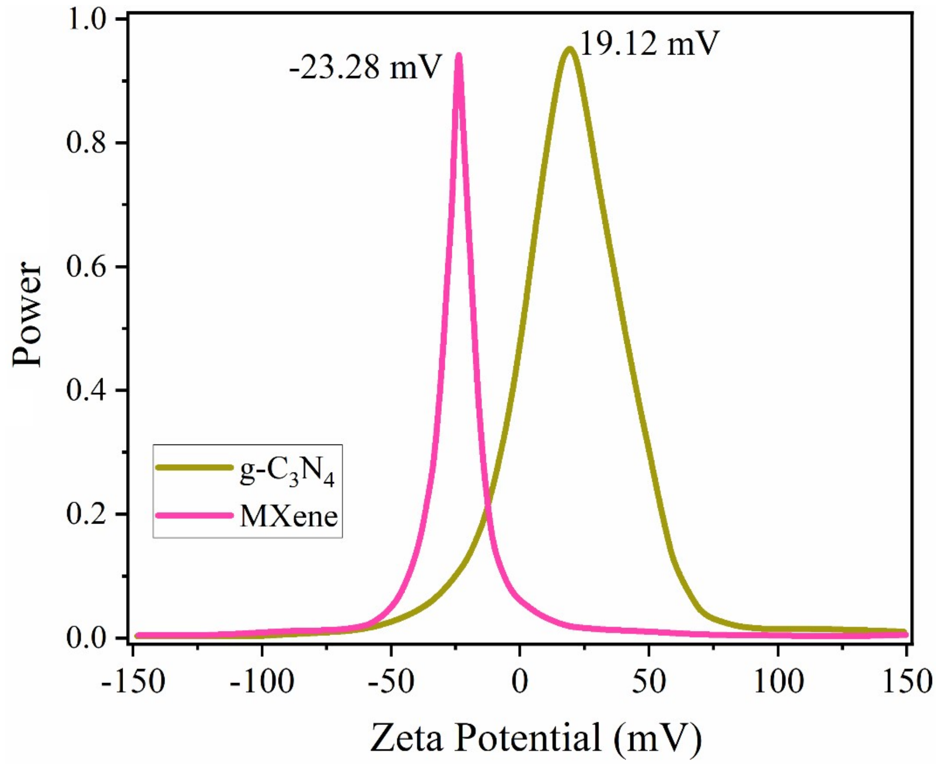

Figure S1: Zeta potential value of pure g-C_3N_4 nanosheets and MXene nanosheets.

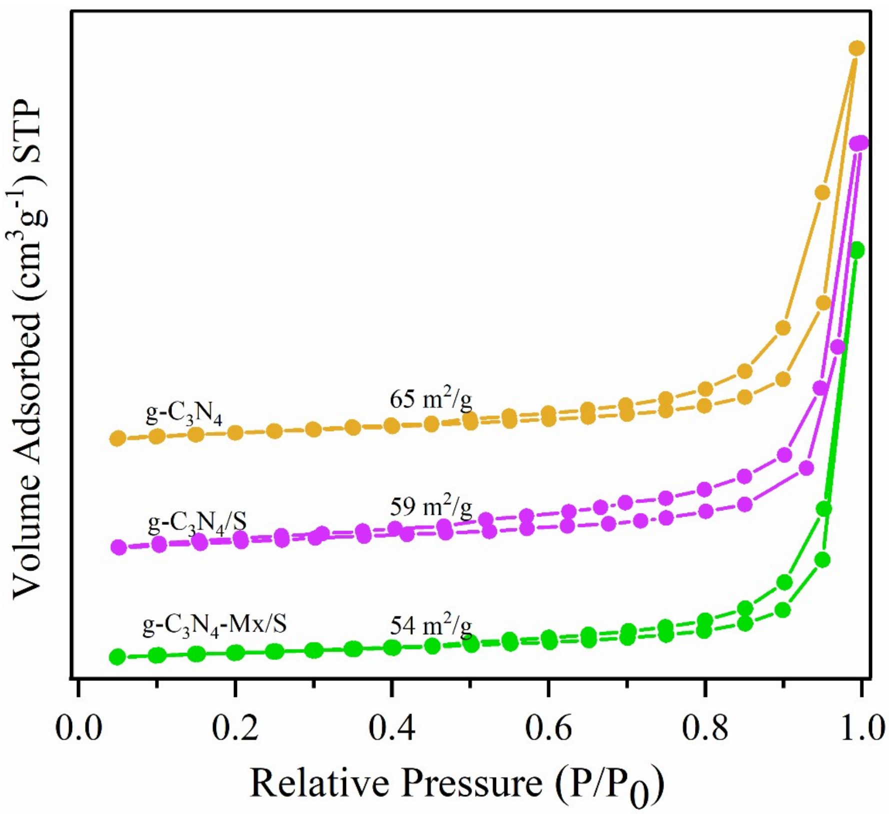

Figure S1: N_2 sorption isotherms for the as-prepared materials.

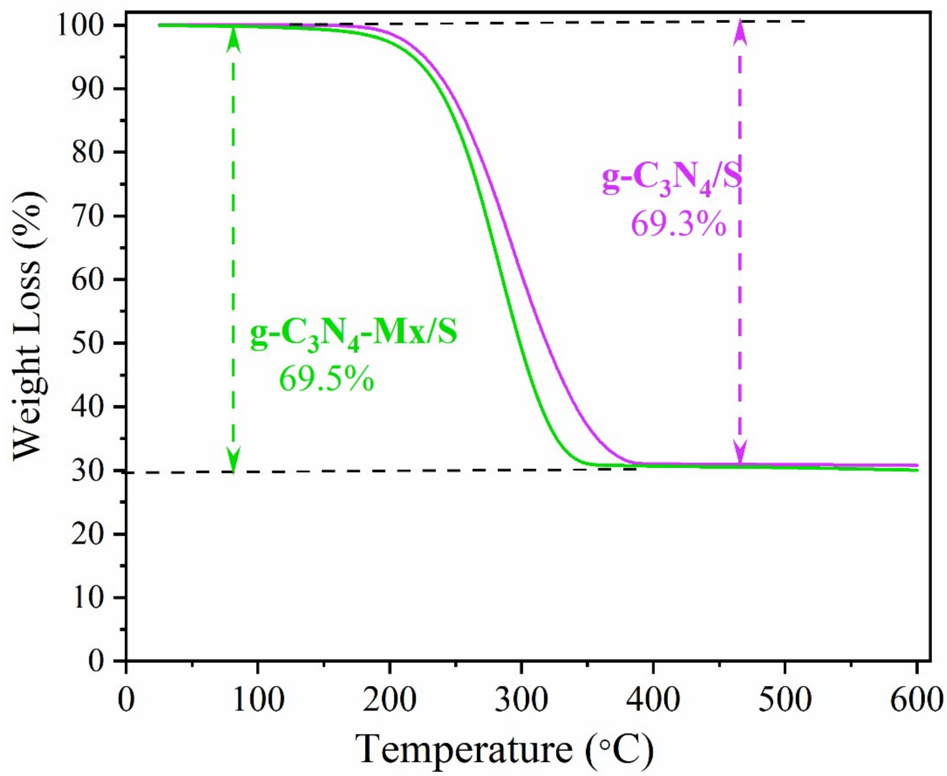

Figure S3: TGA profile of sulfur-based composite.

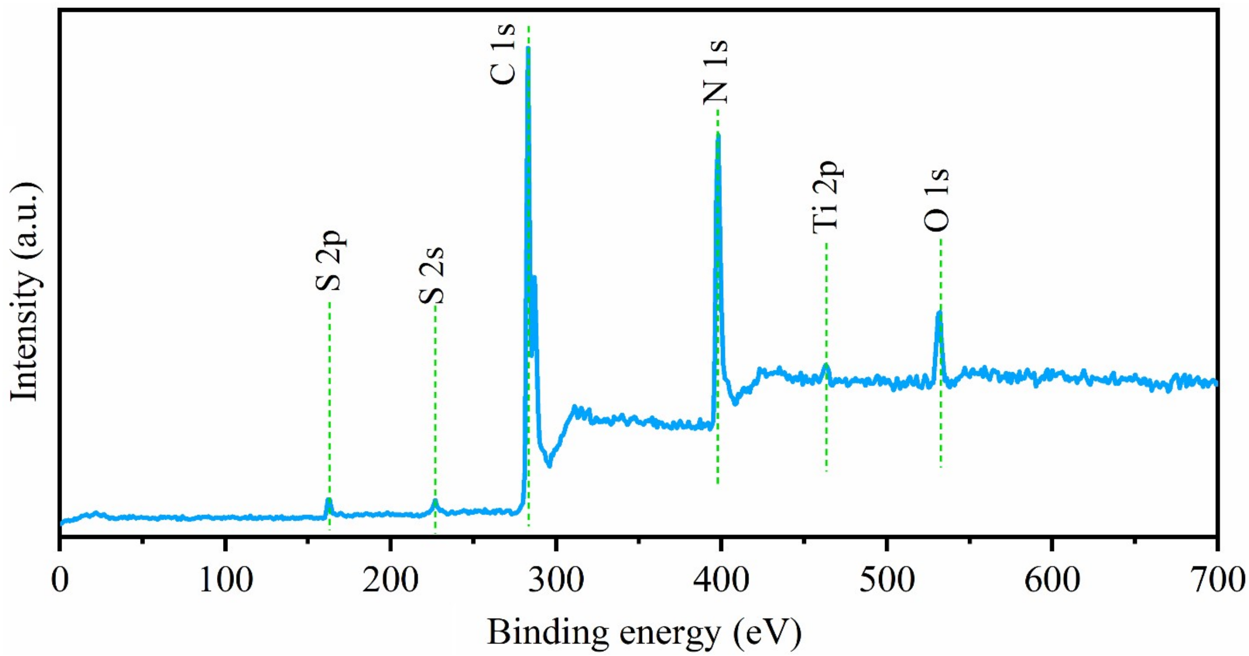

Figure S4: XPS survey scan for g-C_3N_4-Mx/S composite.

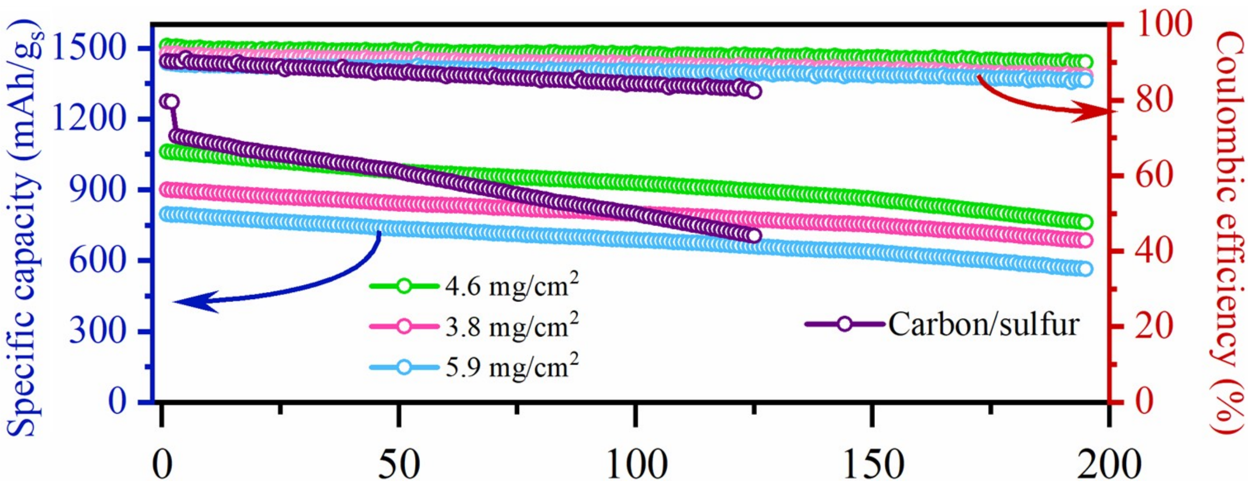

Figure S5: Cycle performance of the g-C_3N_4-Mx/S cathode with varied sulfur loading for 190 cycles at C/8.

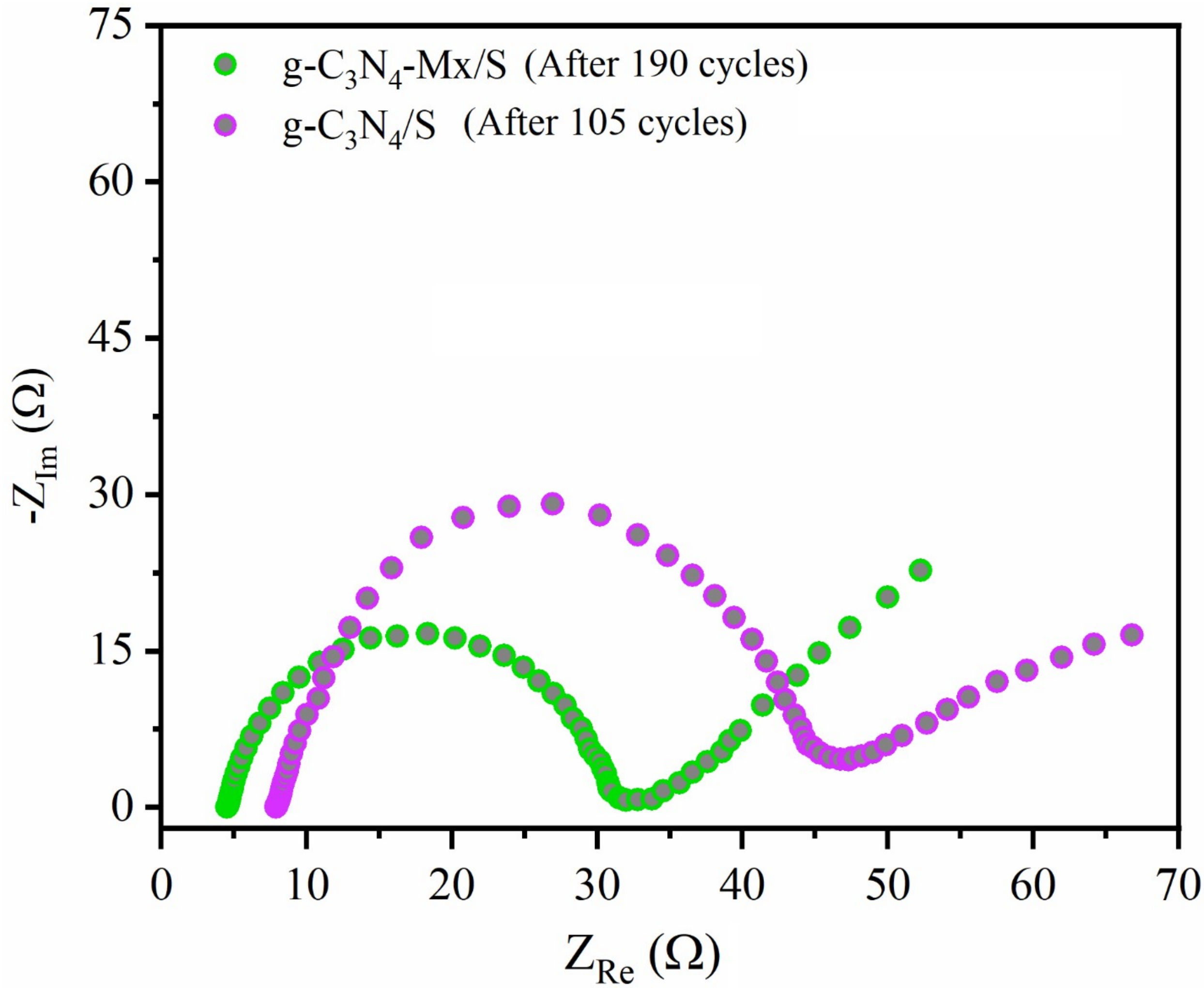

Figure S6: EIS spectra of g-C_3N_4-Mx/S cathode extracted from the pouch cell after 190 charge-discharge cycles.

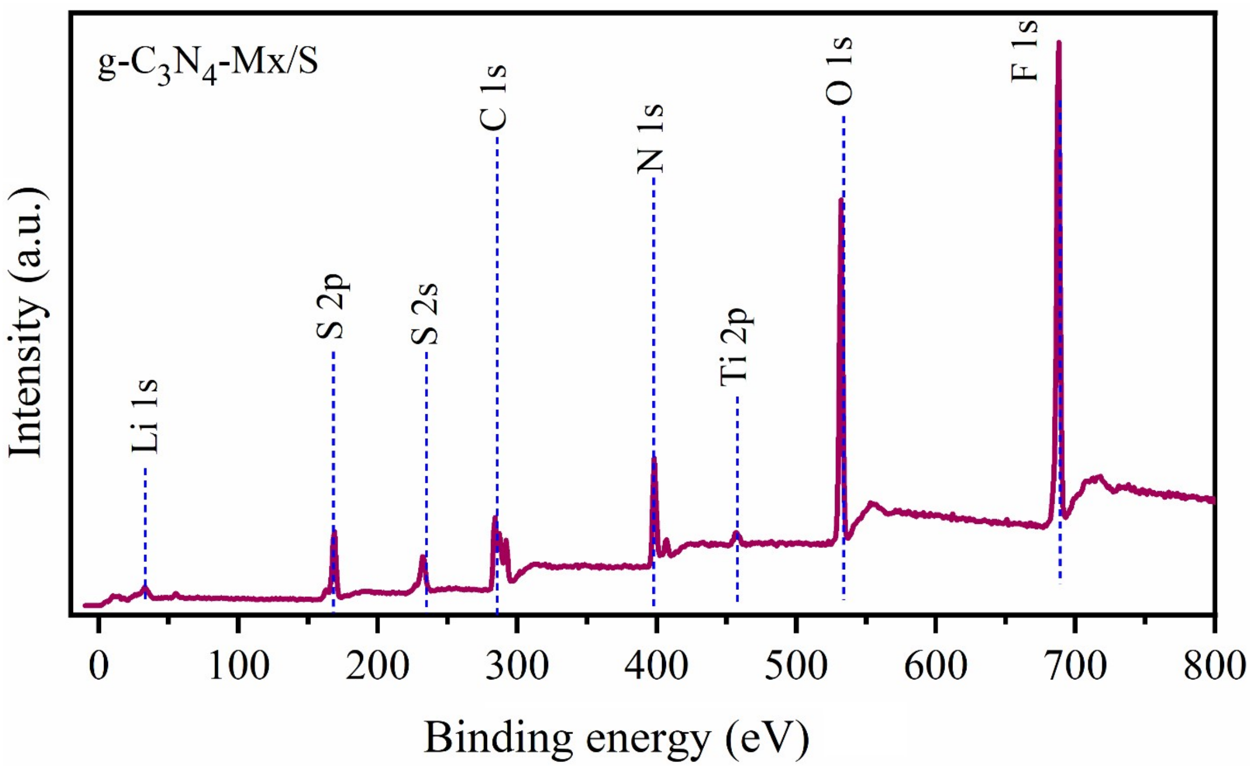

Figure S7: Complete XPS scan spectrum of the g-C_3N_4-Mx/S cathode obtained from the pouch cell cycled for 190 charge-discharge cycles.

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