

Electronic Supplementary Information

Lithiophilic AlN modified copper layer for high-performance lithium metal anode

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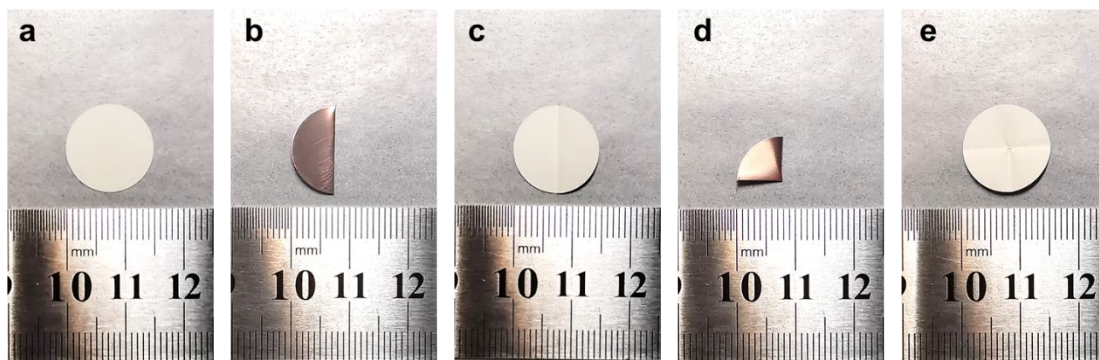


Figure S1. Digital images of the folding test for AlN@Cu substrate.

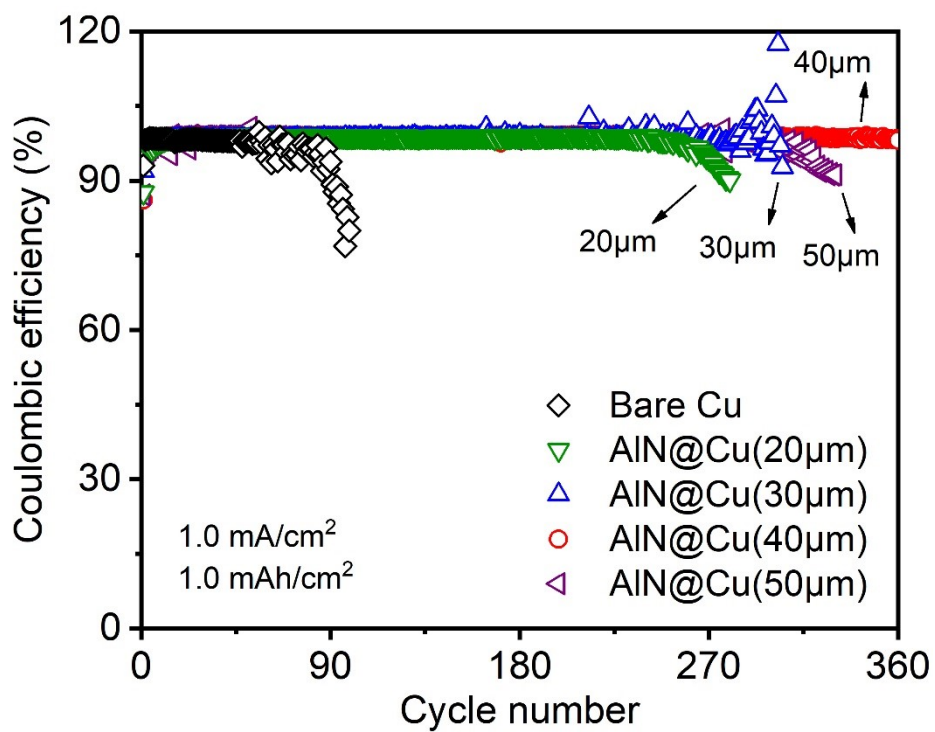


Figure S2. CEs comparison of bare Cu and AlN@Cu with various thickness (20 μm , 30 μm , 40 μm and 50 μm).

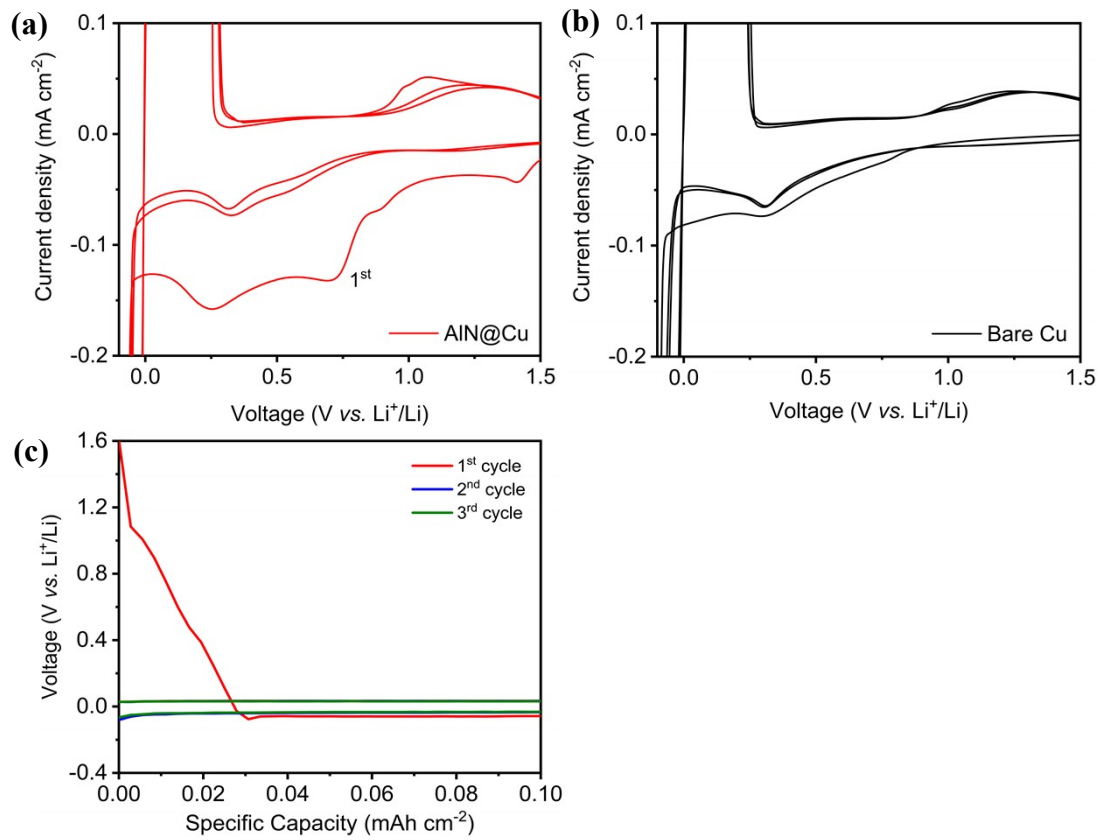


Figure S3. Enlarged CV curves of half cells (a) with AlN@Cu substrate and (b) with bare Cu substrate, (c) voltage profile of the half cells with AlN@Cu substrate.

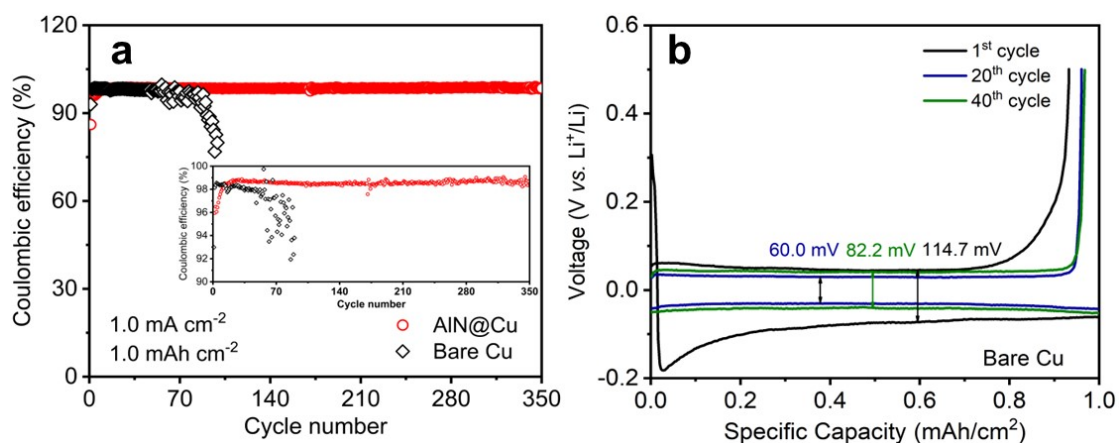


Figure S4. Electrochemical performance of half cells. (a) CEs of bare Cu and AIN@Cu at 1.0 mA cm^{-2} under fixed capacity of 1.0 mAh cm^{-2} ; (b) charge/discharge voltage-capacity profiles of bare Cu at 1st, 20th and 40th cycles.

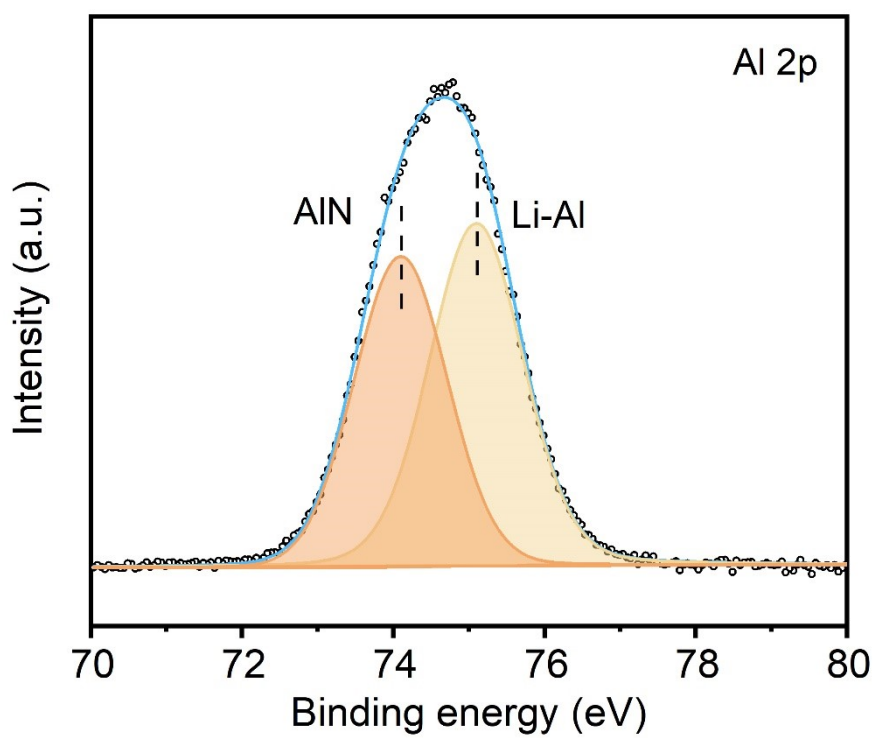


Figure S5. Al 2p high-resolution XPS spectra of AlN@Cu after initial discharge process.

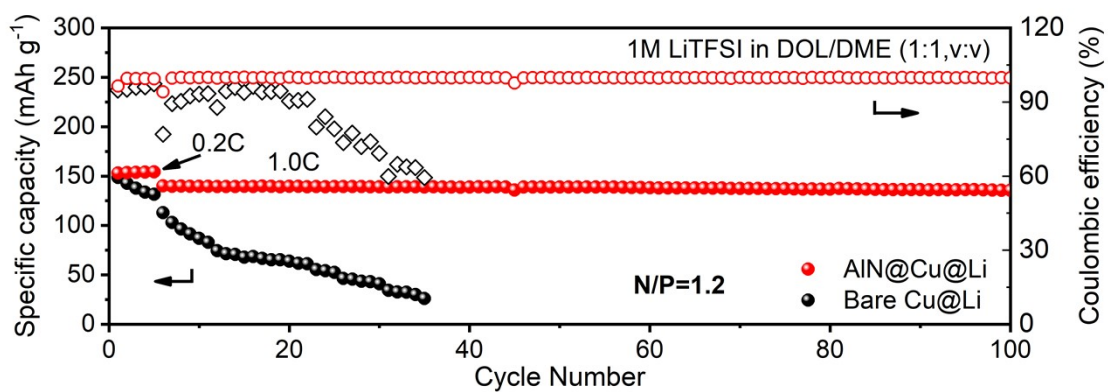


Figure S6. Cycling performance of Li/LFP full cells based on 1M LiTFSI in DOL/DME (1:1, v:v) electrolyte at 1.0 C with a restrict N/P ratio of 1.2.

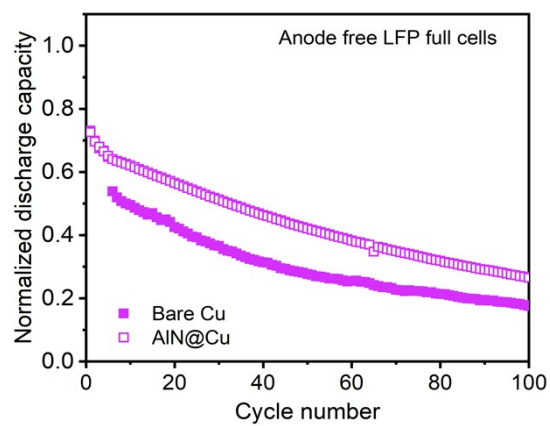


Figure S7. Cycling performance of anode free LFP full cells with bare Cu substrate and AlN@Cu substrate.

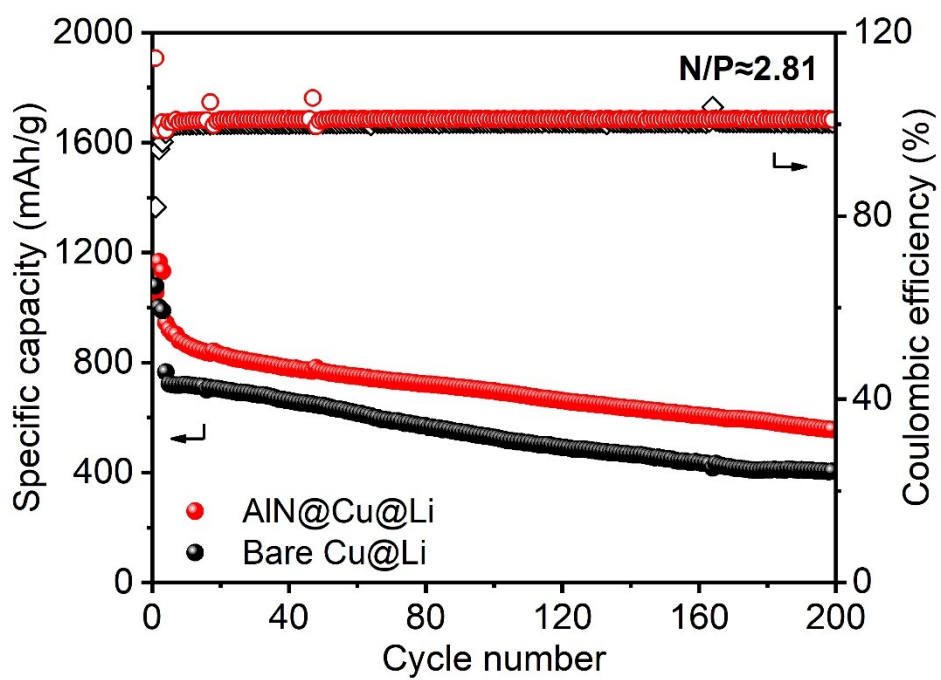


Figure S8. Galvanostatic cycling performance of Li/S cells with bare Cu@Li and AlN@Cu@Li at 0.5 C with a restrict N/P ratio of 2.81.

Table S1. Fitting equivalent circuit model and impedance parameters of half cells.

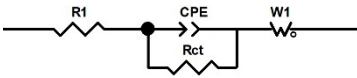
	R_s (Ω)		R_{ct} (Ω)	
	1 st	20 th	1 st	20 th
Modified Cu	9.25	9.42	44.41	33.69
Pristine Cu	3.41	4.64	137.62	37.25

Table S2. Comparison of cycle performance in Li/Cu half cells with other coating strategies.

Strategy	Electrolyte	Cycle conditions	Cycle Performance	References
AlN layer	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO₃	1.0 mA/cm²; 1.0 mAh/cm² 3.0 mA/cm²; 1.0 mAh/cm²	98.5%; ~380 cycles 98.1%; ~160 cycles	This work
Grain-Boundary-Rich artificial SEI (ZrO ₂ , Li ₂ O, Li ₃ N, and LiN _x O _y)	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	96.2% ; ~120 cyeles	Adv. Funct. Mater. 2022 , 32, 2107249
Dual-protective interface (inner: Prussian blue (PB); outer: reduced graphene oxide (rGO))	1.0 M LiTFSI in DOL/DME (1:1) with 1.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	97.8%; 150 cyeles	Adv. Energy Mater. 2021 , 11, 2102242
LiCl+PVDF-HFP dual-protective layer	1.0 M LiTFSI in DOL/DME (1:1) with 1.0 wt.%LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	99.5%; ~180 cyeles	Energy Stor. Mater. 2021 , 41, 485–494
Aluminum silicate (ASO) fibers coating	1.0 M LiTFSI in DOL/DME (1:1) with 0.2 M LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	97.0% ; ~170 cyeles	Chem. Eng. J. 2021 , 408, 128016
Cu ₂ O film	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	97.7% ; ~250 cyeles	Chem. Eng. J. 2022 , 433, 133689
Ti ₃ C ₂ T _x /g-C ₃ N ₄ artificial layer	1.0 M LiTFSI in DOL/DME (1:1) with 1.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	98.0% ; ~320 cycles	Adv. Sci. 2022 , 2103930
PEO/UPy coating	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	98.4% ; ~150 cycles	Angew. Chem. Int. Ed. 2020 , 59, 2055
Dual alloy Li _x Al-Li _x P hybrid interface	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	98.5% ; ~300 cycles	Chem. Eng. J. 2022 , 434, 134637
Li ₂ S/Li ₂ Se coating	1.0 M LiTFSI in DOL/DME (1:1) with 1.0 wt.% LiNO ₃	1.0 mA/cm ² ; 1.0 mAh/cm ²	98.0% ; ~360 cycles	Adv. Funct. Mater. 2020 , 30, 2001607
PVDF-HFP /Li ₇ La ₃ Zr ₂ O ₁₂	1.0 M LiTFSI in DOL/DME (1:1) with 2.0 wt.% LiNO ₃	2.0 mA/cm ² ; 1.0 mAh/cm ²	95.0% ; ~100 cycles	J. Power Sources 2020 , 450, 227710