Supplementary Information

Graphene Anchored on Cu Foam as Lithiophilic 3D Current Collectors for Stable and Dendrite-free Lithium Metal Anode

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Fig. S1. N₂ sorption isotherms of Cu foam and GN@Cu foam.
Fig. S2. Raman spectra of GN@Cu foam before and after 10 cycles.

Fig. S3. EDS mapping of GN@Cu foam: b) Copper and c) carbon distribution in the selected area
Fig. S4. a-c) Voltage profiles of Li plating/stripping on Cu foam and GN@Cu foam electrodes in the first cycle at 0.5 mA cm\(^{-2}\), 1 mA cm\(^{-2}\) and 5 mA cm\(^{-2}\), respectively. d-f) Cycling performance comparison of Cu foam and GN@Cu foam electrodes in half cells at different current densities.

Fig. S5. a) Cycling performance comparison of Li plating/stripping at 4 mA cm\(^{-2}\) for 1 mAh cm\(^{-2}\) on Li foil and GN@Cu foam Li electrodes in symmetric cells. b) Detailed voltage profiles of Li foil and GN@Cu foam Li electrodes in different cycles.
Fig. S6. Sectional SEM image of GN@Cu foam, showing the thickness of GN@Cu foam is 270 μm.

Fig. S7. Voltage profiles of Li plating/stripping on Cu foam and GN@Cu foam electrodes in the 100th cycle at 2 mA cm$^{-2}$. 
Fig. S8. a) Voltage profiles of Li plating/stripping on Cu foam and GN@Cu foam electrodes in the first cycle at 1 mA cm$^{-2}$ for 5 mAh cm$^{-2}$ Li. b) Cycling performance comparison of Cu foam and GN@Cu foam electrodes in half cells at 1 mA cm$^{-2}$.

Fig. S9. Cycling performance of Li plating/stripping at 0.5 mA cm$^{-2}$ for 1 mAh cm$^{-2}$ on Cu foil Li electrodes in symmetric cells.

Fig. S10. Voltage profiles of Li plating/stripping at 10 mA cm$^{-2}$ for 10 mAh cm$^{-2}$ on GN@Cu foam Li electrodes in symmetric cells.
Fig. S11. a) Charge/discharge curves of the Cu foil Li/LFP and GN@Cu foam Li/LFP full cells at 0.2 C. b) Cycling performance of Cu foil Li/LFP and GN@Cu foam Li/LFP full cells at 0.2 C.

To study the superiority of lithiophilic host, cycling performance in carbonate electrolyte (1 M LiPF₆ in EC/DEC, 1:1 by volume ratio) is shown in Fig. S12. It can be seen that GN@Cu foam exhibits lower nucleation overpotential and better cycling stability compared to Cu foam, confirming the lithiophilic property of GN@Cu foam. It is worth mentioning that the CE of these materials in carbonate electrolyte is lower than that in ether electrolyte, which indicates that ether electrolyte and LiNO₃ additive are favorable for Li plating/stripping.

Fig. S12. a) Voltage profiles of Li plating/stripping on Cu foam and GN@Cu foam electrodes in the first cycle at 0.5 mA cm⁻² in carbonate electrolyte. b) Cycling performance comparison of Cu foam and GN@Cu foam electrodes in half cells at 0.5 mA cm⁻².