

Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Pre-Planted Nucleation Seeds for Rechargeable Metallic Lithium Anode

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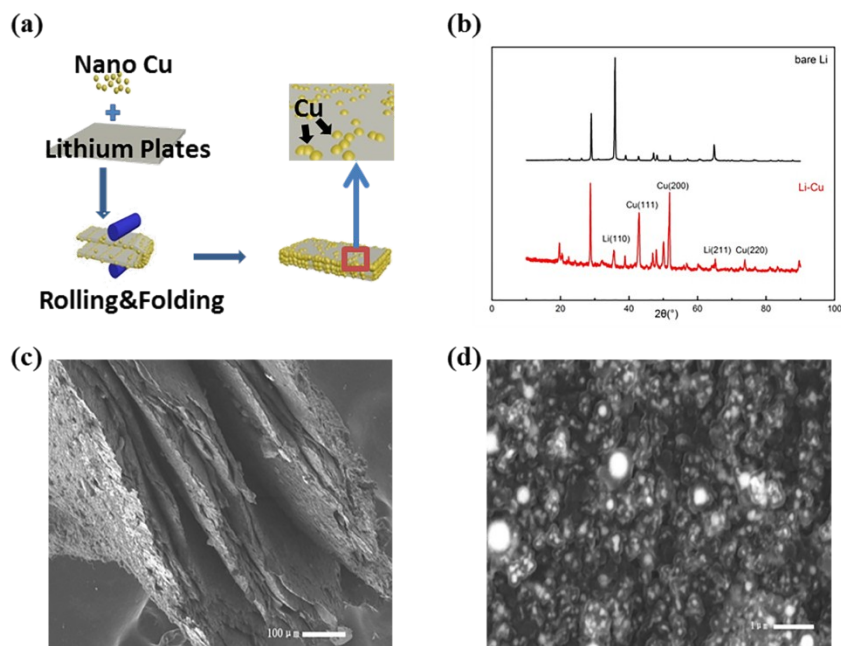


Fig.S1. (a) The synthesis schematic of Li-Cu hybrids mainly consists of rolling&folding. (b) XRD spectrum of Li-Cu hybrids and bare Li (c) Sectional view of Li-Cu hybrids exhibited a typical lamellar structure. (d) Top view of Li-Cu hybrids showed that numerous copper nanoparticles distributed on lithium.

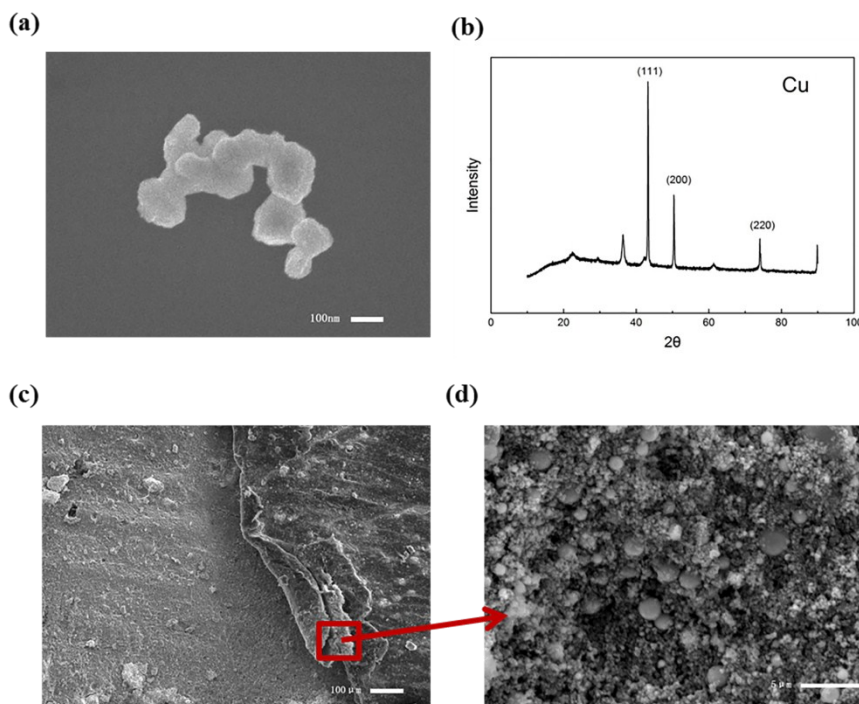


Fig.S2. SEM picture and XRD spectrum of Cu nanoparticles were respectively shown in (a) and (b).SEM of Li-Cu hybrids at the place where some sheets rolled up (c-d) revealed that Cu nanoparticles were distributed in the lamellar structure of the hybrids.

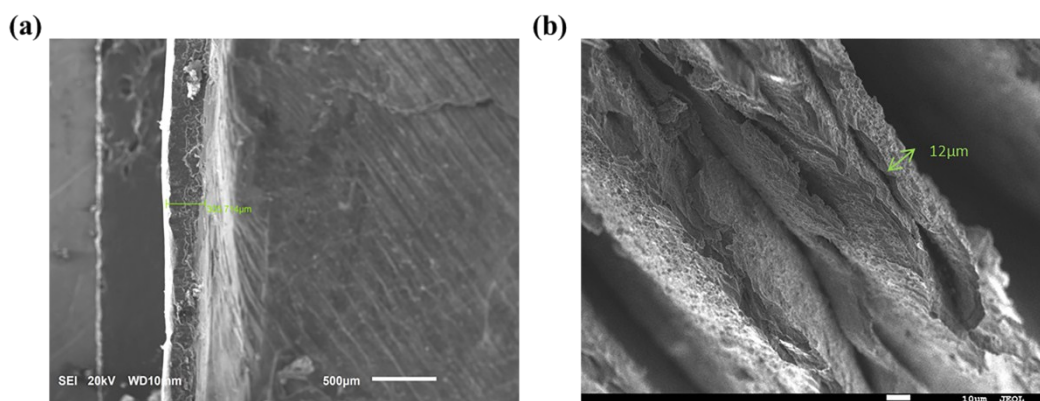


Fig.S3. SEM images of the sectional morphology of Li-Cu hybrid demonstrated that the thickness of the hybrid is about 300microns, and the internal layer thickness is about dozens of microns.

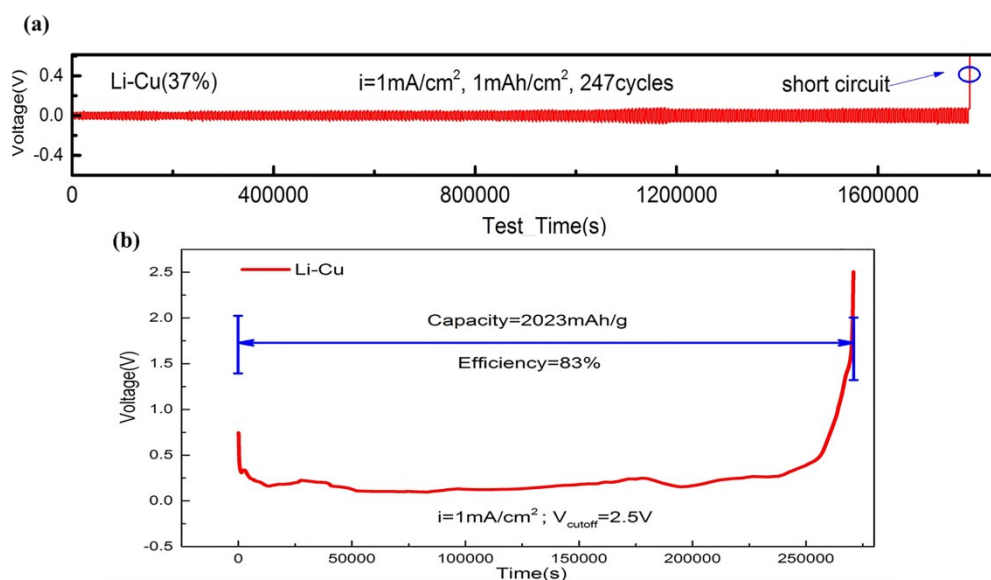


Fig. S4. (a)The complete voltage profile until Li-Cu(37%) cell make a short circuit revealed that Li-Cu (37%) can maintain stable cycling for more than 480h. (b) Typical discharge profile of Li-Cu(37%) hybrids revealed a specific capacity of 2023mAh g⁻¹

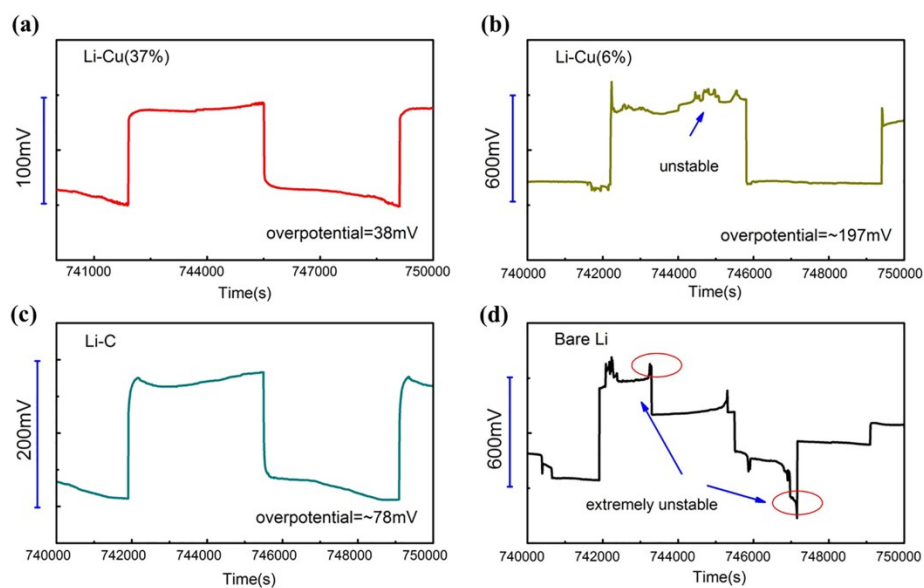


Fig. S5. The magnified voltage profile at 104th cycle for (a) Li-Cu(37%), (b) Li-Cu(6%), (c) Li-C and (d) bare Li.

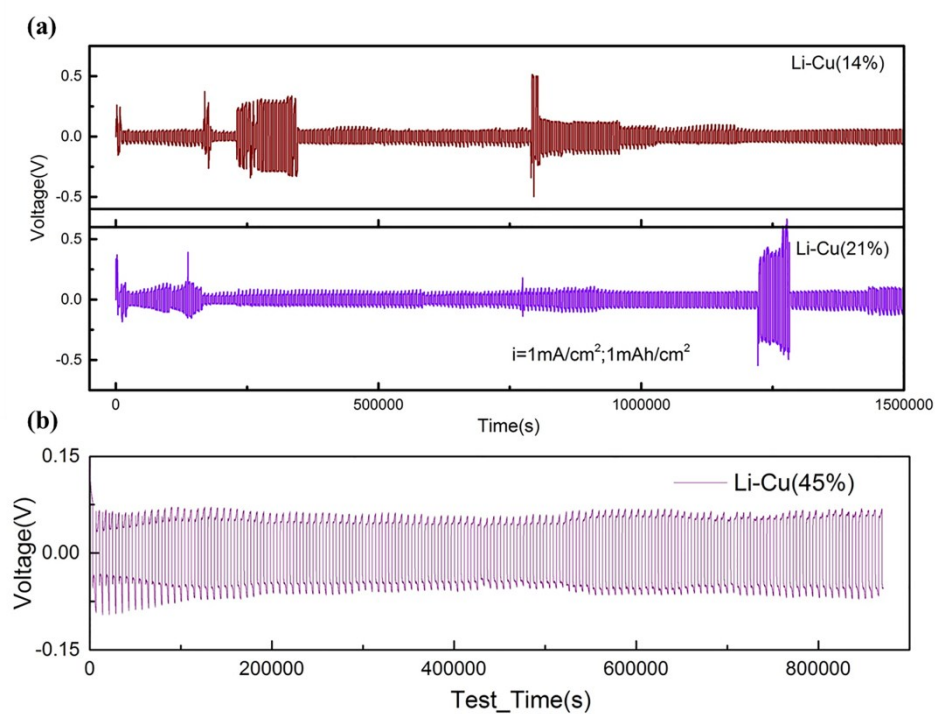


Fig. S6. Electrochemical performance of Li-Cu hybrids with (a) lower Cu content and (b) higher lower Cu content indicated that the stability of Li-Cu hybrids increased with the percentage of Cu.

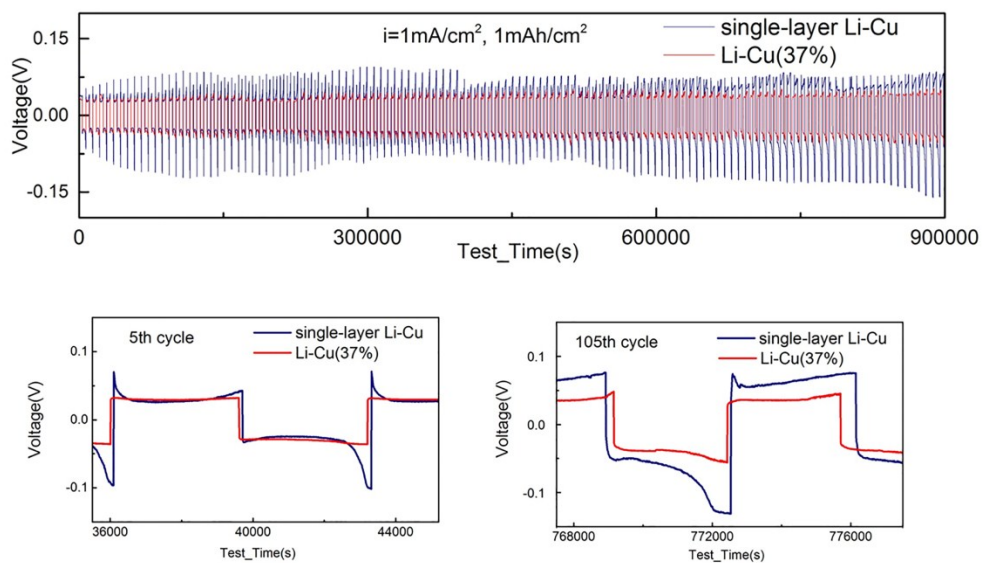


Fig.S7. (a) Electrochemical performance of single-layer Li-Cu hybrid. Magnified voltage profile at the (b) 5th cycle and (c) 105th cycle revealed the superior stability of multi-layer Li-Cu hybrid.

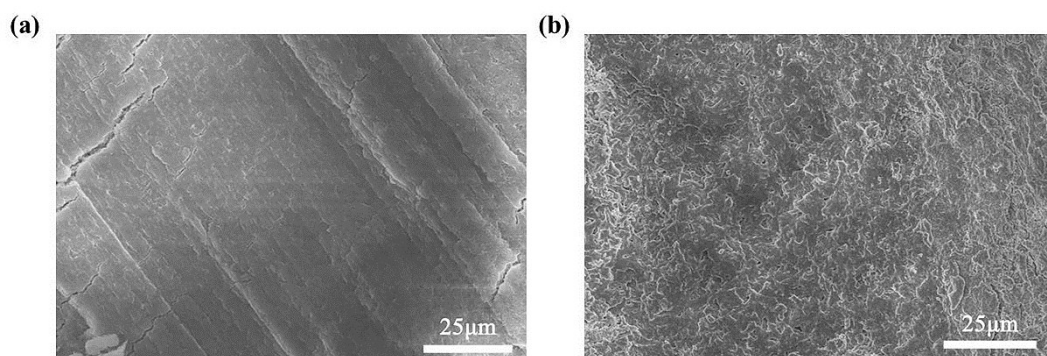


Fig.S8. SEM images of single-layer Li-Cu hybrid after cycling for (a) 50 and (b) 200 cycles under a current density of 1mA/cm² and a capacity of 1mAh/cm².

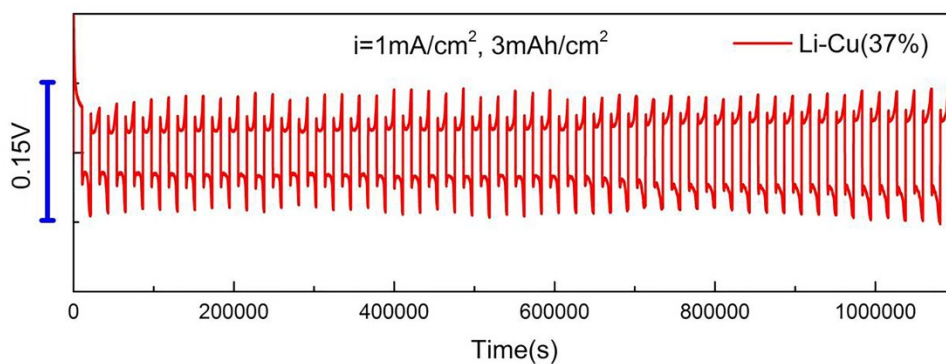


Fig.S9. Electrochemical performance of Li-Cu hybrid under a higher capacity of 3mAh/cm².

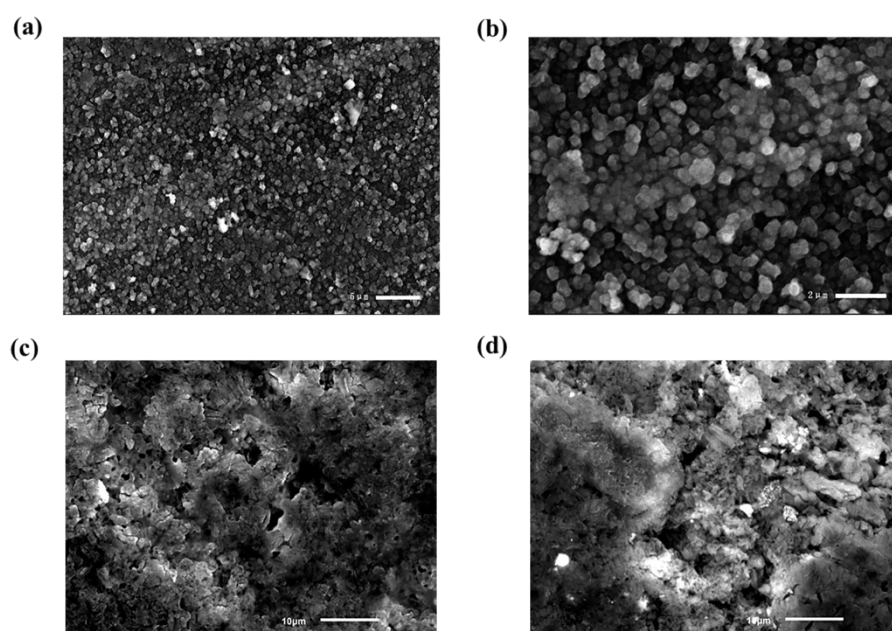


Fig.S10. High magnification SEM images after 30 cycles for (a)(b) Li-Cu hybrid and (c)(d) bare Li electrodes displayed totally different morphology. The granular-like deposition of Li in Li-Cu electrode indicated that Cu nanoparticles had significant influence on the nucleation behavior

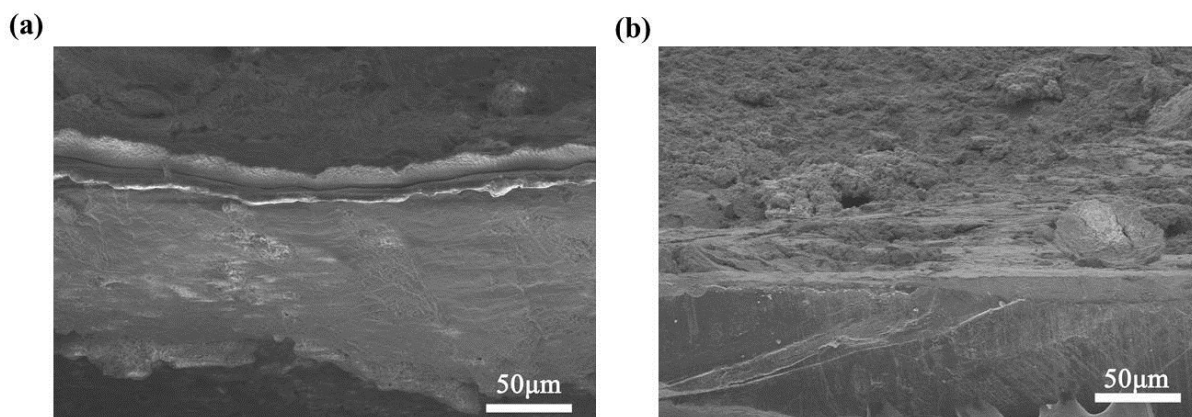


Fig.S11. High magnification SEM images of cross-sectional morphology after 200 cycles for (a) Li-Cu hybrid and (b) bare Li electrodes.

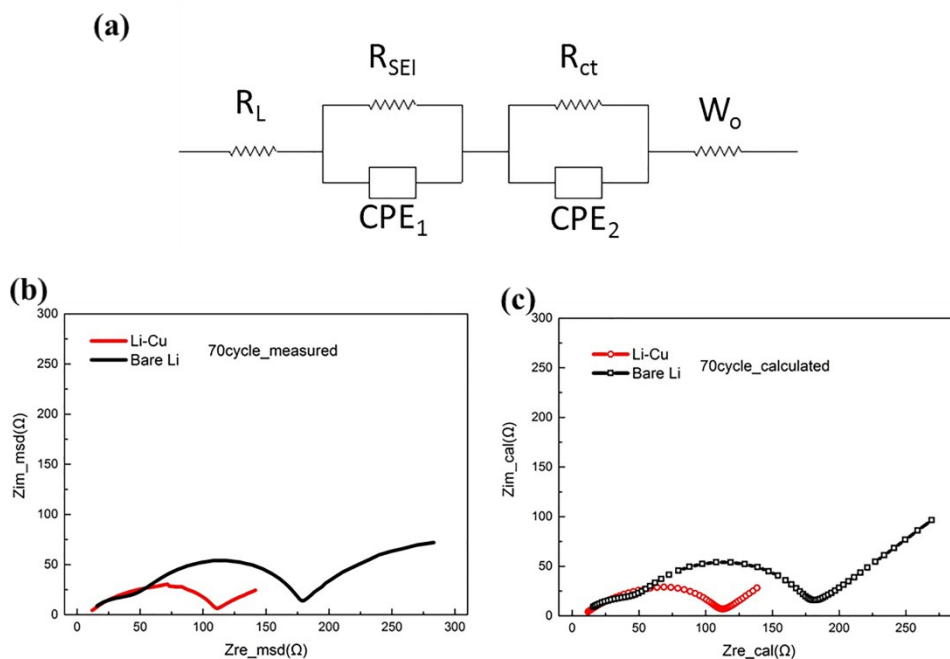


Fig.S12. Test results and analysis of EIS (a) Equivalent circuit used for calculation included three kinds of resistances: R_L , R_{SEI} and R_{ct} . Nyquist plots (b) measured and (c) calculated of Li-Cu hybrids and bare Li symmetric cells after 70 cycles indicated a lower resistance of the Li-Cu hybrids anode.

| | R_L [Ω] | R_{SEI} [Ω] | R_{ct} [Ω] |
|---------|-----------------------|---------------------------|--------------------------|
| Li-Cu | 8.233 | 36.59 | 65.92 |
| Bare Li | 8.283 | 46.15 | 118.6 |

Table S1. calculation results for EIS