

## Supporting Information

### Stable Lithium Metal Anode Achieved by *In Situ* Grown CuO

### Nanowire Arrays on Cu Foam

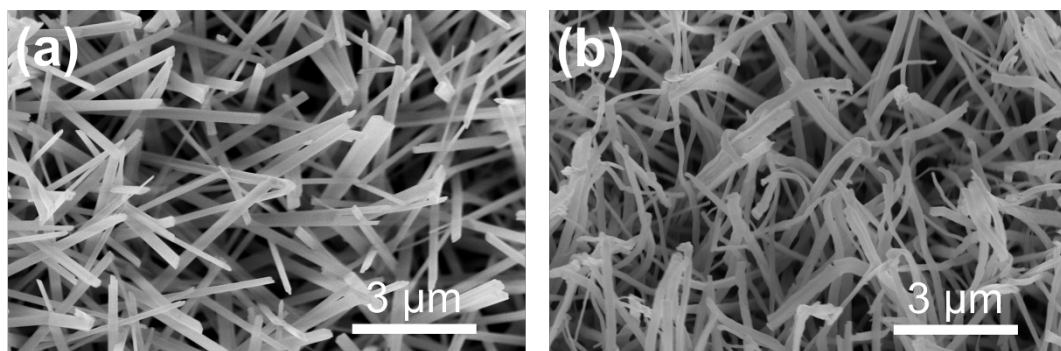
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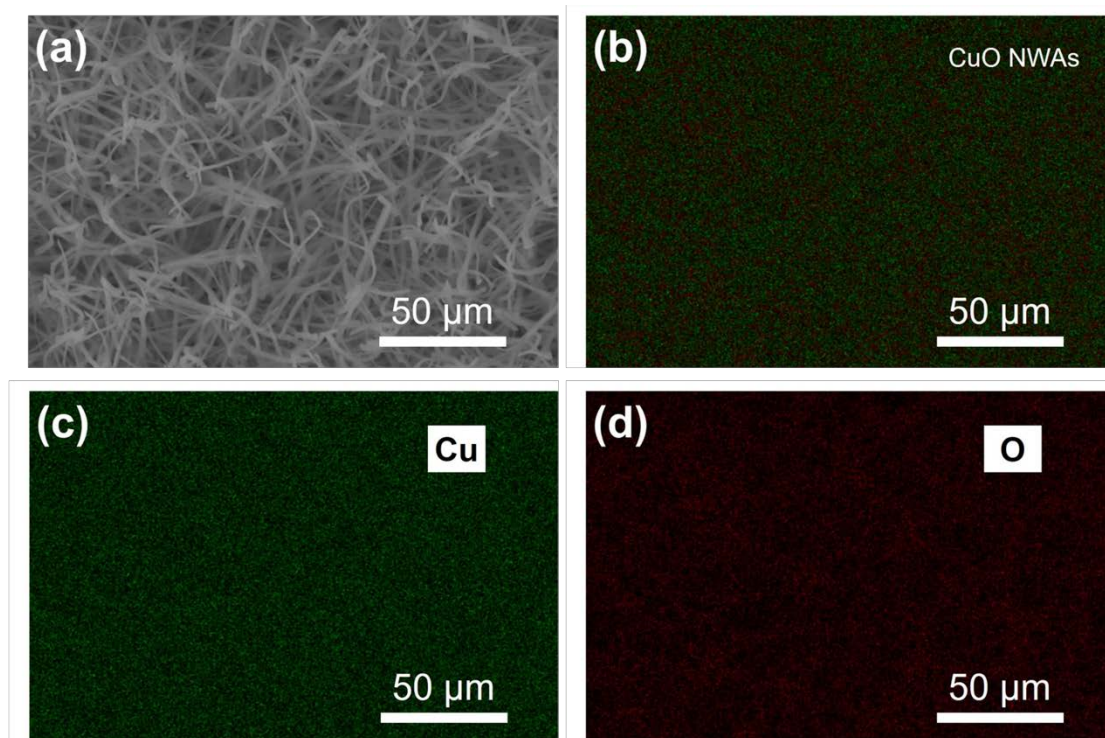
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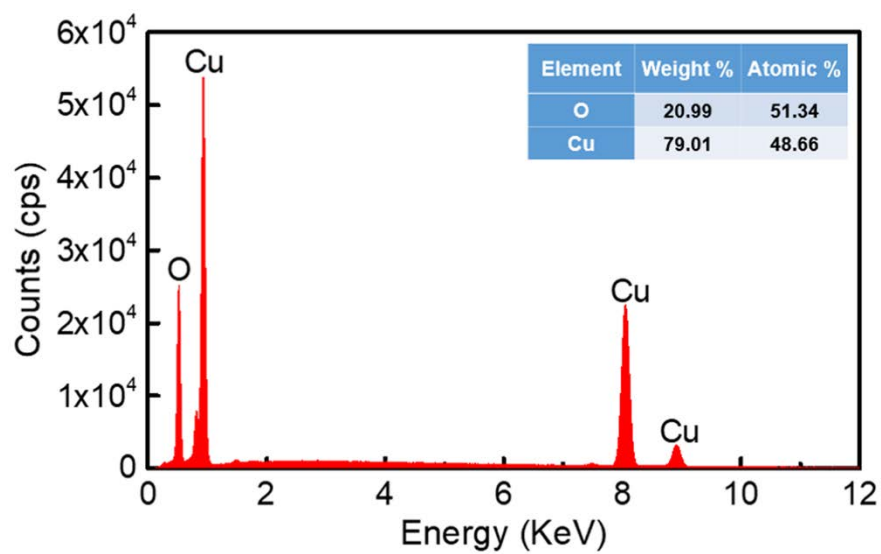
\* E-mail: [sycheng@fzu.edu.cn](mailto:sycheng@fzu.edu.cn).



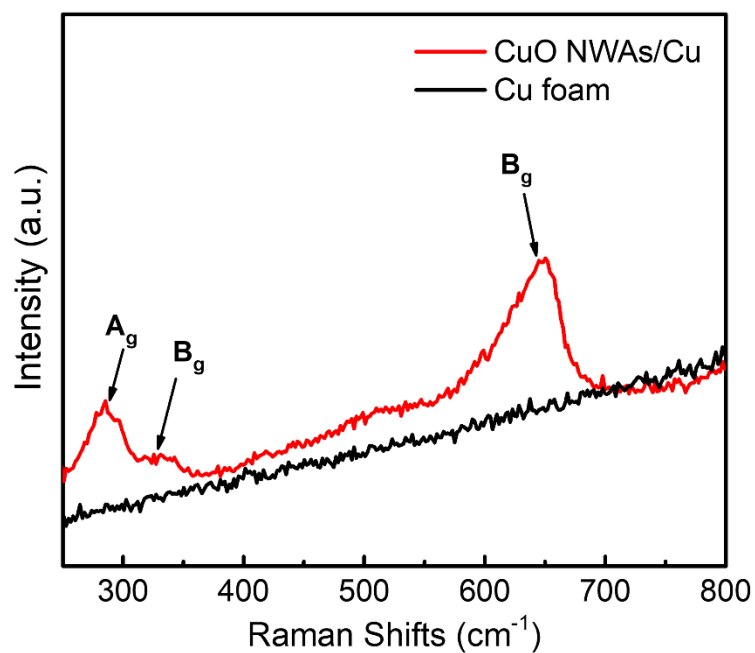
**Figure S1.** The high magnification SEM images of a)  $\text{Cu(OH)}_2$  NWAs/Cu and b)  $\text{CuO}$  NWAs/Cu.



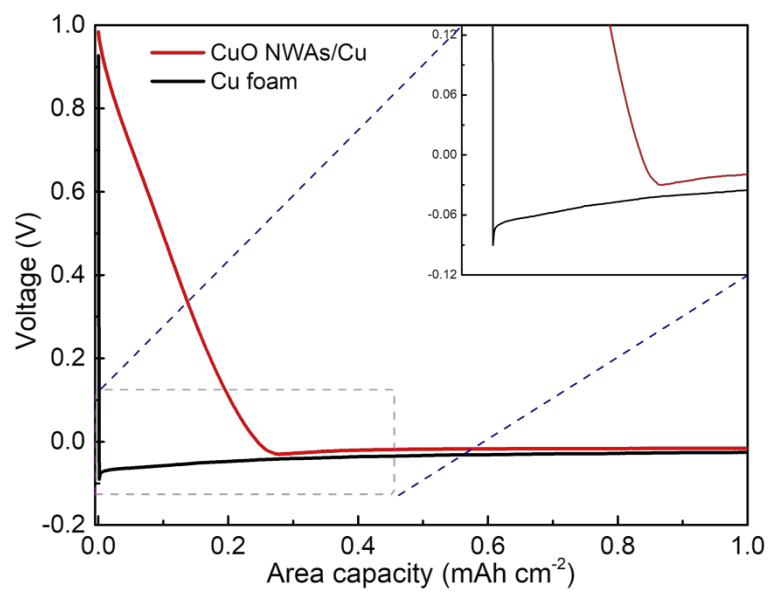
**Figure S2.** The SEM images of a) the CuO NWAs/Cu and the corresponding EDX elemental mapping of b) CuO NWAs, c) Cu and d) O.



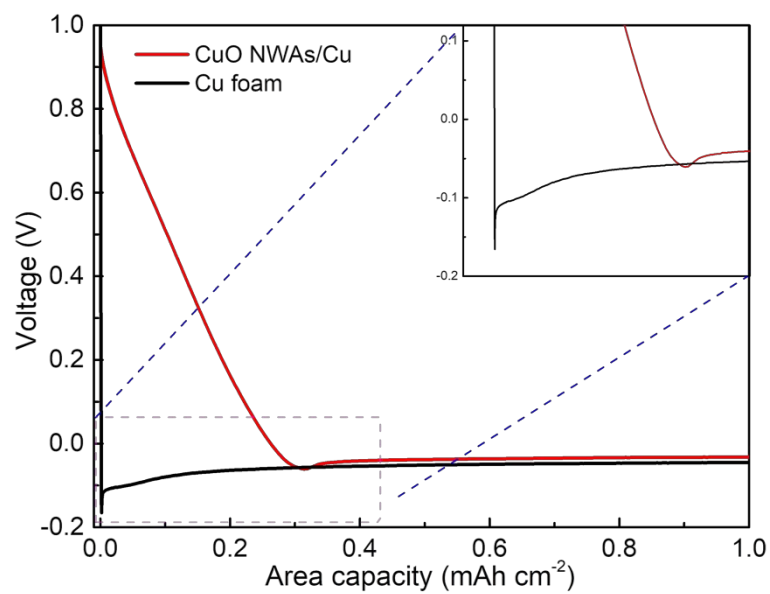
**Figure S3.** The EDX analysis of the CuO NWAs/Cu.



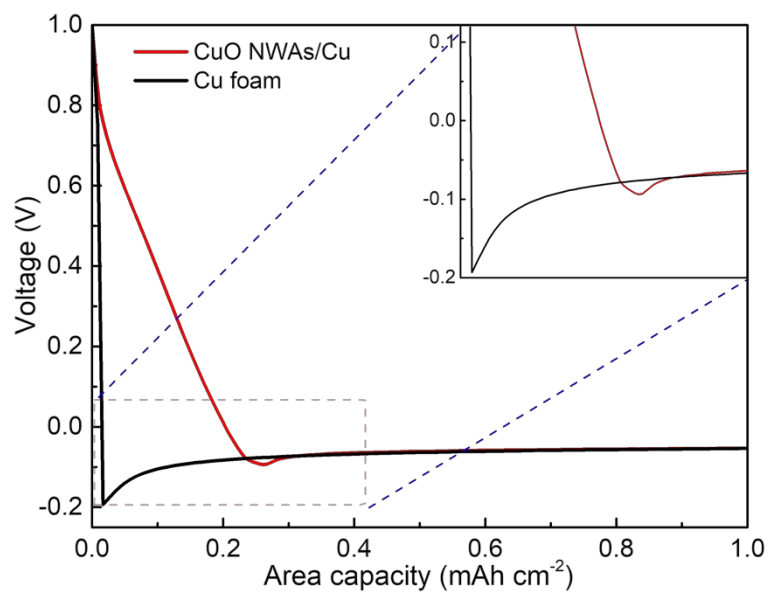
**Figure S4.** The Raman spectra of the Cu foam and CuO NWAs/Cu. The three peaks located at 280, 328, and 648 cm<sup>-1</sup> are corresponded to the A<sub>g</sub>, B<sub>g</sub>, and B<sub>g</sub> vibration modes of CuO, respectively.



**Figure S5.** The voltage profiles for Li nucleation on the Cu foam and CuO NWAs/Cu with an area capacity of  $1 \text{ mAh cm}^{-2}$  at  $0.5 \text{ mA cm}^{-2}$

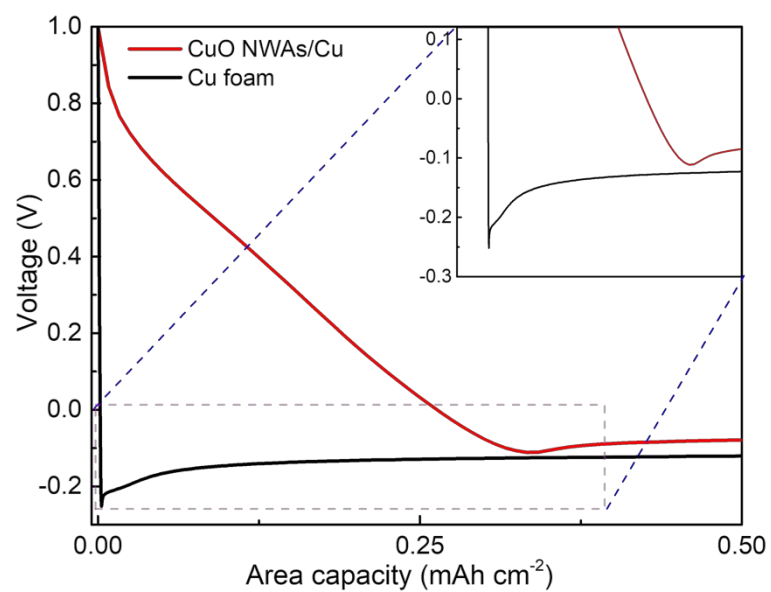


**Figure S6.** The voltage profiles for Li nucleation on the Cu foam and CuO NWAs/Cu with an area capacity of  $1 \text{ mAh cm}^{-2}$  at  $1 \text{ mA cm}^{-2}$



**Figure S7.** The voltage profiles for Li nucleation on the Cu foam and CuO NWAs/Cu with an area capacity of 1 mAh cm<sup>-2</sup> at 2 mA cm<sup>-2</sup>

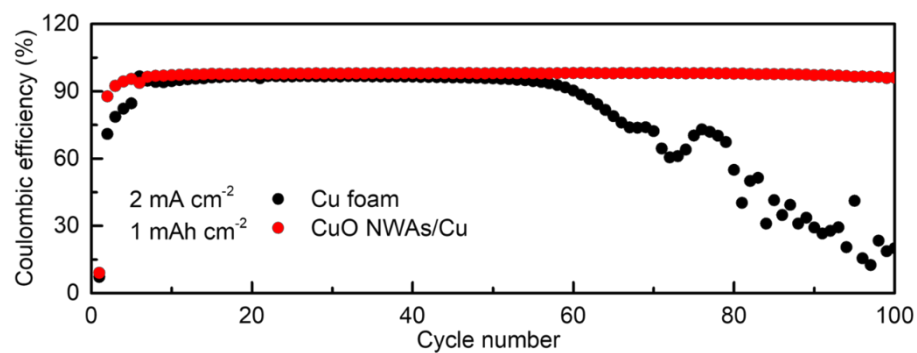




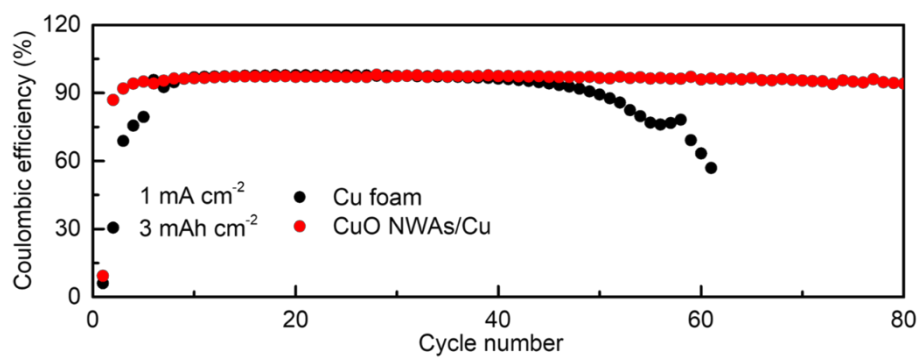
**Figure S8.** The voltage profiles for Li nucleation on the Cu foam and CuO NWAs/Cu with an area capacity of  $0.5 \text{ mAh cm}^{-2}$  at  $3 \text{ mA cm}^{-2}$

**Table S1.** Values of nucleation overpotential at different current densities

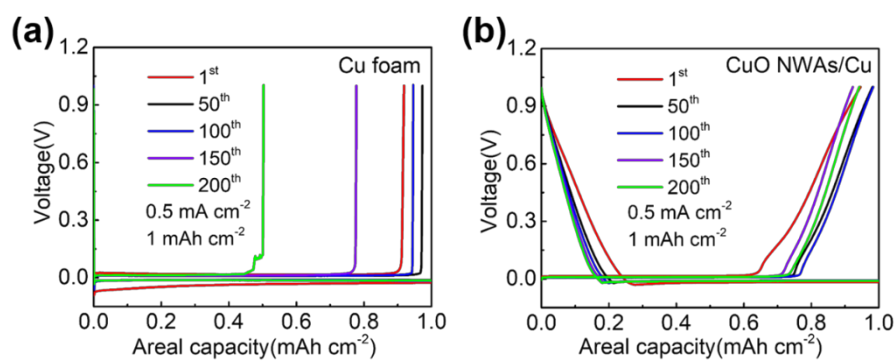
| Area capacity            | Current density         | Cu foam                  | CuO NWAs/Cu |
|--------------------------|-------------------------|--------------------------|-------------|
|                          |                         | Nucleation overpotential |             |
| 1 mAh cm <sup>-2</sup>   | 0.5 mA cm <sup>-2</sup> | -65 mV                   | -15 mV      |
|                          | 1 mA cm <sup>-2</sup>   | -125 mV                  | -30 mV      |
|                          | 2 mA cm <sup>-2</sup>   | -140 mV                  | -40 mV      |
| 0.5 mAh cm <sup>-2</sup> | 3 mA cm <sup>-2</sup>   | -130 mV                  | -35 mV      |



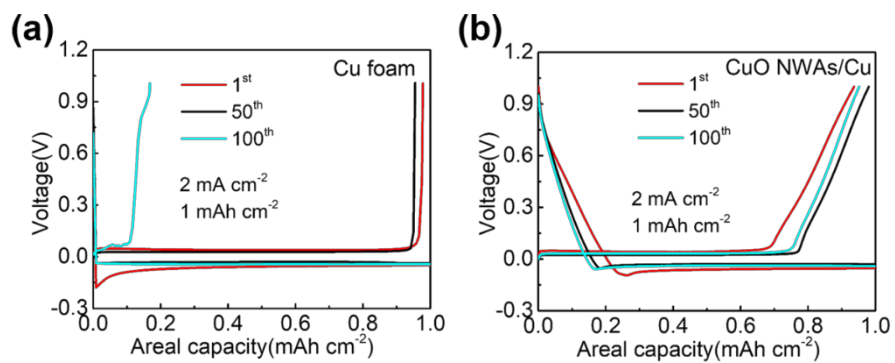
**Figure S9.** The Coulombic efficiency of Cu foam and CuO NWAs/Cu with an area capacity of  $1 \text{ mAh cm}^{-2}$  at  $2 \text{ mA cm}^{-2}$ .



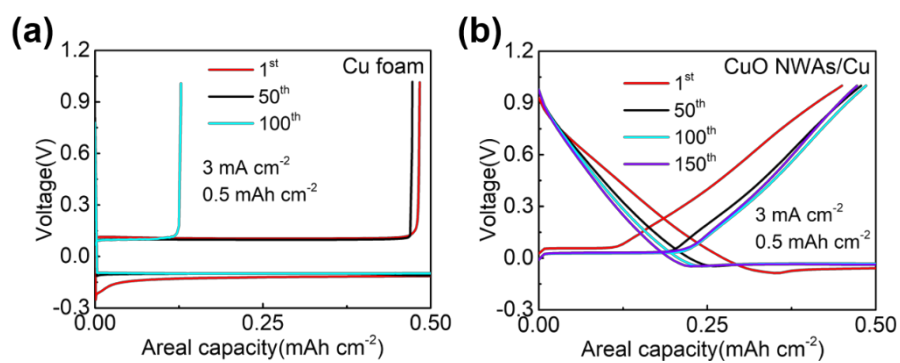
**Figure S10.** The Coulombic efficiency of Cu foam and CuO NWAs/Cu with an area capacity of 3 mAh cm<sup>-2</sup> at 1 mA cm<sup>-2</sup>.



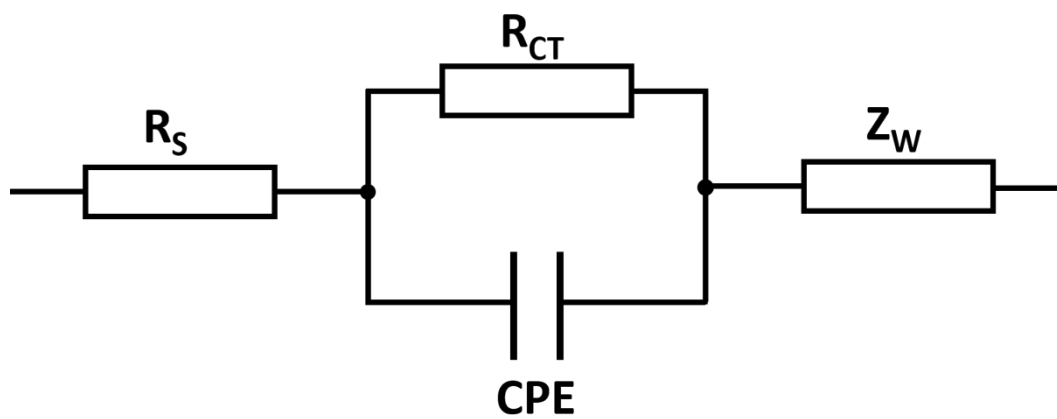
**Figure S11.** Voltage profiles of a) Cu foam and b) CuO NWAs/Cu with an area capacity of  $1 \text{ mAh cm}^{-2}$  at  $0.5 \text{ mA cm}^{-2}$ .



**Figure S12.** Voltage profiles of a) Cu foam and b) CuO NWAs/Cu with an area capacity of  $1 \text{ mAh cm}^{-2}$  at  $2 \text{ mA cm}^{-2}$ .

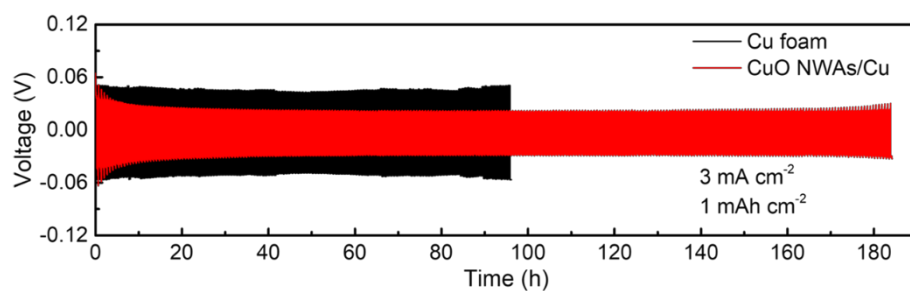


**Figure S13.** Voltage profiles of a) Cu foam and b) CuO NWAs/Cu with an area capacity of  $0.5 \text{ mAh cm}^{-2}$  at  $3 \text{ mA cm}^{-2}$ .



**Figure S14.** Equivalent electrical circuit model corresponding to the Nyquist plots. The  $R_s$  is equivalent series resistance,  $R_{CT}$  is interfacial charge transfer resistance and  $Z_w$  is Warburg impedance.





**Figure S15.** The voltage-time curves of the Cu foam and CuO NWAs/Cu in a symmetric cell test with the area capacity of 1 mAh cm<sup>-2</sup> at 3 mA cm<sup>-2</sup>.