Supporting Information

CuO Nanorods Grown Vertically on Graphene Nanosheets as a Battery-type Material for High-Performance Supercapacitor Electrodes

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Contents of the Supporting Information

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The specific capacitance C_A (C cm^{-2}) was calculated from the GCD curves according to the following formula:

$$C_A = I \times \Delta t/(A) \quad \text{(S1)}$$

where I, Δt, and A corresponds to discharge current (A), discharge time (s), and the area of the electrode (cm^{-2}), respectively.

An symmetric supercapacitor (SSC) device was assembled by using two same CuO/rGO@NF electrodes, which was analyzed under a 6.0 M KOH solution at room temperature. The specific capacitance C_{cell} (F g^{-1}) was calculated from the GCD curves according to the following formula:

$$C_{cell} = I \times \Delta t/(\Delta V \times M) \quad \text{(S2)}$$

where I, Δt, $\Delta V$and M corresponds to discharge current (A), discharge time (s), potential window (V) and the total mass of active materials of both electrodes (g), respectively. The energy density E (W h kg^{-1}) and power density P (KW kg^{-1}) was performed according to the following equations:

$$E = C_{cell} \times \Delta V^2/2 \quad \text{(S3)}$$

$$P = E/\Delta t \quad \text{(S4)}$$

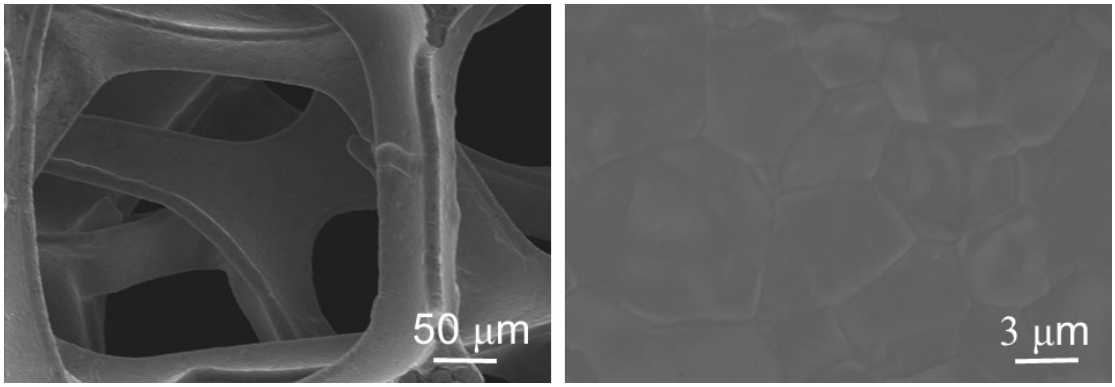

Figure S1. SEM image of bare Ni Foam

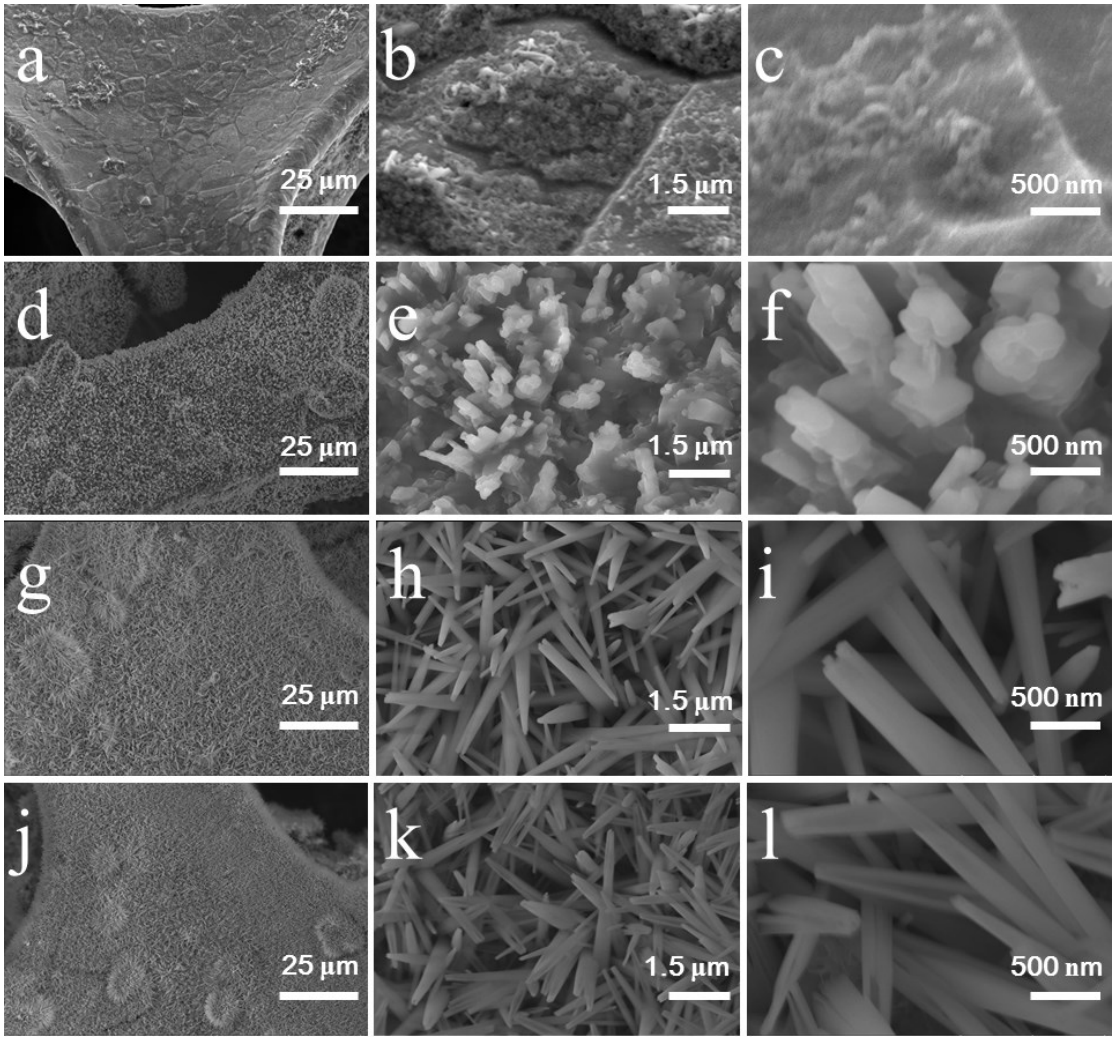

Figure S2. SEM image of CuO/rGO@NF electrodes prepared by electrochemical oxidation for 1 min (a-c) ,10 min (d-f), 30 min (g-i), 1 h (j-l)

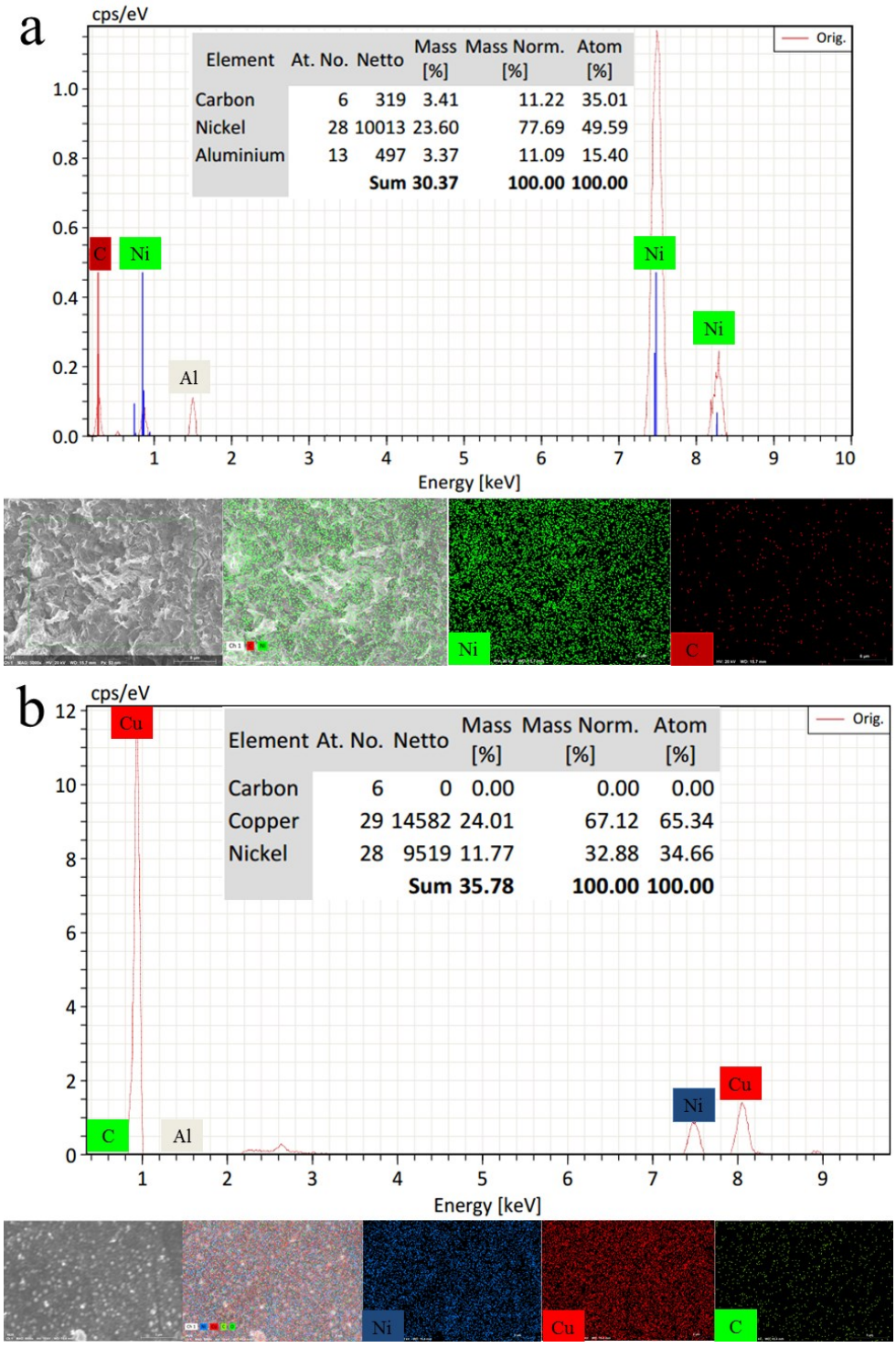

Figure S3. EDX image of (a) rGO@NF electrode and (b)Cu/rGO@NF electrode with different element mapping images

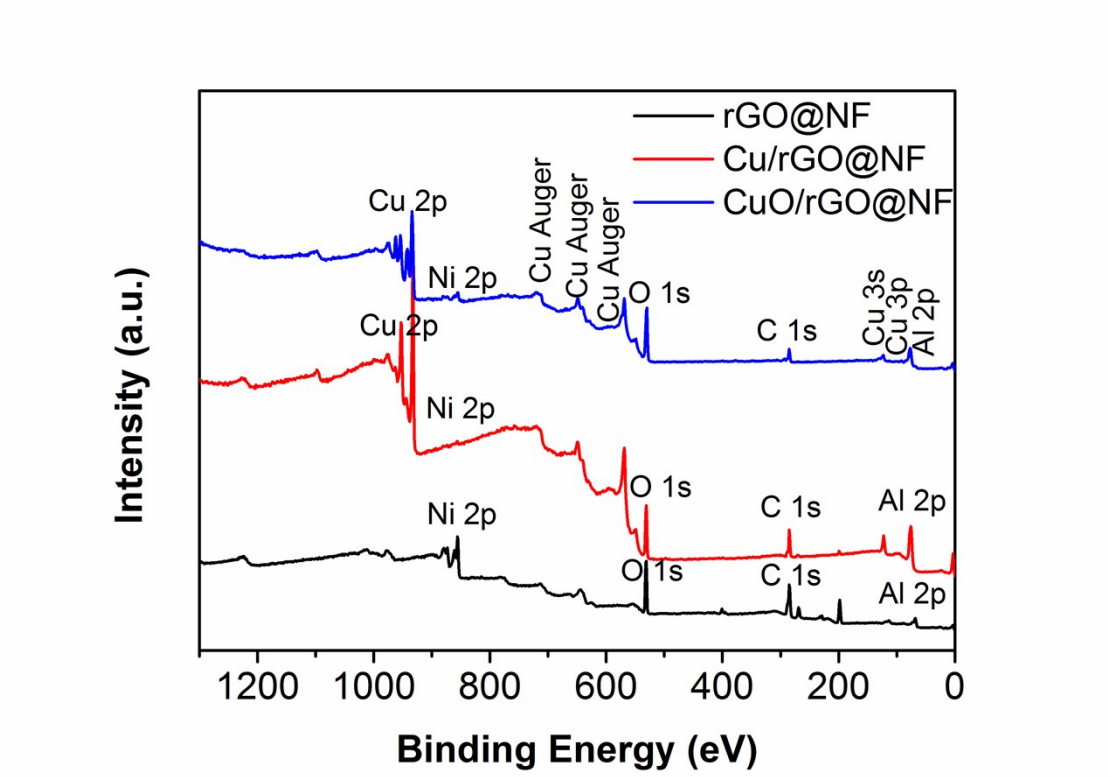

Figure S4. XPS survey spectrum of rGO@NF, Cu/rGO@NF and Cu/rGO@NF electrodes.

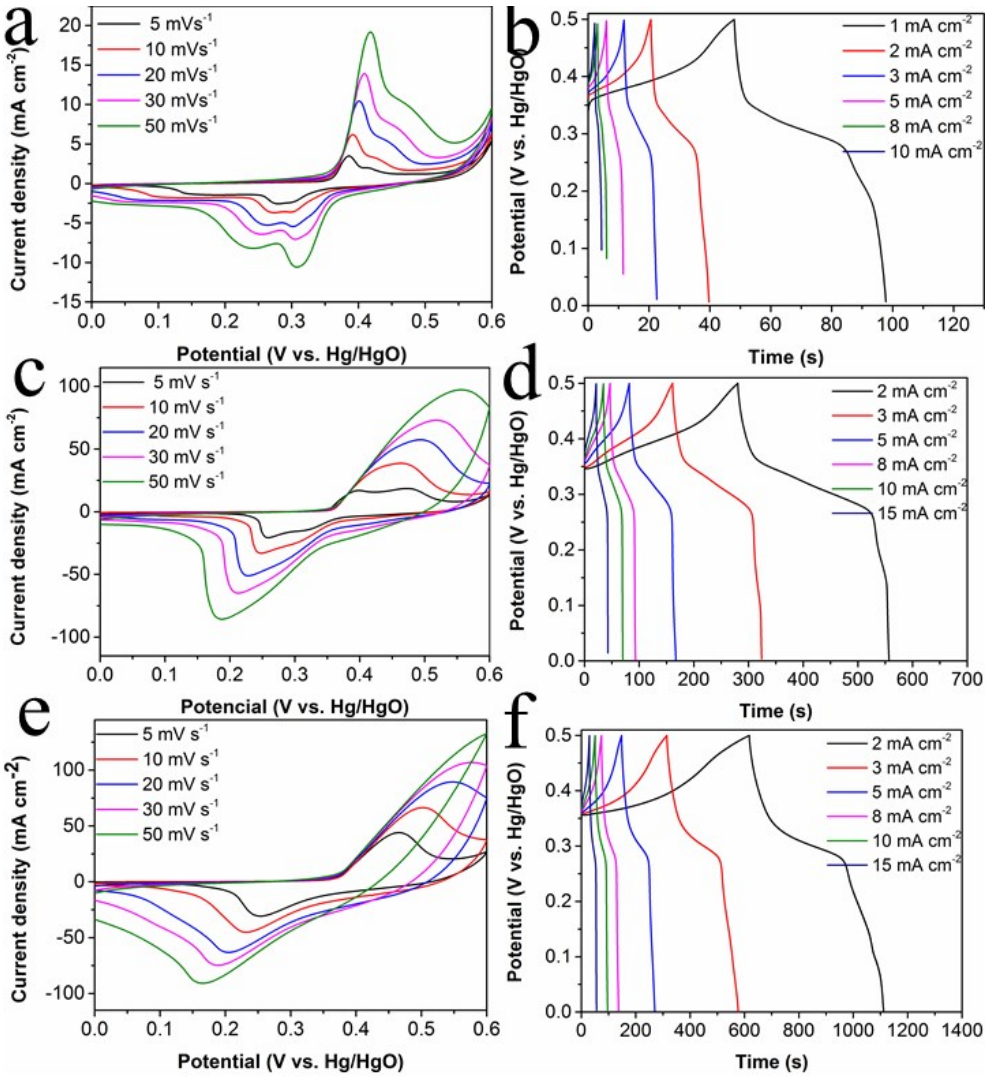

Figure S5. (a,c,e) CV curves of the NF, rGO@NF and Cu/rGO@NF electrodes at different scan rates. (b,d,f) GCD curves of the NF, rGO@NF and Cu/rGO@NF electrodes at various current densities.

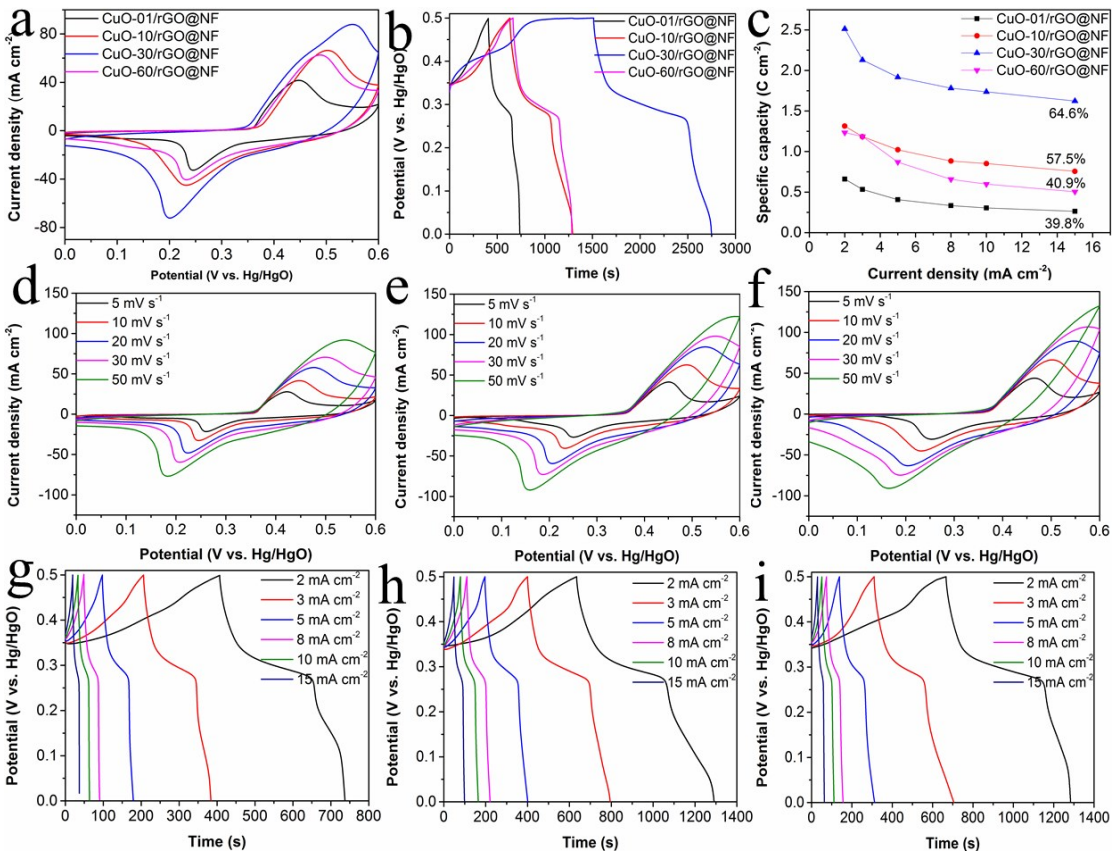

Figure S6. (a) Comparative CV curves of the CuO-01/rGO@NF, CuO-10/rGO@NF, CuO-30/rGO@NF, CuO-60/rGO@NF electrodes at 10 mV s^{-1}. (b) Comparative GCD curves of the four electrodes at 2 mA cm^{-2}. (c) Specific capacitance of the four electrodes at different current densities. (d-f) CV curves of the CuO-01/rGO@NF, CuO-10/rGO@NF, CuO-60/rGO@NF electrodes at different scan rates. (g-i) GCD curves of the CuO-01/rGO@NF, CuO-10/rGO@NF, CuO-60/rGO@NF electrodes at various current densities.

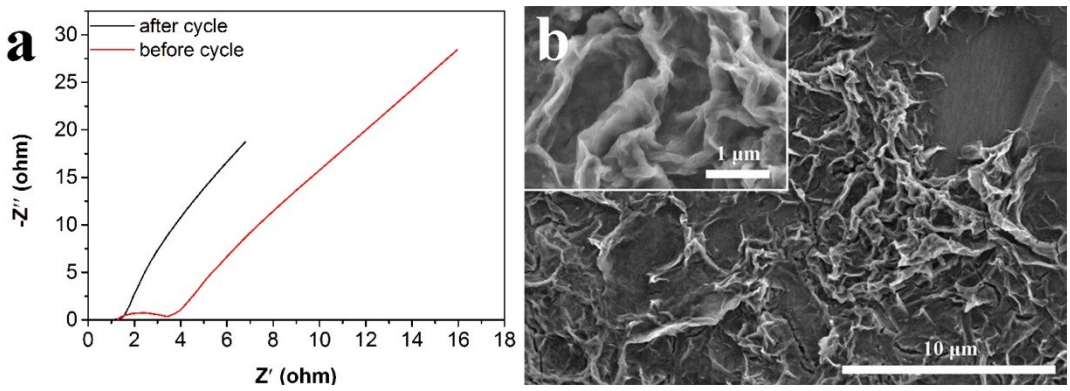

Figure S7. (a) EIS plots of the CuO/rGO@NF electrode before and after stability test at a frequency range of 100 kHz-0.01 Hz. (b) SEM image of CuO/rGO@NF after 1500 charge-discharge cycles.

Table S1. Comparison of the capacity of the similar materials reported previously.

Electrode	Method	Electrolyte	Capacity or Capacitance	Ref.
MoNPs/NF@Ni_3S_2	Ion implantation	2 M KOH	1.06 C cm^{-2} at 1 mA cm^{-2}	1
Ni_3S_2/ NF	Hydrothermal	2 M KOH	0.50 C cm^{-2} at 1 mA cm^{-2}	1
NiO/Ni_3S_2	Hydrothermal	6 M KOH	2.28 C cm^{-2} at 2 mA cm^{-2}	2
$Cu(OH)_2$/Cu/CLS	Copper Plating	6 M KOH	8.46 F cm^{-3} at 5 mA cm^{-3}	3
Cu-MOF/$Cu_{2+1}O$	Hydrothermal	6 M KOH	1.54 F cm^{-2} at 2 mA cm^{-2}	4
3D CuO/Cu	Femtosecond laser	3 M KOH	3.34 F cm^{-2} at 1 mA cm^{-2}	5
CuO NSs-CWTs	Drop-casting	1 M KOH	0.67 F cm^{-2} at 2 mA cm^{-2}	6
CVO Cu@CuO	CV oxidation	6 M KOH	1.67 F cm^{-2} at 2 mA cm^{-2}	7
NiO-CuO	Hydrothermal	3 M KOH	4.35 F cm^{-2} at 2 mA cm^{-2}	8
Cu/Cu_2O	Photo-assist	2 M KOH	782.0 F g^{-1} at 1 A cm^{-2}	9
NiCo-LDH/CuO	Corrosion growing	3 M KOH	1.97 F cm^{-2} at 7.96 A cm^{-2}	10
CuO/rGO@NF	Filtered cathodic vacuum arc technology	6 M KOH	2.51 C cm^{-2} at 2 mA cm^{-2}	This work

References

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