

Supporting Information

Water-soluble inorganic salts with ultrahigh specific capacitance: crystallization transformation investigation of CuCl₂ electrodes

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Table S1 Specific capacitance of CuO reported in literatures

CuO morphology	Specific capacitance F/g	Electrolyte	Ref.
CuO nanosheet arrays grown on nickel foam	569	6M KOH	1
lotus-like CuO/Cu(OH) ₂ hierarchical arrays	278	5M NaOH	2
flower-like nanostructures	133.6	6M KOH	3
carbon nanotube/CuO composites	60	6M KOH	4
thin film of CuO multilayer nanosheets	43	1M Na ₂ SO ₄	5

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Table S2 Pseudocapacitance of metal cations in the present work

Active Ion	Faradic Reaction	Theoretical capacitance	Practical capacitance (ion)
Cu^{2+}	$\text{Cu}^{2+} + \text{e} \leftrightarrow \text{Cu}^{+}$	5061 (0.3V)	5442 F/g (CuCl_2)

The calculation of theoretical capacitance of active cation.

$$Q = CV$$

where Q= charge C= capacitance (F), V = operating voltage window

Charge with 1 mol metal cation, one electron per metal cation

$$Q = 1 \text{ mol} \times 6.02 \times 10^{23} \text{ mol}^{-1} \times 1.6 \times 10^{-19} \text{ C} = 9.632 \times 10^4 \text{ C}$$

Thus capacitance $C = Q/V$

Theoretical specific capacitance of active cation $C_m = C/M$, where M is molecular weight.

C_m = specific capacitance (F/g)

The calculated theoretical capacitances of active cations and their practical capacitance are shown in Table S2.

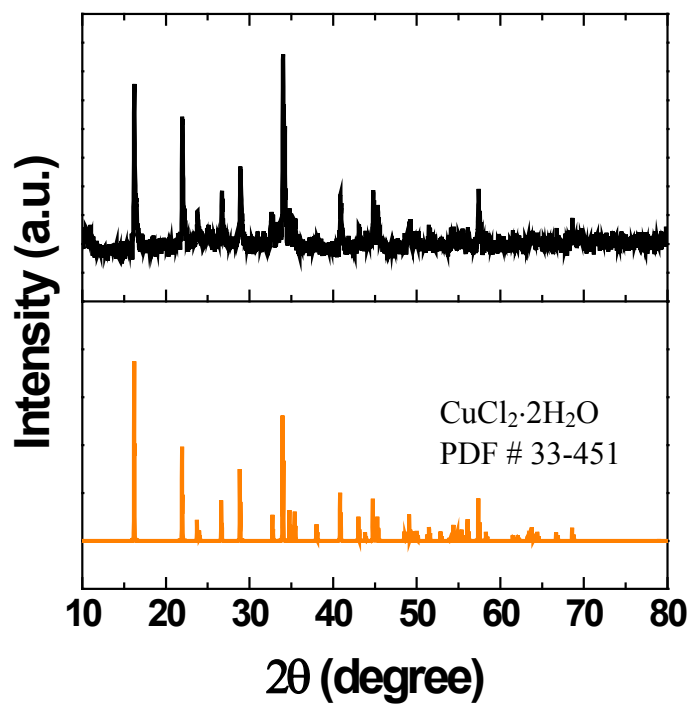


Fig. S1 XRD pattern of the original CuCl_2 blending with PVDF and acetylene black with NMP as solvent before electrochemical measurement. For comparison, the standard XRD pattern of $\text{CuCl}_2 \cdot \text{H}_2\text{O}$ (PDF # 33-451) is also shown.

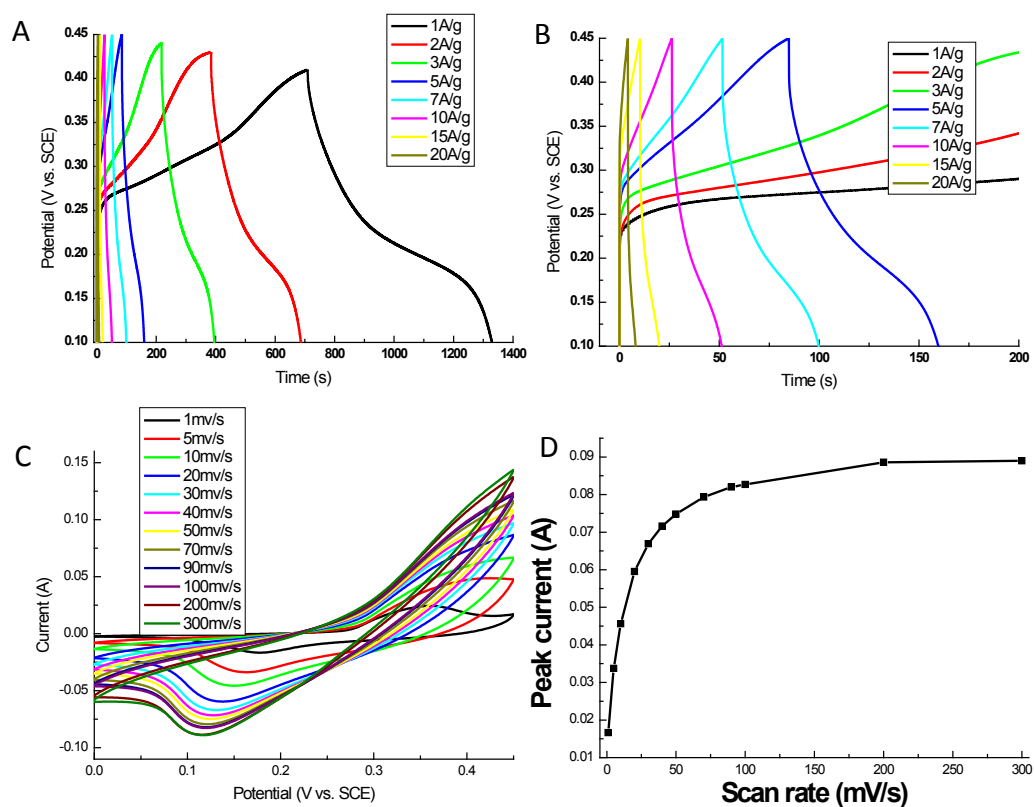


Fig. S2. (A and B) Charge-discharge curves at different current densities between 1 and 20 A/g. (C) Cyclic voltammetry of inorganic salt electrodes at different scan rates between 1 and 300 mV/s. (D) The cathode peak current versus the scan rate.

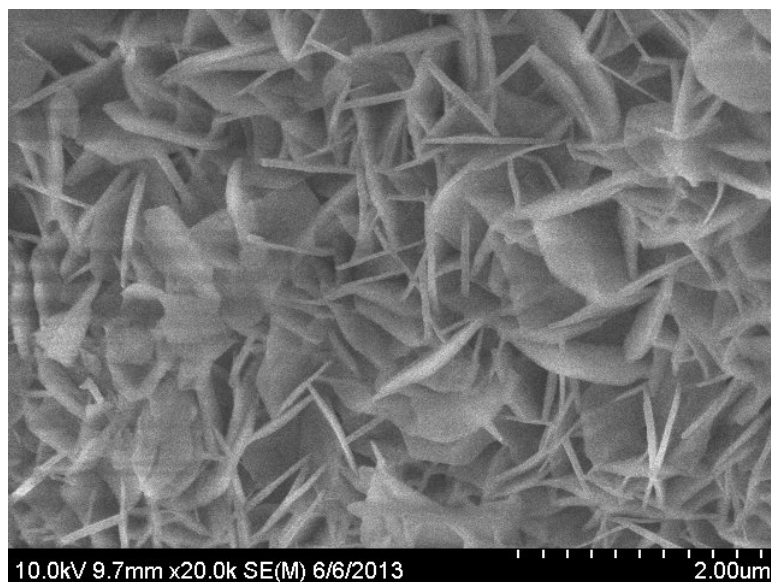


Fig. S3 SEM image of CuCl_2 electrode dipped in KOH without undergoing electrochemical measurement.

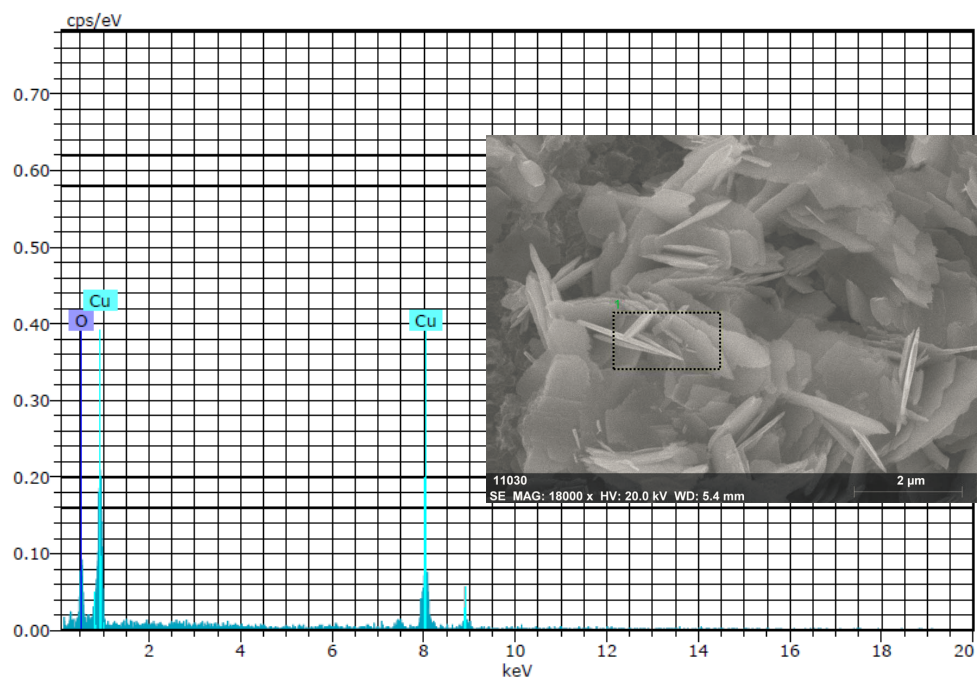


Fig. S4. EDX and SEM prove that the sheet-like products were CuO.

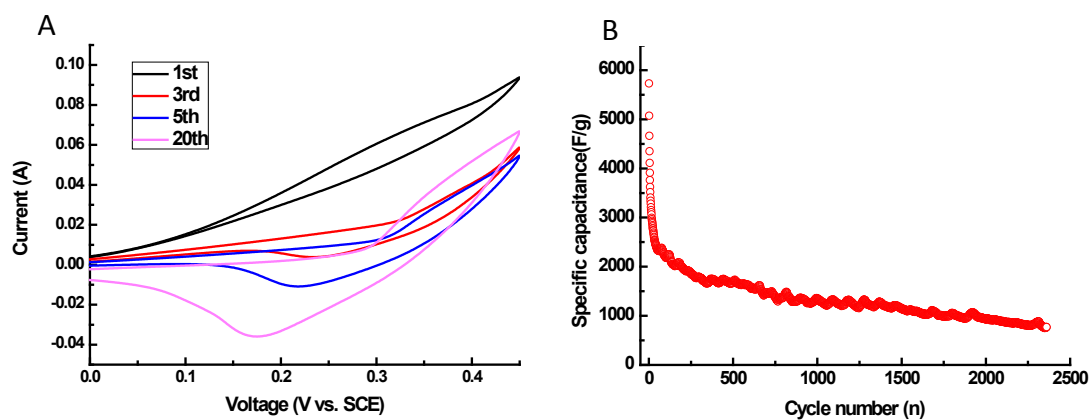


Fig. S5. (A) Cyclic voltammograms showing the evolution process of CuCl_2 electrode at the scan rate of 10mV/s. (B) Cycle performance of CuCl_2 electrodes at the current density of 1A/g in 2M KOH.

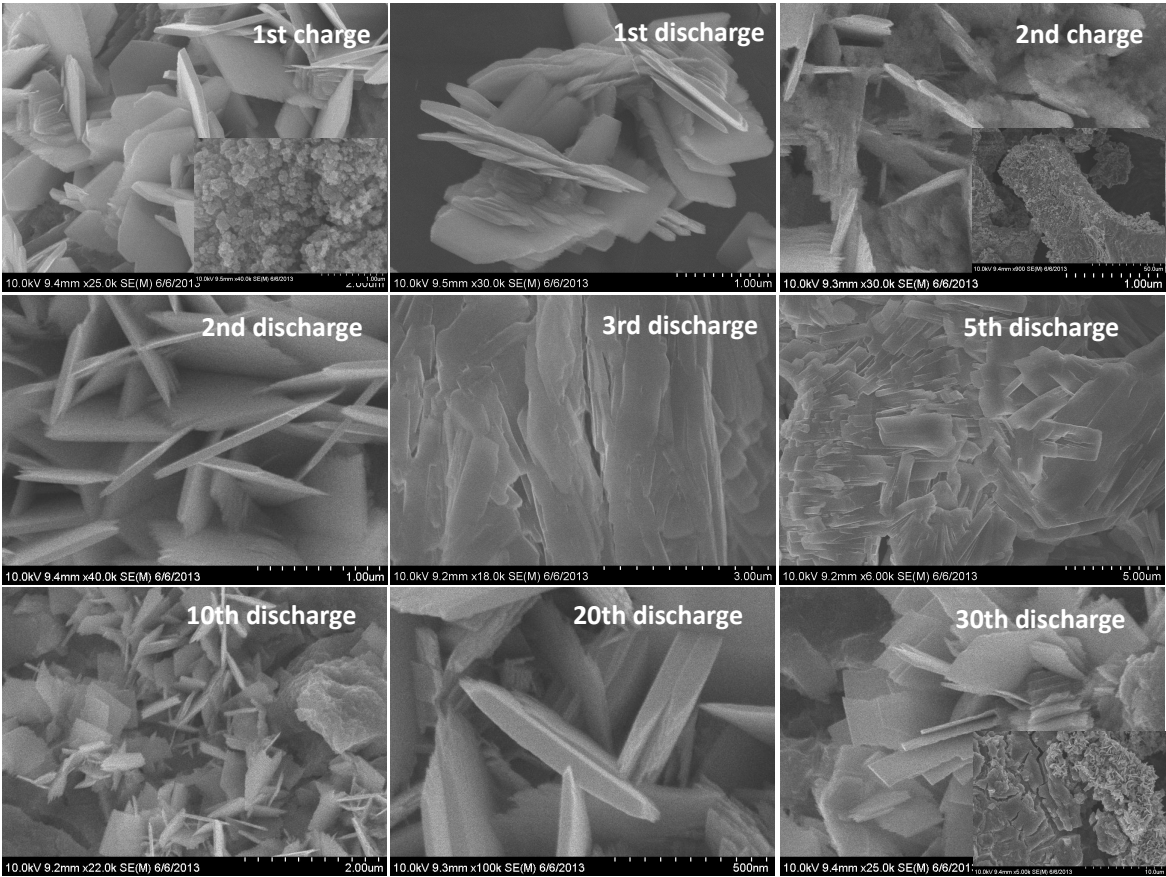


Fig. S6 SEM images of electrodes obtained after different charge-discharge cycles.

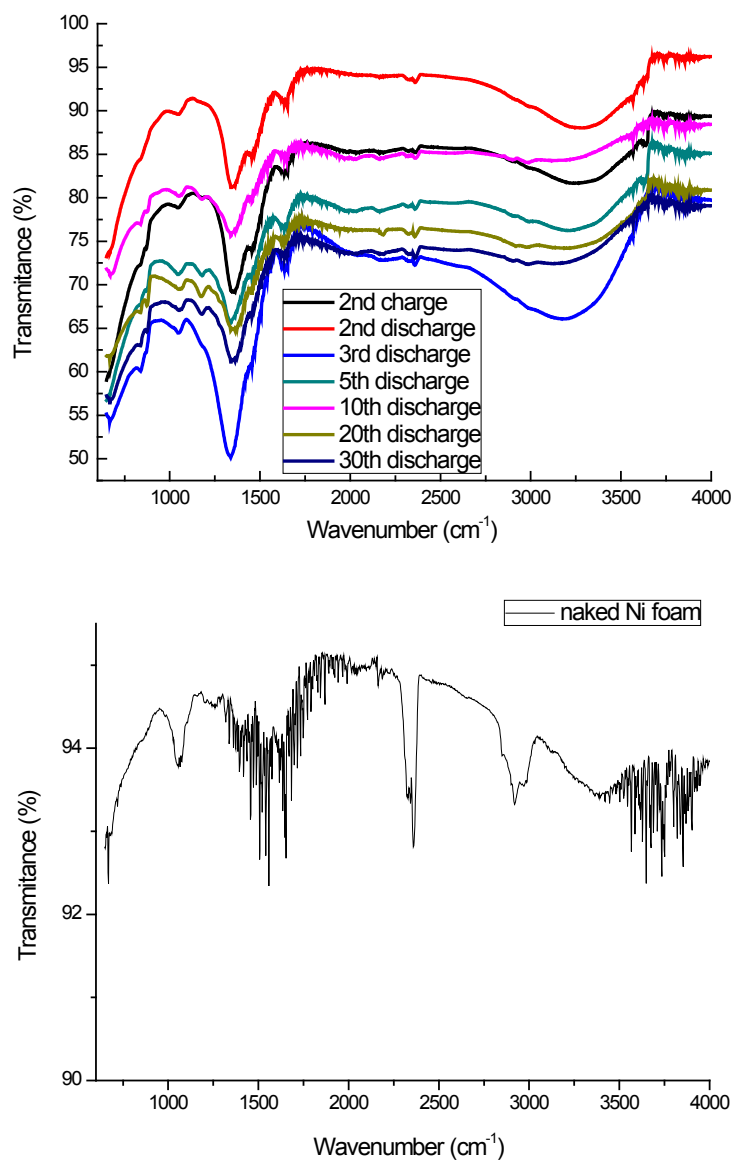


Fig. S7. FTIR spectra of electrodes after different charge-discharge cycles and naked Ni foam.

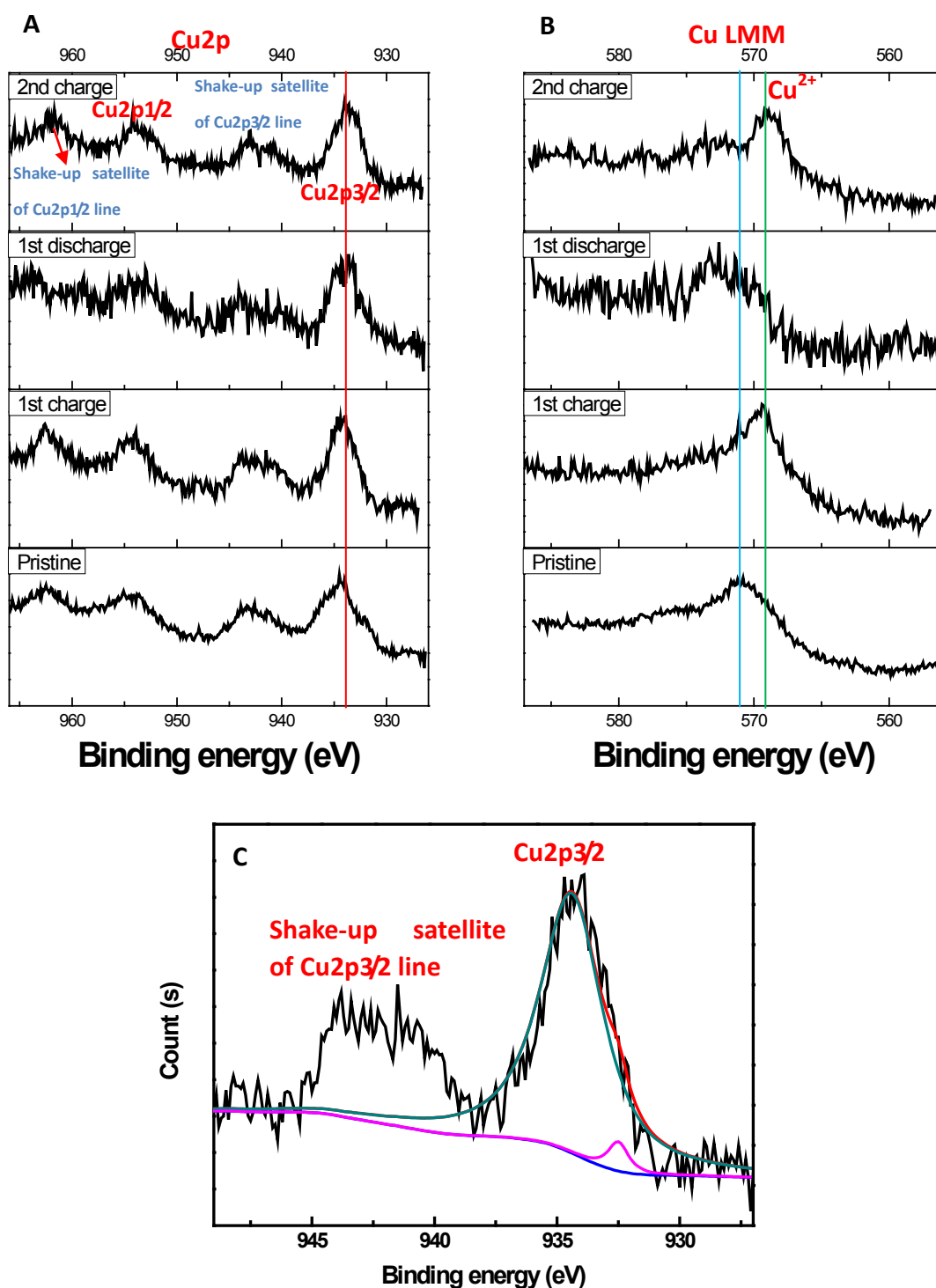


Fig. S8 (A) Cu2p XPS and (B) Auger spectra (Cu LMM) of pristine, charged and discharged electrodes. (C) Cu2p XPS of electrode after 1st charge process. Two different peaks centered at 933.6, and 932.5 eV, respectively.