

Supporting Information

Diffusion-dominated redox performance of hydrated copper molybdate for high-performance energy storage

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Physical Characterization: Scanning electron microscopy (SEM, ZEISS Sigma 500, field emission scanning electron microscope) was used to examine the morphology and microstructure of the synthesized materials. X-ray diffraction (XRD, Malvern Panalytical Aeris X-ray diffractometer) analysis was performed to assess the crystalline properties of the binder-free electrodes. X-ray photoelectron spectroscopy (XPS, Thermo NEXSA XPS instrument fitted with a monochromate, Al $K\alpha$ X-ray source) analysis was performed to analyze the chemical valency states of the materials. The structure of CMO was investigated by a Fourier transform infrared spectrometer (FT-IR; Shimadzu 8900, Kyoto, Japan).

Electrochemical measurements:

The electrochemical properties of the as-prepared hybrid electrodes were studied on a Biologic electrochemical analyzer using a beaker-based three-electrode cell system with an electrolyte solution of 1M KOH. The Ni foam coated with the CMO_{AH} or CMO_{BH} electrode was used as the working electrode, a platinum mesh and an Ag/AgCl electrode were used as the counter and reference electrode, orderly. The cyclic voltammetry tests were conducted in the voltage window of 0 to 0.6 V at different scan rates. The galvanostatic charge-discharge tests were carried out at different current densities within a potential range of 0 to 0.5 V. Electrochemical impedance spectroscopy was recorded at open-circuit voltage with 20 mV amplitude in a frequency range from 0.01 Hz to 100 kHz in a 1 M KOH. The specific capacitance of the electrode in three-electrode mode was calculated from the GCD curves according to the following equation $C = \frac{I \times \Delta t}{m \times \Delta V}$, where C is the specific capacitance (F/g or F/cm²), I is the discharge current (A), Δt is the discharge time (s), ΔV is the potential window (V), and m is the mass of the active material (g). The specific energy (E) and specific power (P) of the electrodes were calculated from the following

equations: $E = \frac{I \times \Delta V^2}{m \times \Delta V}$; $P = \frac{E}{\Delta t}$, where E is the specific energy (Wh/kg), C is the specific capacitance (F/g), ΔV is the potential range (V), P is the specific power (W/kg) and Δt is the discharge time (s).

Coin-cell type asymmetric supercapacitor (ASC)

The device was assembled in a coin-cell using CMO as binder-free electrode and commercial activated carbon composite was used as negative electrode. The negative electrode was prepared by casting a slurry of the electroactive material: activated carbon, carbon black and polytetrafluoroethylene (PTFE) binder with a weight ratio of 8:1:1 in N-methyl-2-pyrrolidone (NMP) onto a nickel foam current collector and then the electrode was pressed and dried at 60 °C overnight. To assemble the cell, the negative electrode and positive electrode were face to face placed in between the filter paper, in which 1M KOH was added as the electrolyte.

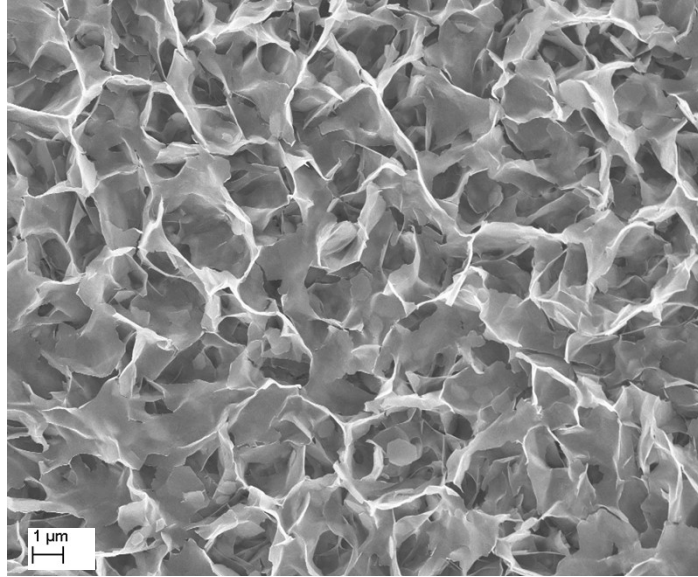


Figure S1. SEM image of COM_{AH} electrode showing the porous sheet-like structures.

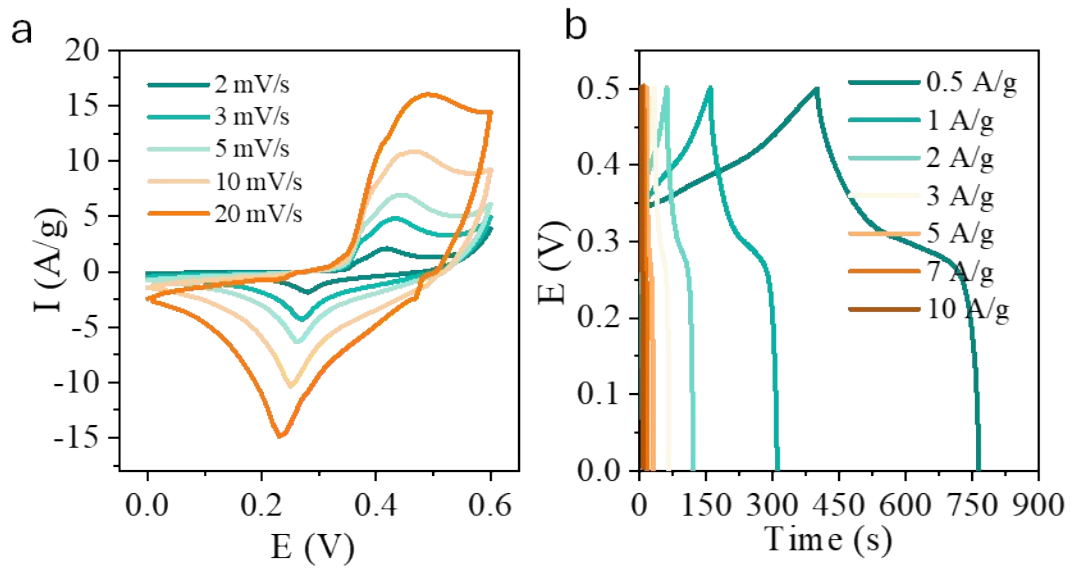


Figure S2. CV curves and GCD-curves of CMO_{AH} electrode tested in three-electrode system

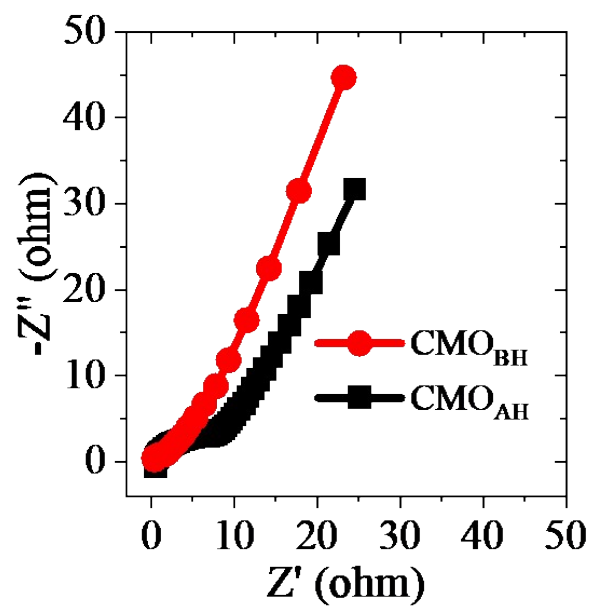


Figure S3. EIS plot of CMO_{BH} and CMO_{AH} electrodes measured in three-electrode system

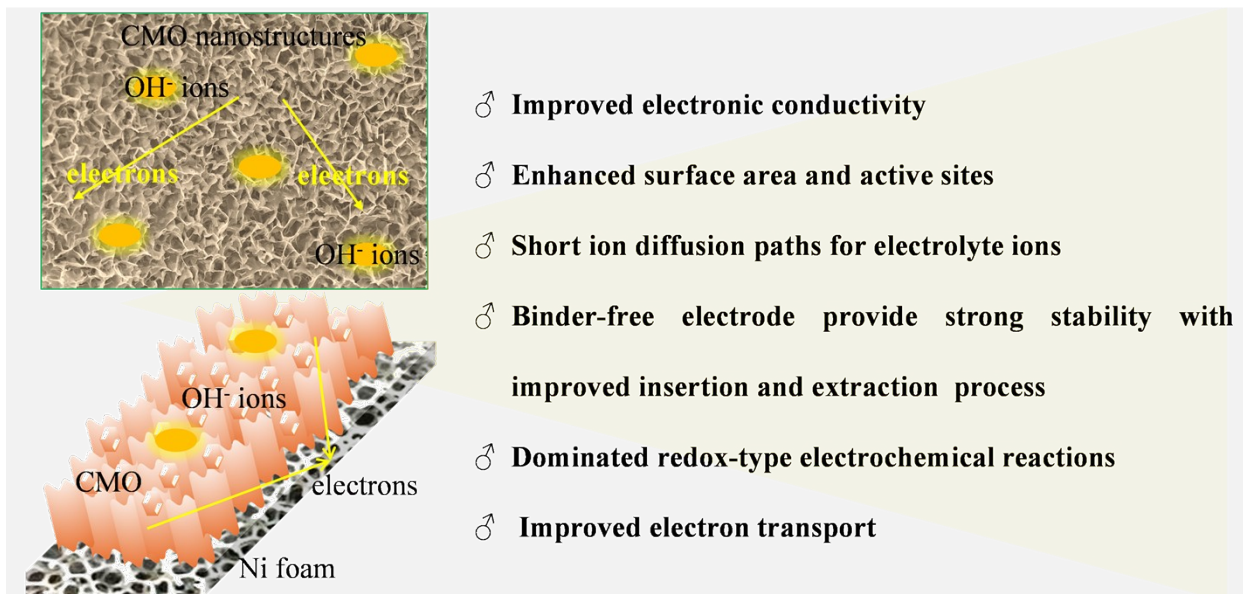


Figure S4. Schematics showing the structural advantages of CMO electrode during the charge storage process.

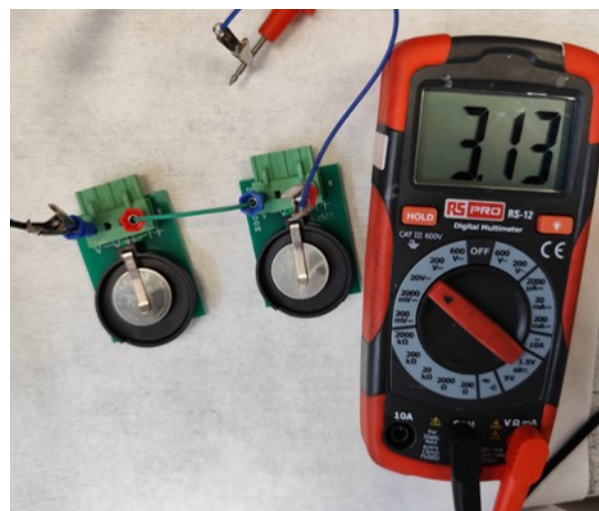


Figure S5. Voltage output of two-coin cell-based ASCs measured using multimeter.