Supporting Information

Bioinspired Fiber-like Porous Cu/N/C electrocatalyst Facilitating Electrons Transportation toward oxygen reaction for Metal-air Batteries

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Supporting Information Contains:

S1. Characterization of the materials

A field-emission scanning electron microscopy (FESEM, FEI Quanta-200) and a scanning transmission electron microscopy (STEM, MIRA3 TESCAN) were taken to run morphology tests. X-ray diffraction (XRD, Rigaku 3014) measurements were investigated with Cu-Ka radiation. N_2 adsorption/desorption curve were taken with a Quantachrome instrument (Quabrasorb SI-3MP) at 77 K. Expressions for chemical states of the carbon, nitrogen and sulfur in the material were performed by X-ray photoelectron spectroscopy (XPS, ESCA LAB 250Xi).

S2. Electrochemical measurements

Briefly, catalysts, acetylene black, and polytetrafluoroethylene emulsion (PTFE, 60 wt %) were blended in a mass ratio of 6:1:3 to make a catalytic layer rolling with a gas diffusion layer and a current collector as the air electrode. The aluminum-air battery model was a self-made electrochemical cell. The Al-air battery we applied was assembled with aluminium alloy plate as anode, aqueous electrolyte which contained 6.00 M KOH and 0.01 M Na_2SnO_3, 0.50 mM $In(OH)_3$, 7.50 mM ZnO as anticorrosives and made air electrode as cathode in a home-made cell model. The discharge curve of aluminum-air battery was recorded at a constant current density of 50 mA cm^{-2}. The rate performance of aluminum-air battery was measured at different current densities from 50 mA cm^{-2} to 200 mA cm^{-2}.

S3. The Koutechy-Levich (K-L) equation

The K-L equation was applied to calculate the average electron transfer number of made samples.

The K-L equation is given as follows:

$$\frac{1}{j} = \frac{1}{j_k} + \frac{1}{B\omega^{0.5}}$$

where j_k is the kinetic current and ω is the electrode rotating rate. B could be determined from the slope of the K-L plots based on the Levich equation as follows:

$$B = 0.2nF(DO_2)^{2/3}\nu^{-1/6}C_{O_2}$$

where n represents the number of electrons transferred per oxygen molecule, F is the Faraday constant (F = 96485 C mol^{-1}), D_{O_2} is the diffusion coefficient of O_2 in0.1 M KOH (1.9×10^{-5} cm^2 s^{-1}), ν is the kinetic viscosity (0.01 cm^2 s^{-1}), and C_{O_2} is the bulk concentration of O_2 (1.2×10^{-6} mol cm^{-3}). The constant 0.2 is adopted when the rotation speed is expressed in rpm.

S4. XPS full spectra of CuNC (MOF).

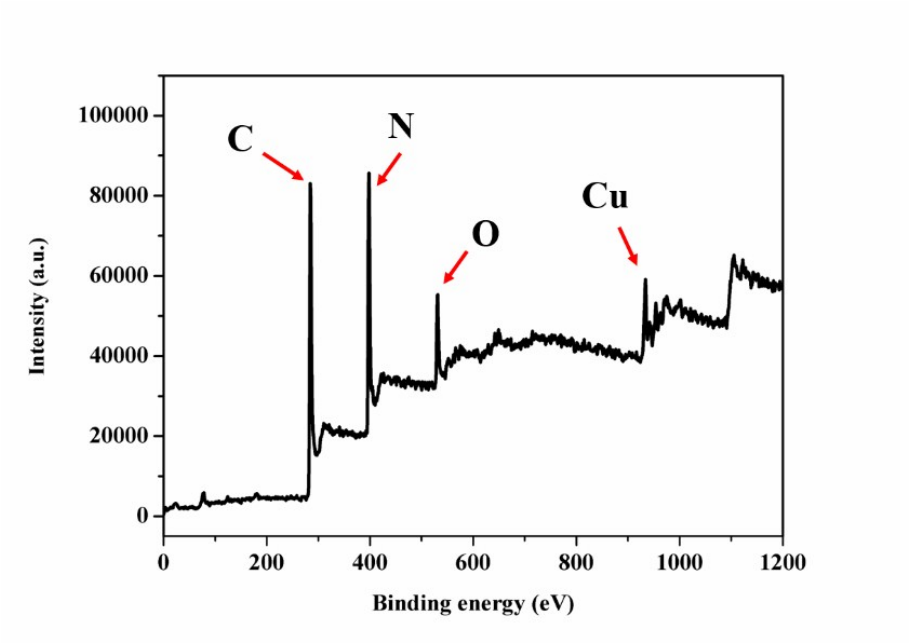

Figure S1. XPS full spectra of CuNC (MOF).

S5. ORR chronoamperometric response of CuNC (MOF), CuNC NPs and Pt/C catalysts at a constant voltage of 0.67 V vs RHE.

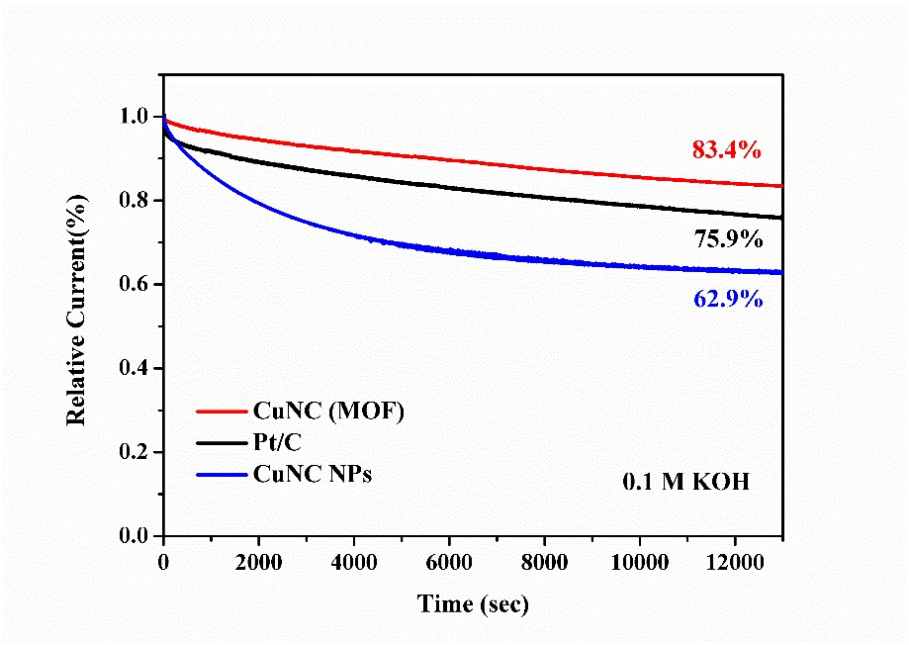

Figure S2. ORR chronoamperometric response of CuNC (MOF), CuNC NPs and Pt/C catalysts at a constant voltage of 0.67 V vs RHE.

S6. EDX results of CuNC NPs

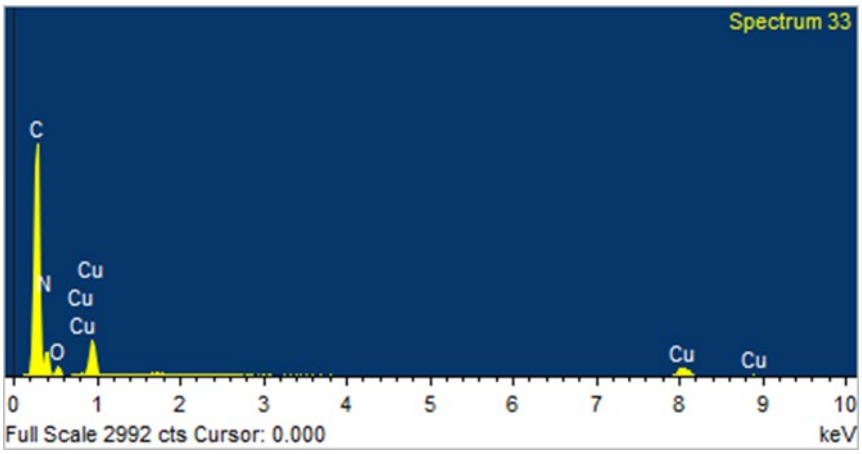

Figure S3. EDX results of CuNC NPs.

S7. XPS full spectra of CuNC NPs.

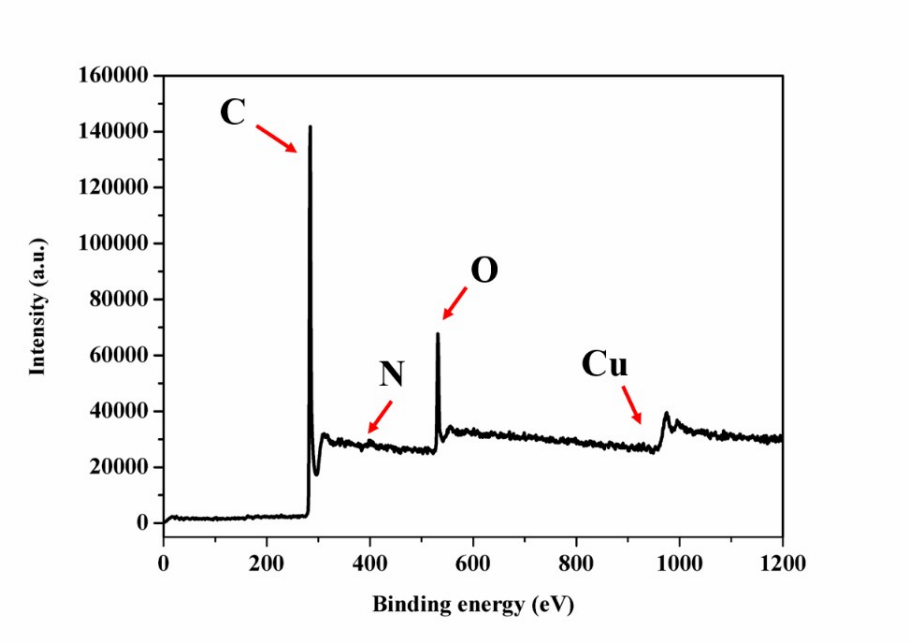

Figure S4. XPS full spectra of CuNC NPs.

S8. Electrical conductivity of different samples measured by the four-probe method

Table S1 Electrical conductivity of different samples measured by the four-probe method

Sample	CuNC NPs	CuNC (MOF)
Conductivity (S m^{-1})	4.29	16.1