Supporting Information

for

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Cu^{II}porphyrin-Mediated Reed-Straw-Carbon-Based Cu-N-C catalysts for Efficient Electrocatalytic Nitrate Reductions

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S1. Methods for NO_3^-, NO_2^-, NH_4^+ Concentration Determination and Data Analysis.

A UV-Vis spectrophotometer (TU-1810, Persee) was used to determine the concentrations of nitrate, nitrite and ammonium.

NH_4^+: Prepare a series of standard NH_4Cl solution. Take 2 mL NH_4Cl solution of different concentrations, add 1 mL colored solution (5wt % salicylic acid, 5wt % sodium citrate and 1 M NaOH), 2 mL 0.05M NaClO solution and 0.2 mL 1 wt % sodium nitroprusside solution, add deionized water to 10 mL. Shake well and leave in the dark for 2 hours, spectral scanning was performed using UV-VIS absorption spectroscopy in the range of 550 ~ 850 nm. The characteristic absorption peak is present at 673 nm, so the absorbance value of this wavelength is selected to construct the standard curve. The linear regression equation is y=0.098x+0.0034, which used for calculating NH_4^+ concentration.

NO_3^-: A series of NO_3^- standard solutions were prepared. Take 5 mL of NO_3^- standard solution of different concentrations, add 0.1mL 0.8% sulfamic acid solution, 1mL 0.1M HCl solution and 3.9mL distilled water, and shake evenly. Spectral scanning is performed in the range of 210 nm~230 nm. It is found that the maximum absorbance exists at the wavelength of 213nm, so the standard curve of NO_3^- is drawn using the absorbance at 213 m, and the equation of the standard curve is y = 0.0498x +0.0908, which used for calculating NO_3^- concentration.

NO_2^-: A series of NO_2^- standard solutions were prepared. Take 1 mL of NO_2- standard solution with different concentration, add 1 mL p-aminobenzenesulfonic acid solution, 1 mL of α-naphthylamine solution and 7 mL of deionized water, and mixed evenly for spectral scanning in the range of 450~600 nm. The maximum absorption wavelength is 525 nm, according to which the standard curve of NO_2^- is drawn and calculated, and the equation is: y = 0.677x + 0.0317, which used for calculating NO_2^- concentration.

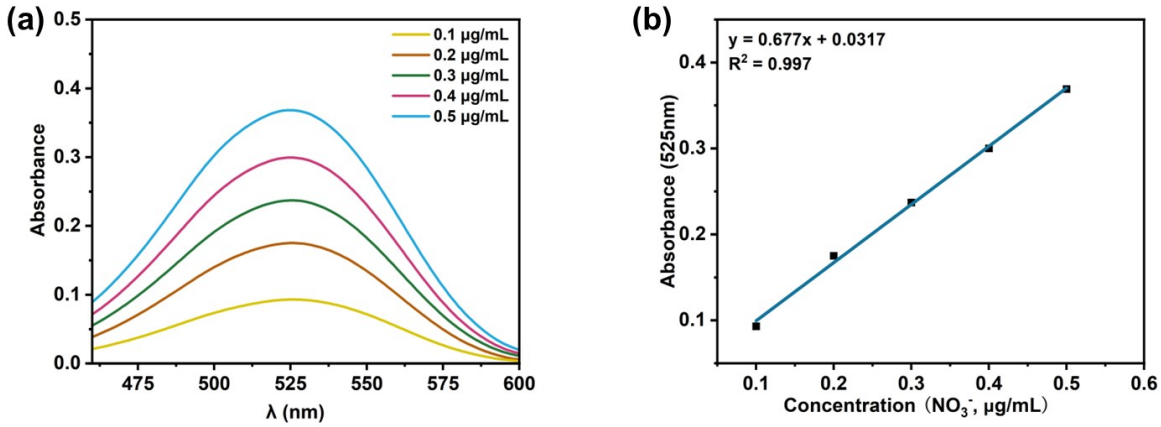

Figure S1. (a) UV-vis absorption spectra of $NaNO_3$ concentrations, (b) Calibration curve of NO_3^-.

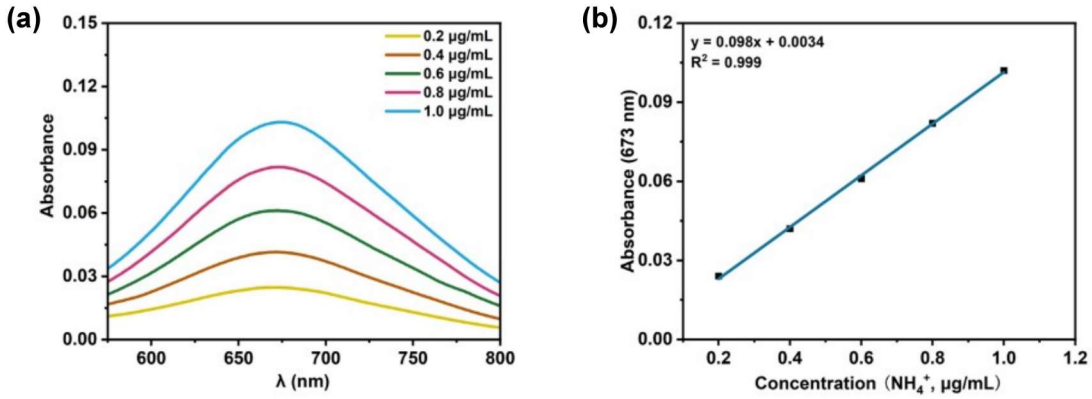

Figure S2. (a) UV-vis absorption spectra of NH_4Cl solution with different concentrations stained by indophenol blue method. (b) Calibration curve of NH_3.

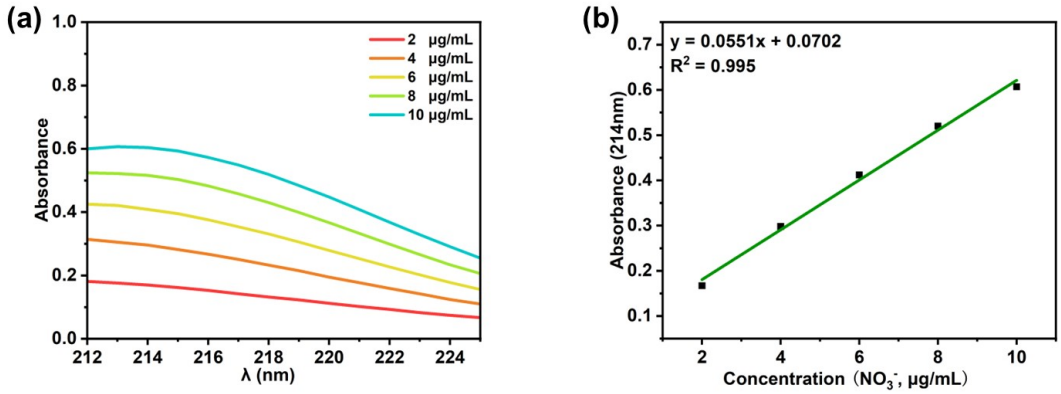

Figure S3. (a) UV-vis absorption spectra of $NaNO_2$ concentrations, (b) Calibration curve of NO_2^-.

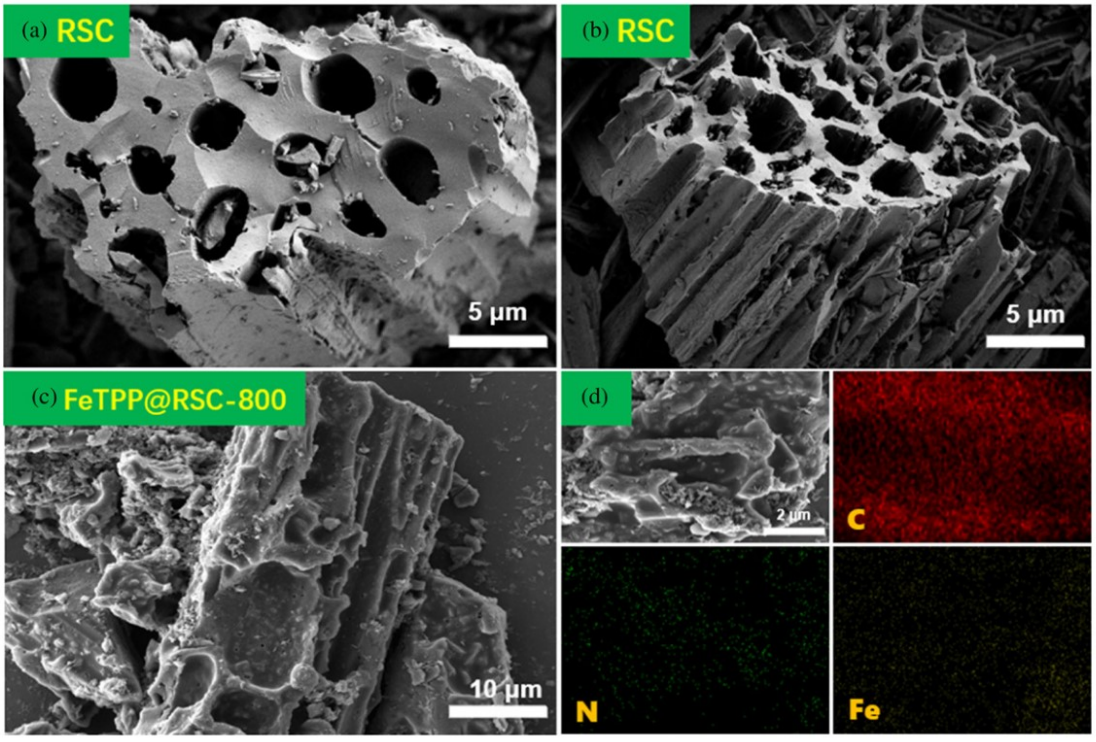

Figure S4. Scanning electron microscopy (SEM) images from Metalloporphyrin-mediated biomass porous single- and dual-metal M-N-C catalysts with 3d, 4d and 5d electrons for efficient electrocatalyzed nitrogen reductions.

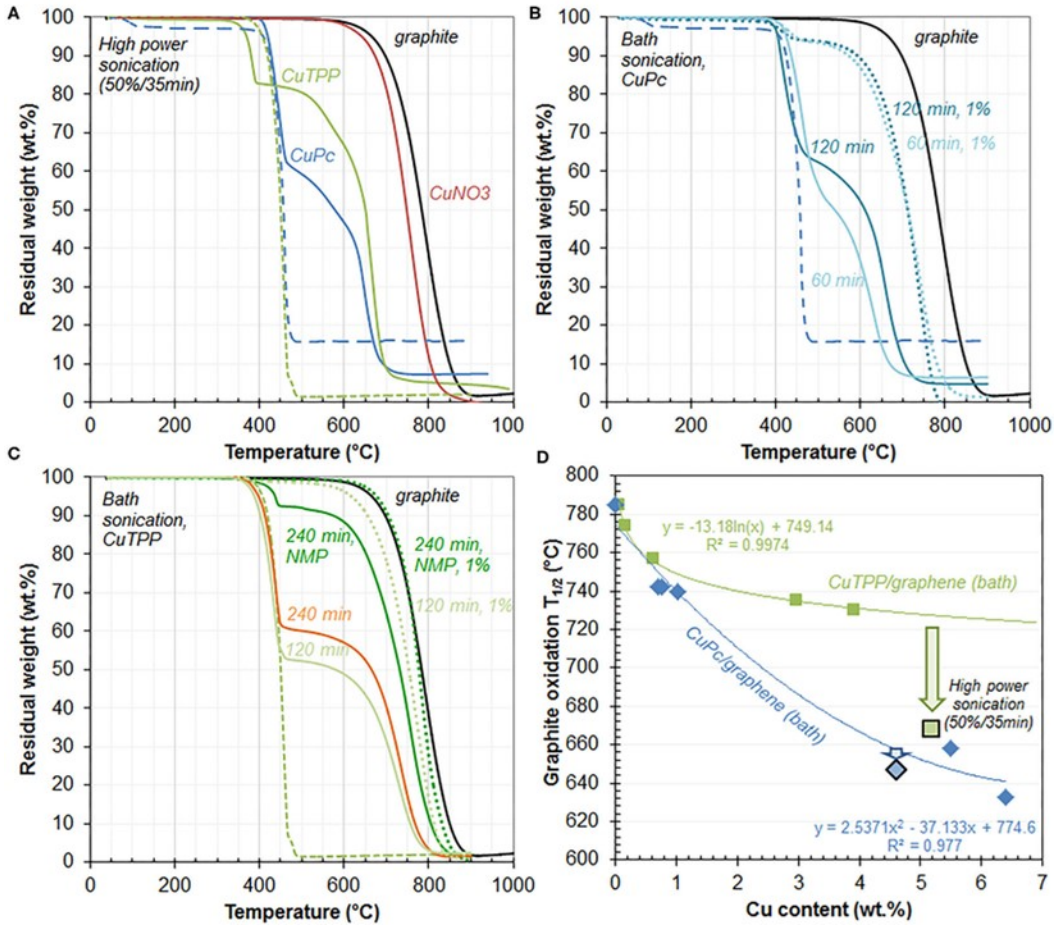

Figure S5. (a) TGA images from Intercalation of Copper Phthalocyanine Within Bulk Graphite as a New Strategy Toward the Synthesis of CuO-Based CO Oxidation Catalysts.