Figure S1. SEM image of bare NF.
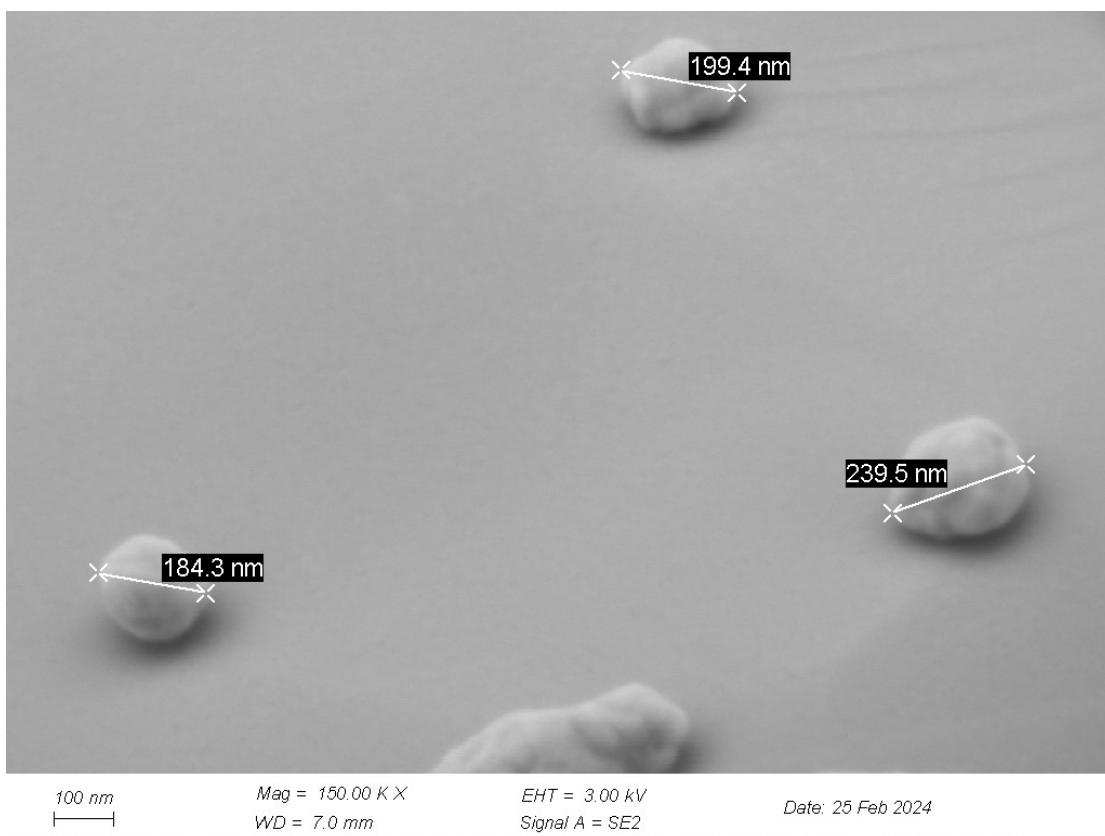

Figure S2. High-resolution SEM images of Cu nanoparticles electrodeposited on nickel foam for

10 s.

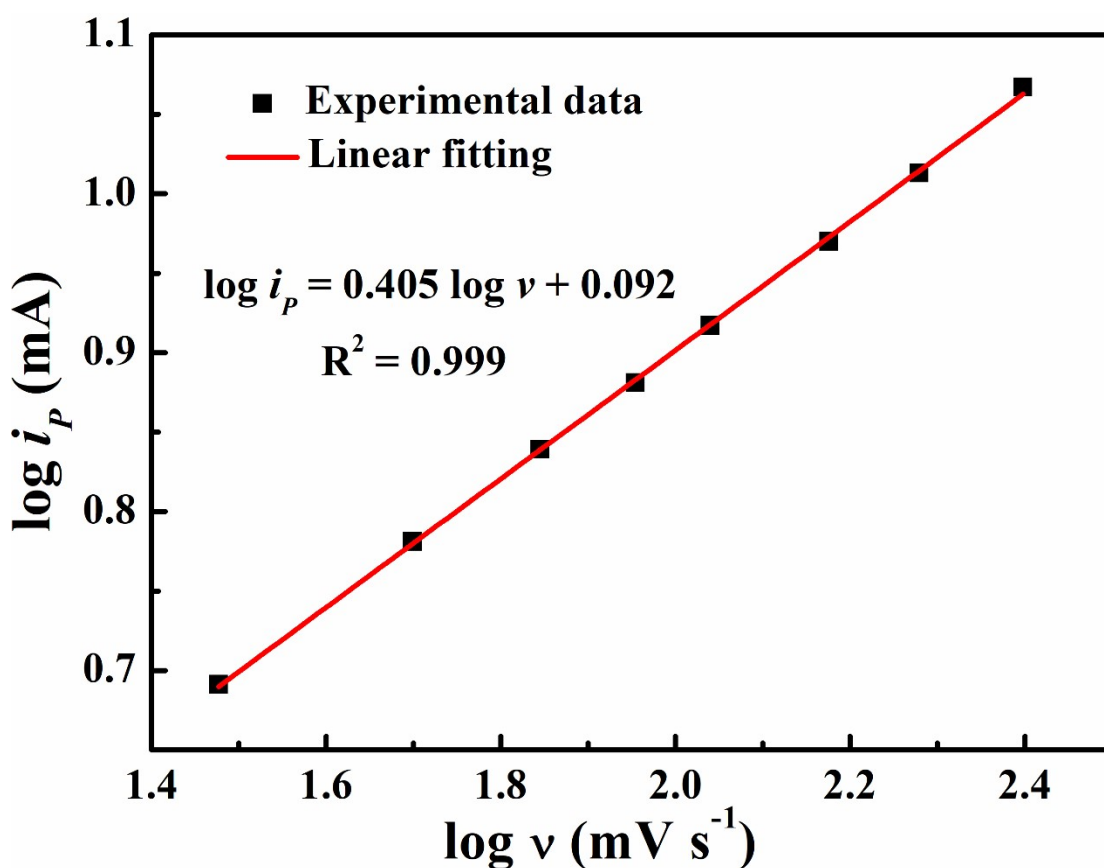$$\log i_P = 0.405 \log v + 0.092$$
$$R^2 = 0.999$$

Figure S3. Dependence of logarithm of peak current on the logarithm of scan rate for 1.25 mM creatinine in 0.1 M PBS (pH 7.0) at Cu NPs film/NF electrode.
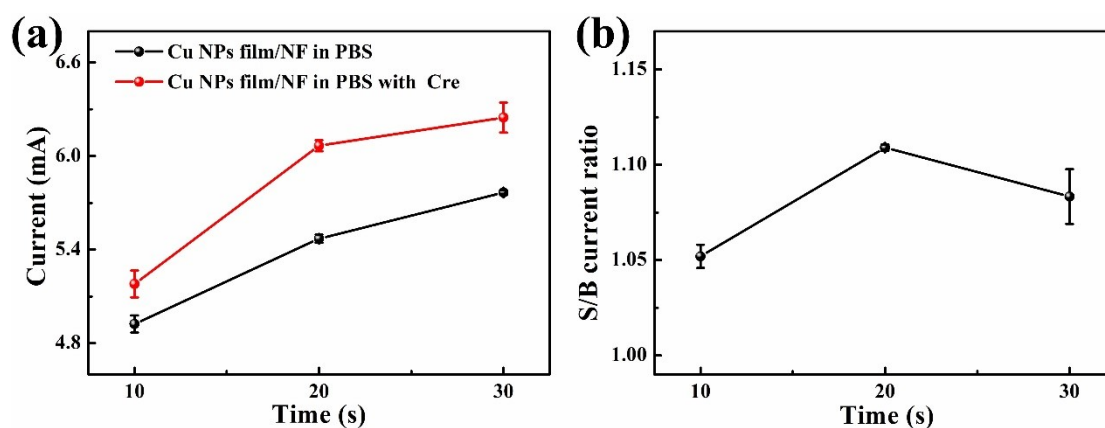

Figure S4. S/B current ratios were obtained from cyclic voltammograms of Cu NPs film/NF sensing electrodes prepared at different electrodeposition times (10s, 20s, and 30s) in 0.1 M PBS for 1.25 mM creatinine detection.
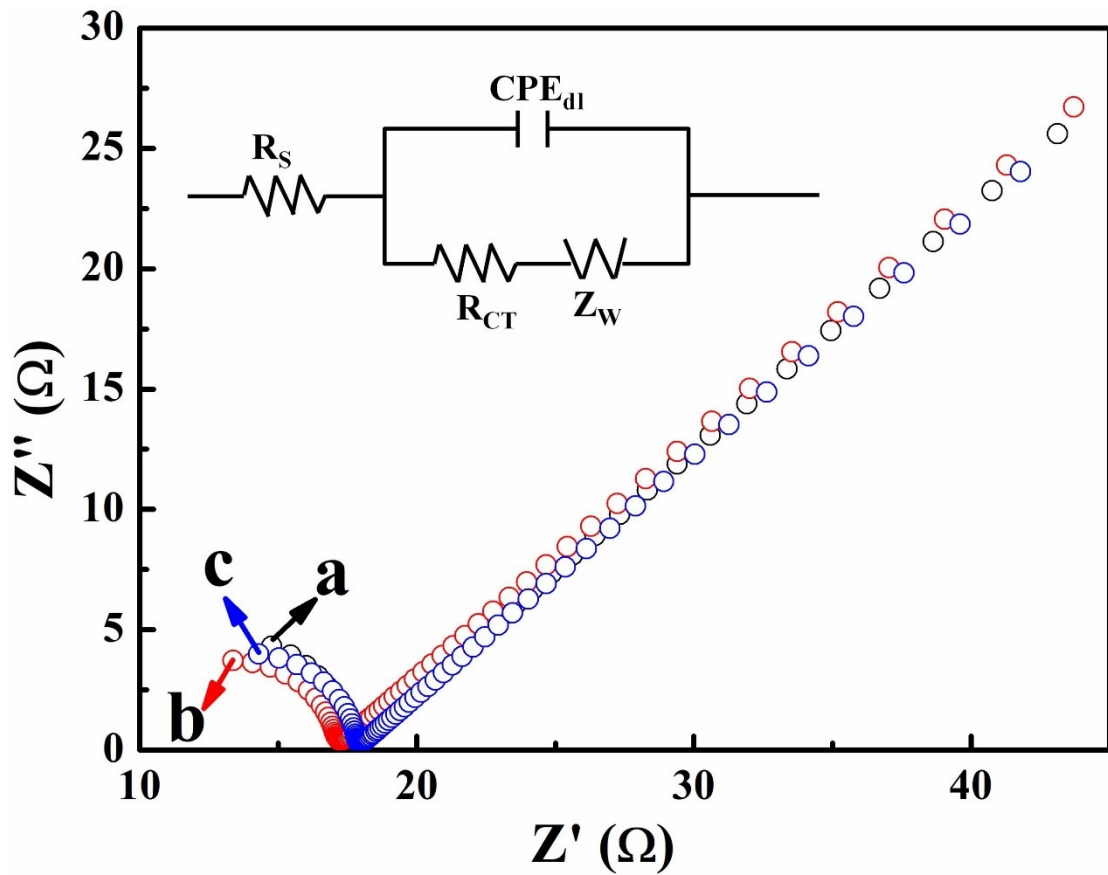
Figure. S5 EIS of Cu NPs film/NF electrodes prepared by electrodeposition for 10 s (a), 20 s (b), and 30 s (c) were carried out in an electrolyte solution containing 5 mM $[Fe(CN)_6]^{3-/4-}$ and 0.1 M KCl. (Inset:Equivalent circuit model used for EIS fitting, which includes the ohmic resistance of the electrolyte (Rs), the double-layer capacitance (CPEdl), the charge-transfer resistance (Rct), and the Warburg impedance (Zw). The diameters of the semicircular arcs in the high-frequency region denote the charge-transfer impedance, while the straight lines in the low-frequency region denote the substance-transfer impedance.)
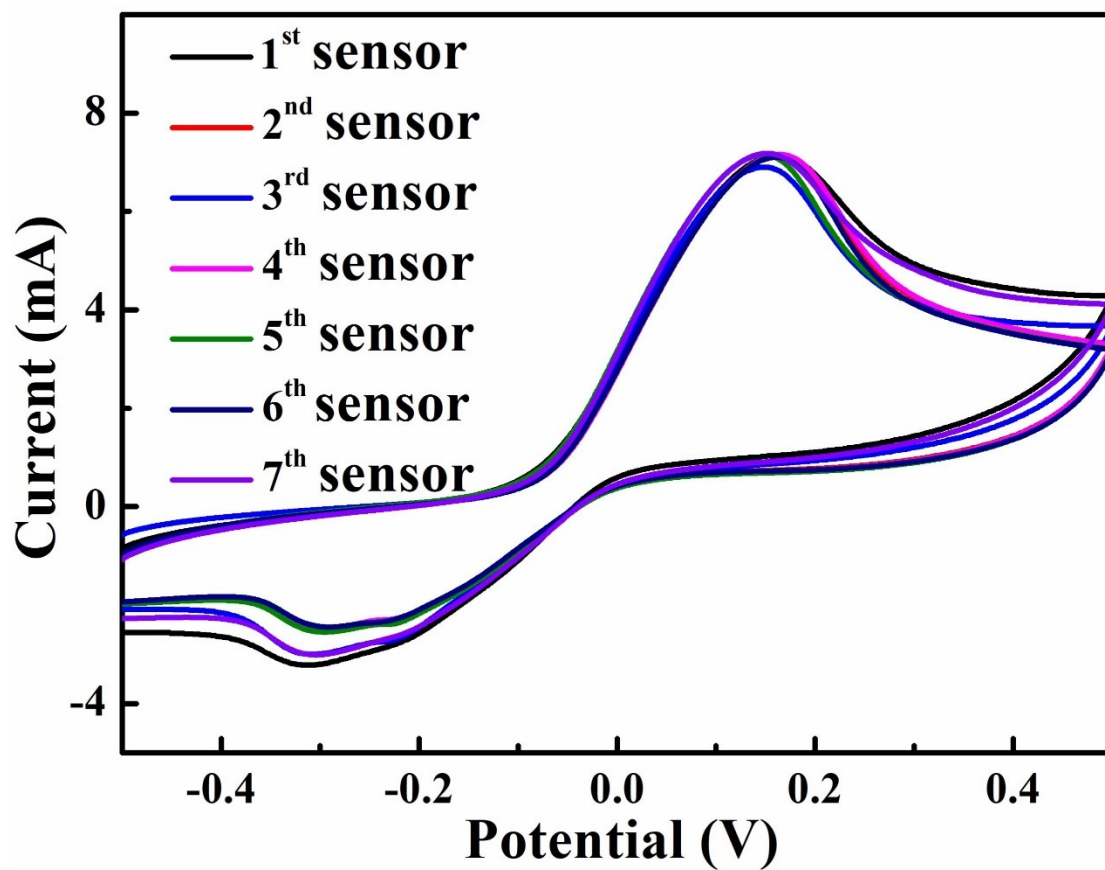
Figure S6. CV curves of seven sensors were prepared under the same growth parameters for the detection of 5 mM creatinine.
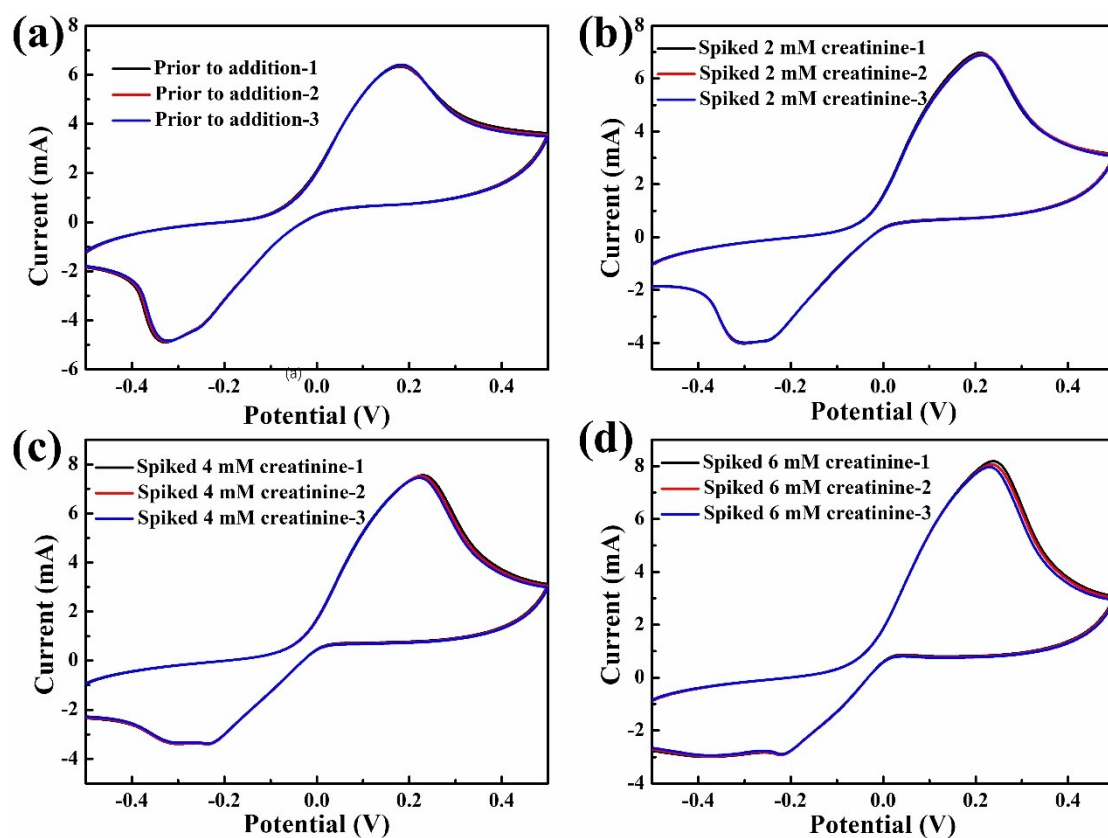
Figure S7. CV curves of diluted urine without standard addition (a), with the addition of 2 mM creatinine (b), with the addition of 4 mM creatinine (c), and with the addition of 6 mM creatinine (d) were measured using Cu NPs film/NF electrode.