

## **Electrochemical Characterization of Thermally Oxidized Copper**

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**Abstract:** This work aims to compare the electrochemical performance of thermally oxidized copper foil and mesh electrodes, focusing on the effect of morphology on charge storage and mass transport mechanisms. Copper foils [1] and mesh (wire diameter 100  $\mu\text{m}$ , aperture size  $180 \times 180 \mu\text{m}$ ) were thermally treated at 400  $^{\circ}\text{C}$  for 1 h to form copper oxides layers. Electrochemical properties were assessed through cyclic voltammetry (CV), chronoamperometry, and electrochemical impedance spectroscopy (EIS). Electrochemical measurements were conducted in 0.1 M NaOH electrolyte. Surface morphology was analyzed using scanning electron microscopy (SEM), while phase composition and crystallographic structure were determined by X-ray diffraction (XRD). Cyclic voltammetry data reveals a higher cathodic current response at 300 mV for the mesh compared to the foil oxide, especially at high sweep rates, both electrodes having the same geometrical area (1  $\text{cm}^2$ ). CV reflects fast charging and surface effects, while chronoamperometry shows the steady-state current, where the signal becomes stable over time and depends mainly on how fast species reach the electrode. The obtained results demonstrate that Cu oxide mesh electrode exhibits a stronger cathodic response and a more pronounced scan rate dependence than Cu oxide foil, indicating a higher electroactive surface area and improved charge transfer properties. These features suggest that the mesh substrate is more suitable for electrochemical applications.

**Keywords:** Electrochemical impedance, cyclic voltammetry, redox reactions, biosensors, nanomaterials.

### **References**

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