**Background**
Photocatalysts are functional materials that utilize sunlight to catalyze a reaction. Some uses include splitting water into hydrogen and oxygen gas for carbon neutral energy and removing hazardous contaminants from drinking water.

A novel photocatalyst, CuBiW$_2$O$_8$, is being investigated for stability relative to a well researched photocatalyst, Cu$_2$O. The objective of this REU was fabricating, characterizing, and testing the Cu$_2$O films to understand the differences in stability in comparison to the novel photocatalyst.

**Methods**
Films of Cu$_2$O were made using three electrode electrodeposition. To test the viability of the fabricated films, they were characterized with scanning electron microscope (SEM) images and X-ray diffraction (XRD). To find the stability of Cu$_2$O, photoelectrochemical (PEC) testing was performed in acidic and basic solutions. Optical characterization was also done to verify the absorption range of Cu$_2$O.

**Characterization**

### Scanning Electron Microscope Image (SEM)

This data was gathered in a three-electrode setup in a sulfate and persulfate solution at acidic and basic pH. The films were irradiated by a Xenon lamp equipped with an Air Mass (to simulate solar light) filter for 10 minutes. The light was chopped ON/OFF with 10 seconds intervals. The basic solution degrades by 62% in roughly 70 s, whereas the acidic solution current degrades by 53% in 30 s. This indicates the film is much more stable in basic solutions. The films were completely dissolved in 10 minutes under light irradiation, confirmed by SEM imaging.

### X-ray Diffraction (XRD)

The XRD pattern shows intense peaks of the Cu$_2$O film (black) matched to FTO (fluorine doped tin oxide coated glass, the substrate) and cubic Cu$_2$O [1]. Addition weak peaks were matched to CuO [2] and cuprocitrol [3] impurities.

### Photoelectrochemical (PEC) Properties

The onset wavelength for absorption is 500 nm, which is characteristic of Cu$_2$O [4].

### Absorbance

The bottom image is a wide view of the film showing homogenous coating. The top image is a closer view of the crystals on the substrate.

### Crystal Structure: XRD

The XRD pattern shows intense peaks of the film (black) matched to FTO (fluorine doped tin oxide coated glass, the substrate) and cubic Cu$_2$O [1]. Addition weak peaks were matched to CuO [2] and cuprocitrol [3] impurities.

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**References**