

# Copper Electrode Information

## Product Materials Disclaimer

*Important information about Pine Research Instrumentation copper electrodes. Please review this information prior to use. Contact Pine Research with any questions.*

### 1. Copper Oxidation Information

Standard copper electrodes, disk inserts, and cylinder inserts from Pine Research Instrumentation are fabricated using 99.99% pure copper rod from major commercial metals suppliers. Copper oxidation arises spontaneously in air (and water) and cannot easily be prevented. Copper oxides will form readily over time, making the initial mirror finish polish look irregular. Copper oxides tend to form on solid copper surfaces in a heterogeneous manner, looking similar to how dried water spots appear on glass.

After a copper electrode is manufactured, it is tested to ensure the seal (fixed electrode) is good and the electrochemical response passes our internal quality assurance guidelines. Copper disk inserts are solid material and do not require testing. Copper electrodes that are polished to a mirror finish appear bright, shiny, and homogeneously copper colored across the entire surface (see: Figure 1-1). Within days of exposure to air in the atmosphere, copper electrodes will begin to show signs of spontaneous oxidation. The resultant copper oxides could be white, green, or orange colored spots heterogeneously appearing on the copper (see: Figure 1-1). Such oxidation cannot be avoided. It may arise during inventory storage or transit to the customer. For customers whose copper electrodes are shipped via airplane, the extent of copper oxidation may be exacerbated by differential pressure, temperature, and humidity.

Despite the presence of copper oxides on the electrode, disk, or cylinder, customers are able to bring the electrode back to a mirror finish with routine polishing. Please do not be alarmed if the copper electrode you have recently received shows signs of oxidation. It is an unavoidable physical process. The same oxidation will occur in your lab when the electrode is exposed to air during storage.



#### INFO:

Pine Research cannot guarantee you will receive your copper electrode, disk, or cylinder insert that is bright, shiny, and mirror polished. Exposure to air will rapidly cause spontaneous oxidation of the copper. Simply routine cleaning (polishing) will bring a new mirror polished electrode back to its original condition.

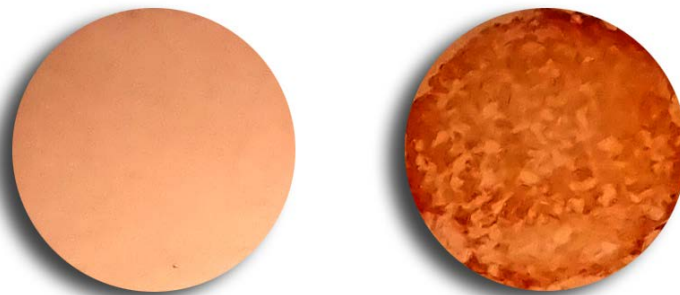


Figure 1-1. Freshly Polished Copper Electrode Surface (Left); Copper Oxidation on Electrode Surface (Right)

## 2. Routine Polishing of Copper

Routine cleaning is recommended as a way to simply touch up the copper electrode surface after a few uses, or to remove any oxides that have formed during storage, shipment, or use. This type of cleaning and polishing can be performed on a daily basis. Pine Research offers an electrode polishing kit (part #: AKPOLISH), but the materials required to perform routine cleaning of an electrode surface are very common in laboratories performing electrochemistry:

1. Remove the backing and affix a piece of microfiber polishing cloth to a still flat surface. Commonly, this is a thicker sheet of glass or polymer, dedicated to electrode polishing.
2. Dispense a small volume of 0.05  $\mu\text{m}$  alumina slurry onto the microcloth. In general, about 3 mm round spot is sufficient.
3. Polish the electrode against the slurry, keeping the electrode surface parallel to the surface of the cloth. A figure-8 pattern while gently turning the electrode is a useful technique.
4. Clean the alumina particles off the electrode using distilled water.
5. *OPTIONAL*: Rinse the electrode surface in an ultrasonication bath (containing distilled water) for a 1-5 minutes to shake loose any alumina particles. Be sure to suspend only the electrode surface in solution, perhaps by using a ring stand and clamp (i.e. do not place the entire assembly into the ultrasonication bath).

**INFO:**

In light of the discussion above, Pine Research Instrumentation makes no warranty, express or implied, regarding the surface characteristics, surface chemistry, or surface morphology of glassy carbon electrodes.

## 3. Product Use Warning

Researchers are warned that copper electrodes should not be used highly concentrated strong acid for extended periods of time. Doing so will increase the rate of oxidation. Routine polishing of the copper surface may not be sufficient to bring the electrode back to a bright, shiny, mirror polish finish.

**CAUTION:**

Do not use copper electrode in highly concentrated strong acid for long periods of time, as this will rapidly form heterogeneous oxides on the surface of the electrode, which can pit beyond the surface.

## 4. Contact Us/Support

Please contact Pine Research Instrumentation with any of your needs including general and technical questions, pricing/quote assistance, selection guidance, applications questions, etc. We are here to serve you. Contact us via the means provided below.

### 4.1 By Phone

Our offices are located in Durham, NC in the eastern US time zone. We are available by phone Monday through Friday from 9 AM EST to 5 PM EST. You can reach a live person by calling +1 (919) 782-8320.

### 4.2 By E-mail

Send an email to [pinewire@pineresearch.com](mailto:pinewire@pineresearch.com). This is the general sales email and our team will ensure your email is routed to the most appropriate technical support staff available. Our goal is to respond to emails within 24 hours of receipt.