

# Standard Operating Procedure: Electrode Polishing and Care

Last updated in 05/15/17 by Selene Li

A smooth, clean, and uniform electrode surface is necessary for reproducible problem free electrochemistry experiments.

## **Examine The Electrodes:**

- ◆ An electrode with deep scratches may need to be wet-polished on [the 800 grit sand pad](#).
  - Put a few drop of water on top of the sand pad, and polish the electrode in a figure 8 motion, keeping the electrode facing parallel to the polishing pad for 5-10 minutes. After that, rinse off the electrode with DI water.
  - This polish procedure is very aggressive, please see appointed person for questions first before proceeding.
- ◆ An electrode with visible scratches or dirt should be polished starting from [Aggressive Cleaning](#).
- ◆ An electrode, which has a perfectly smooth mirror shine surface, should still be polished prior to use, starting with [Routine Cleaning](#).
- ◆ In many occasions, electrode polishing procedure is strongly based on judgments off previous experience. If questions arise, please see appointed person.

## **Reagents and Equipment:**

- ◆ Squirt bottles for water, MeOH, and isopropanol
  - The diamond polishing slurries (15- $\mu\text{m}$  blue, 3- $\mu\text{m}$  yellow, and 1- $\mu\text{m}$  white) are oil base, so a MeOH flush of the electrode is required.
- ◆ 2-50mL beakers for sonicating electrodes, which are in the E-Chem draw with the polishing kit.
- ◆ 1 larger beaker for waste
- ◆ Polishing kit – 2 boxes (in the E-Chem drawer), containing four polishing pads, three white diamond (nylon) pads (15  $\mu\text{m}$ , 3  $\mu\text{m}$ , and 1  $\mu\text{m}$ ), and one fuzzy brown alumina pad, and both diamond (15  $\mu\text{m}$ , 3  $\mu\text{m}$ , and 1  $\mu\text{m}$ ) and alumina polishing slurry bottles.
  - Shake polishing slurries thoroughly before use.

### [Aggressive Cleaning:](#)

1. Rinse the 15- $\mu\text{m}$  nylon polishing pad thoroughly with DI water prior to use. This will help break up any clumps of grit that were not rinsed off from a previous use.
2. Rinse the electrode surface with DI water followed by MeOH to flush away any encrusted material on the surface.
3. Start polishing with the largest particle size ([the blue 15- \$\mu\text{m}\$  diamond polish](#))

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- ◆ Find the 15- $\mu\text{m}$  polishing pad. It will be labeled on the back, and have a blue spot on the front, if it has been used.
  - ◆ Shake the bottle of 15- $\mu\text{m}$  diamond polish thoroughly and apply three-four drops in the center of the pad.
  - ◆ Polish the electrode in a figure 8 motion, keeping the electrode facing parallel to the polishing pad for 5 minutes.
  - ◆ After that, rinse the electrode well with MeOH.
  - ◆ Check the electrode face for any scratches.
    - If new scratches appear, this means there were larger particles on the polishing pad.
    - In this case, re-rinse the polishing pad and repeat the polishing steps.
    - If scratches still appear, you may consider replacing the polishing pad with a new one and start the polishing procedure over from the largest particle size. Recommend to see the pointed person before replacing new pads.
  - ◆ Sonicate the electrode for 5 minutes in a beaker clean with fresh and clean isopropanol to remove any residual particles.
  - ◆ Sonicate the electrode for 5 minutes in a beaker of fresh and clean DI water.
  - ◆ You may have to repeat this process a few times until no new scratch.
4. Repeat the polishing procedure described in Step 3 above with [the yellow 3  \$\mu\text{m}\$  diamond polish](#) with appropriately labeled polishing pad.
5. Repeat the polishing procedure described in Step 3 above with [the white 1  \$\mu\text{m}\$  diamond polish](#) with appropriately labeled polishing pad.
6. The final polishing step is with the alumina polish
- ◆ Rinse the fuzzy brown pad thoroughly with DI water.
  - ◆ Shake the bottle of alumina polish well and put four-five drops evenly around the pad surface.
  - ◆ Polish the electrode in a figure 8 motion, keeping the electrode facing parallel to the polishing pad for 5 minutes.
  - ◆ After that, rinse the electrode well first with DI water.
  - ◆ Sonicate the electrode for 5 minutes in a beaker of clean water to remove any residual particles, and then rinse the electrode again with DI water.
  - ◆ Check the electrode face for any scratches.
    - If new scratches appear, this means there were larger sized particles on the polishing pad.
    - If this is the case, **replace** the polishing pad with a new one and start the polishing procedure over from the largest particle size.
    - If the scratches stay, go back to use the white 1- $\mu\text{m}$  diamond polish and the alumina polish.
  - ◆ Rinse the electrodes with MeOH afterward.

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## Routine Cleaning:

If an electrode has a perfectly smooth mirror shine with very light scratches on the surface, it should be polished starting from 3- $\mu\text{m}$  yellow, 1- $\mu\text{m}$  white diamond polish, and finally the alumina polish with appropriately labeled polishing pads. Repeat Step 1-6 above for detail procedure.

## Before using the electrode:

- ◆ Soak in clean and fresh isopropanol for an additional 10-15 minutes
- ◆ Soak in the solvent, which will be used in echem data collection, for 10-15 minutes
- ◆ Allow electrodes to dry at room temperature or by blowing  $\text{N}_2$  from a distance, and wrap the electrodes using lens papers to protect the electrode surface. **NEVER** use a kimwipe.
- ◆ **DO NOT** touch the electrode surface with your fingers, or place the surface in contact with sharp objects or other materials which could scratch it.

## After using the electrode:

- ◆ Rinse the electrode at least 3 times with the clean and fresh solvent, which was used for the echem measurement.
- ◆ Allow the electrode to dry at room temperature or by blowing  $\text{N}_2$  from a distance. Place the electrodes back the containers, where the electrodes are originally stored in.

If you have any questions, see appointed person.

## **Personal Protective Equipment:**

Safety glasses, nitrile gloves, and lab coats designated for electrode polishing are required.

## **Waste Disposal:**

Any hazardous waste, including diamond and alumina polishing paste, should be disposed properly according to the standard operating procedure.

## **Hazards:**

Solvents, polishing reagents and glassware can be dangerous to you. Please handle them with care.

## **Material Safety Data Sheets:**

Call the ORCBS (517-355-0153) or see lab copy for samples in questions if available.