

## Patterned Metal Electrode Fabrication SOP

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### Materials:

Borofloat or Soda Lime Glass

Photomask

300 MIF Developer (Alternately: 351 Developer; AZ 1518 or S-1818 are appropriate for recoating)

CR-7S Chrome Etchant

Glass cutter

Hydrofluoric Acid Etchant Solution

### Resources:

- D. M. Mattox, *Surface cleaning in thin film technology*, Thin Solid Films, 1978, 53, 81–96.
- R. P. Baldwin, *Fully Integrated On-Chip Electrochemical Detection for Capillary Electrophoresis in a Microfabricated Device*, Anal. Chem., 2002, 74, 3690–3697.

We use soda lime glass for metal electrode fabrication, sourced from Nanofilm, Inc. The glass is 4" x 4" x 0.06", coated with low reflective chrome (100nm) and AZ1518 photoresist (500 nm). The grade is PG. It is very flat, with defects being less than 2 um in height. The glass is ready to expose straight out of the box. Consult the **Glass Microfluidic Device Fabrication SOP** for instruction on how to prepare glass substrates for metal electrode deposition.

Dry the etched glass piece(s) on a hot plate at 100C for about 10 min. This drives any accumulated moisture off of the surface of the exposed glass.

Expose the substrate to an oxygen plasma for one minute using the March Plasmod plasma reactor in the deposition room. This step removes contaminants and thoroughly oxidizes the surface to ensure adhesion of the titanium adhesion layer. Consult the March Plasmod user manual or quick reference guide if necessary.

The counter-sunk metal electrodes are created using an Axxis DC Magnetron Sputterer made by the Kurt J. Lesker, Co. Consult the **Lesker Sputterer SOP** for further detail. Briefly, the plate is put into the sputterer's vacuum chamber, which is then pumped down to at least  $5 \times 10^{-7}$  Torr before sputtering; this takes about 24 hours. Once the chamber has reached this base pressure (which is done to remove contaminants that would undermine the thin film adhesion), the chamber is purged with Ultra High Purity (99.999%) Argon and held at a pressure of 2.5 mTorr. A Titanium adhesion layer is required for all electrode metals; a 40 nm layer is applied at 220 W, which takes 40 seconds. The bulk electrode material is then deposited at parameters that are material-specific: Gold and Palladium are deposited at 250 W at a rate of about 50 nm/min; Platinum is deposited at 200 W at a rate of about 30 nm/min. After deposition, the chamber is vented with Nitrogen and the glass plate is removed.

The unwanted metal is then "lifted off" by dissolving the photoresist layer in a bath of either acetone or dimethyl sulfoxide (DMSO.) The remaining under-layer of Chrome is then removed with chrome etchant.