CNF Protocol for 170um Fused Silica Wafers with Trenches

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1. Wafer Preparation

1) **Mark** wafer in such a way such that you know what side is "up." I use a pen-scribe to gently scrape an **X** in the lower left corner of the flat.
2) Blow Clean with N2
3) Soak in acetone 15 minutes, followed with IPA for 10 minutess.
4) Blow dry with N2

2. Alignment Marks and Trenches

1) Spin **P-20** at 2000 rpm for 30sec, ramp speed of 1000 rpm/sec. [Cover the whole wafer with the P-20, usually 2 droppers full, and let it sit for 15 seconds before spinning off.]
2) Spin **SPR220-3.0** at 2000 rpm for 30sec, ramp speed of 1000rpm/s.
3) **Bake** PR at 115C from 90s.
4) **Expose** using AUTOSTEP. Use the chuck that is made for 170um wafers. I exposure 0.30-0.35sec, (determined 09/02/08 using EXPOsure Array)
5) **Develop** in MIF300 bath for 90 seconds, swirling solution gently. Transfer to a bath of DI to stop the development process. Remove from DI and while holding wafer at edges spray both sides of wafer with DI nozzle in hood to finish rinsing. Dry carefully with N2.

1. **LOOK (!!)** under microscope to see that alignment mark and trenches are in right places, and that the PR has been completely removed from exposed areas. Any diffraction pattern in your features means the wafer was underexposed, and you will need to start over. It helps to put wafer on a clean Beta Wipe to view the contrast between the clear wafer and the pinkish PR.
3. **Measure PR** thicknes using the
4. **Oxford 80 Etch**

--Clean empty chamber for 10 minutes using the "O2 Oxygen clean" recipe.
--Put wafer into chamber and **descum** with 1min O2 to remove residual PR film from developed areas.
--Keep the descummed wafer in the chamber and change the program to the CHF3/O2 ***Oxide*** **Etch** (Note that many processes have similar names)

a) Put wafer in chamber and etch for 1 hour
b) Remove wafer
c) Clean chamber with O2 clean for 10 minutes.
d) Measure depth of a large (>15um) feature using the P-10 pr
e) Measure thickness of PR using XXX
f) The value of e minus d gives you your etched depth. ☺
f) Repeat peat steps (a) – (e) until you reach the depth you want.

Etch rates on the Oxford 81 REI are faster than on the Oxford 82. The 81 etches fused silica at ~1.8um/hr and the 82 etches at ~1um/hr. Be careful not to etch away all of the PR, especially at the edges where the PR becomes thinnest. The Etch rate of fused silica to PR is about 2:1.

5. **Remove PR.** When PR is bombarded by Fluorine, it hardens, and with longer etches becomes very hard to remove. If it is not totally removed before the next process steps, the wafer is usually ruined.

   -- Keep wafer in Oxford (after the CHF3/O2 etch) and do a 10 minute O2 clean. This will remove the hard crust of the PR, as well as much of the PR on the wafer.

   -- Soak in Acetone bath for 1-8 hours until all PR is removed from the wafer. This actual time depends on the amount of resist that was on your wafer to start. Many times the wafer surface can look clean, but look at the wafer edge and if there is a hint of pink, which means you need to continure the acetone soak.

   --Transfer from Acetone to IPA for 15 mins and N2 blow dry

3. Electrodes

1) Spin on **P-20** as above
2) Spin on **SPR700-1.2 2000rpm** for 30s, ramp of 1000rpm/s
3) **Bake** at 115 degrees for 90s
4) Use Autostepper to **expose** electrodes for 0.6s
5) Do an **image reversal** in the YES oven.
6) **Flood expose** 60 seconds
7) **Develop** in MIF-321 for 90s. Into a DI bath and rinsed boths sides with spray nozzle.
8) 1 minute O2 **descum** – either in the Oxford 80 or the Branson etcher.
9) Use either the odd or the even hour e-beam evaporator.
Evaporate 2nm Titanium at 0.2A/s and then 40nm platinum at 1A/s.
10) **Lift-off** in 1165 for 8 hours up to 12 hours.

   --Transfer into IPA bath. Holding wafer in one hand with fingertips at the wafer edges, spray a stream of IPA over the face of the wafer of the wafer to loosen and remove metal that is still attached. **Clean both sides with IPA** and blow dry with N2.

   One needs to be careful LOOK before spaying. If it looks like many parts of the electrodes have not detached – do not spray with IPA as this could to tear off good electrodes. Let it sit in 1165 for a few more hours and try again.

11) 1min O2 Descum in Oxford or Branson – Just because

4. Catalyst Pads

1) Spin **P20** as Above.
2) Spin **SPR700-1.2 4000rpm**, ramp 1000rpm/s, for 30s's.
3) **Bake** at 115 for 90s
4) Use Autostepper and **expose** for 0.3s
5) **Develop** in MIF300 for 90s. Soak and wash in DI as above.
6) 1 min O2 **Descum** as above
7) Even Hour **Evaporator** (This is the only one that will allow the evaporation of Al3O2)
   --Evaporate 10nm of Alunimum Oxide at 2A/s
   --We now want to evaporate only 2A's of Iron. It is very hard to control the rate for a couple of seconds To get a degree of accuracy the tooling factor must be changed.
   --change tooling factor to 300. This is 5X the original preset tooling factor of 60. Therefore, since we want 2A evaporated at 0.2 A/s, we set the rate at 1.0A/s and stop the evaporation when the gauge thickness registers 10A's. At the end of evaporation, DO NOT FORGET to change the tooling factor back. You will get in trouble by CNF people if you don't!
8) Lift-off in 1165 for ~8 hours. Spray etc with IPA (as above for electrode step)
9) Descum in O2 Plasma for 1 minute

6. **Dice--**Acetone 3+ (+?)hrs, IPA BAth, O2 Descum

******* BRING BACK TO CLARK HALL YAY! *******

General Notes:

- Order wafers from Mark-Optics. Specify <2.0 nm surface roughness, polished both sides, one flat, 170um… which is +/-- 25um thickness!)
- After development at EVERY step, look and see that you have good results. A good indication that something is wrong is if you see a pinkish hue or a diffraction pattern where all PR should have been removed. If this doesn't get resolve it, start over! **:-/** This can save considerable time instead of finding a problem after more processing hours.
- Note that over **development** is not necessarily a bad thing. The rate that developer etched unexposed PR is very slow, and this can sometimes help remove PR from your features (However, the quality of the pattern is very sensitive to the **exposure** time!)
- Do not let acetone dry on the wafer. If it does you will see a whitish film which indicates the wafer is dirty. When cleaning with acetone, rinse immediately with IPA to remove residual acetone.
- If you have devices that will be etched for trenches, it is good to add a feature to your mask about 50um wide so you easily measure depth with the profilometer.