Chapter 3.6

Iron Oxide Mask Processing

1.0 *Title*

Iron Oxide Mask Processing

2.0 *Purpose*

Iron oxide masks are glass substrates coated with a thin iron oxide film and AZ1350J photoresist. They are developed and stripped in APT chrome developer machine, but manually etched.

3.0 *Scope*

This chapter covers the iron oxide mask making procedure, which includes: exposing the mask in the GCA Pattern Generator; developing the photoresist in the aptchrome; and manually etching the iron oxide film. Photoresist gets stripped from the mask in the aptchrome as a final step.

4.0 *Applicable Documents*

Revision History

5.0 *Definitions & Process Terminology*

N/A

6.0 *Safety*

Before you proceed with mask processing, please note the following: The door to the Aptchrome process chamber should be kept closed and latched at all times except when loading or unloading masks.

7.0 *Statistical/Process Data*

N/A

8.0 *Available Process, Gases, Process Notes*

Process Notes

8.1   Iron oxide masks are easy to align because they are transparent to visible light, though opaque to UV light and are also strong enough to stand up to contact printing.

8.2   The Microlab stocks iron oxide masks in one size: 5". Plates are 0.090 mils thick. The aptchrome mask developer will accommodate this size.

9.0 *Equipment Operation*

9.1   Enable the aptchrome on the WAND.

9.1.1   The system power to the aptchrome can be turned on by flicking the blue **power on** rocker switch which is located on the left side of the aptchrome. The program status will then be displayed on the program recipe display screen on the front panel. The processing programs 90 (develop) and 92 (strip resist) for this operation are each separately activated by a red rocker switch that will illuminate when selected. The STOP/RESET is a square red button and the RECIPE START a square black button.

9.1.2   To operate the tool, the program recipe display screen will prompt you to **SELECT A PROGRAM AND PRESS START**. Select a recipe by pressing the desired rocker switch which will illuminate when selected. Next press the START button. Once a recipe has been started, it will continue until it finished and the program recipe display screen will read **END OF PROGRAM**. While the recipe is running, the display on the screen will show how much time has elapsed since the start of the recipe.

9.1.3   If the red **STOP/RESET** button is pressed, the tool will immediately cancel the remainder of the recipe and stop whatever it is doing. The program recipe display screen will show you that the recipe has been stopped and will ask you to reset the system by pressing the **STOP/RESET** button once more. The display will then once again prompt you to select a recipe and press **START**.

9.1.4   Only one recipe may be run at a time: if more than one recipe is selected and the **START** button is pressed, neither recipe will run and the system will wait for you to deselect one of the programs.

Important Note: The **STOP/REST** button does exactly that: it stops the recipe at once and does not automatically skip to the next step.

9.2   Checking Chemical Lines

Before starting your process, you will need to run a test program (Program 99- test lines) to check that each chemical is flowing properly at each step. The chemicals should dispense from the nozzle(s) as a fan-shaped spray. The program is set up to allow each required chemical to spray in sequence with water rinses in-between. If the spray is dispensed in a thin stream, the nozzle is clogged and needs to be replaced. Report this promptly on FAULTS.

9.2.1   Select program number 99- test lines. The lamp is on at all times during this program.

9.2.2   Press the START button.

9.2.3   When the program starts, make sure that the desired chemical starts to spray out of its respective nozzle (30 seconds.)

9.2.4   Let the water rinse cycle run through (30 seconds.) The next chemical should then begin to spray. Continue in this fashion until you have worked your way through the program.

9.2.5   If too much water beads up on the door and prevents you from being able to see through, briefly open the door and wipe it dry with a techni-cloth. The techni-cloths are kept in a dispenser on top of the table in R1. 9.2.6 If everything checks out, you can begin processing your iron oxide mask. If there is a problem, contact the Process Staff for help and report the problem on the WAND via FAULTS.

9.3   Processing Iron Oxide Masks

9.3.1   Run the develop Program 90 without a plate initially to make sure the lines are clear.

9.3.2   Load the mask, iron oxide side up, onto the spinner, seating all four corners securely so that it does not fly off and break during the spin.

9.3.3   Close and latch the door and select the desired program number.

9.3.4   Press START.

9.3.4.1   <u>Develop</u>: Program 90

Program 90, which is the initial develop step, does not turn on the lamp during the entire process so that the plate is not exposed. After a standard develop time the plate should be inspected for complete development and the Leitz microscope in R2.

9.3.4.2   <u>Manual Etch</u>

Iron oxide masks are manually etched. Use the deck at sink12. A small rectangular white Teflon® dish labeled **iron oxide etch only** can be found on the deck. A white Teflon tweezers for holding the mask is clipped onto the large white Teflon® beaker which can also be found at this sink. This etch step should only be done in this dish.

Use the Cyantek FE-12 Iron oxide etchant, which can be found in the **APT Chemicals** c-locker in R1. (Additional bottles are stocked in the blue developer cabinet in the lobby.). Etch time is approximately 75 seconds for dark field masks; clear field masks may take as much as 15 seconds longer.

Use the white Teflon tweezers to gently agitate the mask during this step. When the etch is complete, rinse the mask by using the deck hose at the sink then dry with the N2 gun which is mounted at the pattern generator chamber in R2. Inspect the etch at the Leitz microscope in R2.

If the etch is complete the etched area should look like a white matte. If under-etched, repeat the process.

Note: Use fresh etchant for each mask. When finished, pour the used etchant into the large white Teflon beaker at the sink in order to carry it over to sink4 in Y1 for disposal. The aspirator at sink4 is used for this step.

9.4 Photoresist Strip: Program 92

The remaining photoresist is exposed with the lamp on in the first step and then removed with developer concentrate.

Program 92 is a **strip only** process which removes the photoresist from the mask following the develop and etch steps.

9.4.1   When the process is completed, check to see if the plate is completely dry on both sides. If not, use the N2 static gun in R2 to blow it dry.

9.4.2   Dispose of the iron oxide etchant at sink4 in Y1. Pour the used etchant into the large white Teflon beaker at this sink which is kept for this purpose. Carefully carry the beaker over to sink4 in Y1 and use the aspirator to dispose of it then use the deck hose at this sink to rinse out the beaker. Please return the beaker to sink12 afterwards. Reminder: do not pour the etchant down the drain at sink12 in R1 as this sink is not a certified fume hood. Use techni-cloths to wipe up any spills.

9.4.3   When you have completed your Iron Oxide mask processing, run rinse program 93, then disable the APT chrome on the wand.

10.0 *Troubleshooting Guidelines*

If the program recipe display screen is blank, report on FAULTS promptly as this indicates a blown fuse.

11.0   *Figures & Schematics*

Program 99 – Chrome Process Test

Step	Chemical	Output	Description	Spin Speed (10^3 RPM)	Time (sec.)
1	Shipley Microposit Developer 452	Lamp on	Developer Nozzle	.00	30
2	Water Rinse	Lamp on	Top/Bottom Rinse	.00	30
3	Concentrated Chromium Etchant CR-7	Lamp on	Etchant Nozzle	.00	30
4	Water Rinse	Lamp on	Top/Bottom Rinse	.00	30
5	Shipley Microposit Developer 452	Lamp on	Stripper Nozzle	.00	30
6	Water Rinse	Lamp on	Top/Bottom Rinse	.00	30

Program 90 – Develop Only

Step	Chemical	Output	Description	Spin Speed (10^3 RPM)	Time (sec.)
1	Water Rinse	Lamp off	Top/Bottom Rinse	.22	10
2	Shipley Microposit Developer 452	Lamp off	Developer Nozzle	.22	75
3	Water Rinse	Lamp off	Top/Bottom Rinse	.22	45
4	Spin Dry	Lamp off	(Spindry)	.95	120

Program 92 – Strip Only

Step	Chemical	Output	Description	Spin Speed (10^3 RPM)	Time (sec.)
1	Spin	Lamp on	(Lamp on)	.22	480
2	Water Rinse	Lamp on	Top/Bottom Rinse	.22	10
3	Shipley Microposit Developer 452	Lamp on	Stripper Nozzle	.22	60
4	Water Rinse	Lamp on	Top/Bottom Rinse	.22	45
5	Spin Dry	Lamp on	(Lamp on)	.95	120

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M. Kushner - March 2004