

Karl Suss MA6

Scope

- a. This document serves as an outline of a typical operation of the MA6
 - i. To describe best practices of using the mask aligner
 - ii. To include information specific to the mask aligner at the Texas A&M nanofabrication lab
 - iii. Is in sequential order of how an actual alignment/exposure process is prepared and implemented.

Safety

- a. Be sure that you are trained and signed off to use this equipment.
- b. If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.



Front View of MA6

Overview of the Process

I. Setup

- a. Begin setup while waiting for other steps of the lithography process to finish.
- b. Gases/Vacuum
 - i. Turn on the two gas lines behind the MA6. One is Nitrogen the other is air.
 - ii. Flip the switch on the vacuum to turn it on.
- c. Power
 - i. Flip the lamp box's power switch to on. Press and hold the "Lamp" button for 2 seconds. After a few minutes, the number should read out a value near 270.
 - ii. Press the power switch on the main console of the MA6.

II. Test Lamp

- a. Before loading the wafer, you must check the light intensity of the UV source.
- b. The UV intensity meter is in the black storage case near the MA6.
- c. Pull out the meter, plug the sensor into the top of the meter, turn on the power to the meter, and place the sensor on top of the wafer holder.
- d. Set the expose timer to > 10 seconds, or at least long enough to get a good reading. The smallest digit on the time setting is the tenths digit.
- e. Press the Load button, then press the Expose button. **ANYTIME YOU PRESS THE EXPOSE BUTTON, MAKE SURE THE SPIN COATER IS CLOSED AND THAT YOU SAY "EXPOSURE" BEFORE PRESSING THE BUTTON.**



Notable components: Separation and Kontakt lights (green and blue), Expose, Align, and Load buttons, arrow keys to move aligner and microscope for viewing purposes, and mask vacuum switch.

- f. While shielding your face from the UV, read the value on the meter and use that to calculate how much time is needed for exposure. (Check your photoresist's technical documentation for specific values needed for calculations.)
- g. Press the Align button to bring the aligner back to the front.
- h. Turn off the meter, unplug the sensor, and return the contents to the storage case. Make sure to *gently* wrap the sensor's cable around the sensor in the same way you found it. Avoid putting tension on the cable where it goes into the sensor.

III. Mask Loading

- a. Find the Mask you will be using and have it nearby for easy loading.
- b. Confirm that the Vacuum switch is set to the off position.
- c. Loosen the mask holder by evenly unscrewing the knobs on the left side of the aligner.
- d. Slide the holder out towards you and flip it over.

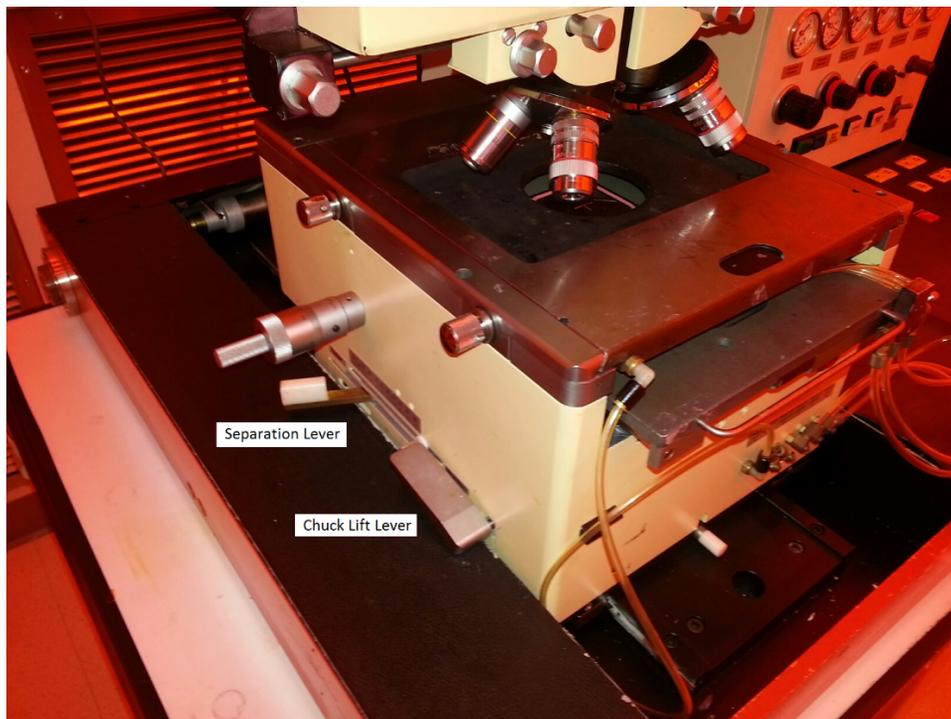
- e. Set the mask onto the holder lining it up with the vacuum gaps. Make sure to have the glass side touching the vacuum gaps and the side with the mask pattern (chrome) facing out.
- f. Turn the vacuum switch on. Flip the holder back over with your hand underneath the mask just in case the vacuum did not seal properly.
- g. Return the holder into the aligner and tighten the knobs back into place.

IV. Loading Wafer

- a. With the aligner still in the “Align” position, you can pull the tray back to access the wafer stand.
- b. Orient your sample so that the pattern on your wafer is as close to the orientation of the mask.
- c. There is a gentle vacuum pull to hold the wafer on the stand and prevent sliding.
- d. Slide the tray all the way back into the aligner.

V. Alignment

- a. To operate the alignment controls, you must first press the Load button followed by the Align button. The first button will move it under the lamp (but not flash). The second button brings it to the proper location for alignment.
- b. Turn the objectives to whatever resolution you need and set the ocular view to Left, Right, or Split. Using either left or right can get most of the alignment done, then split can be used to align the theta more easily.
- c. Bring up the first lever on the left side until the “Kontakt” light comes on. To adjust from there, slide the second lever towards the front until the “Separation” light comes on with the “Kontakt” light still lit.



A view of the chuck lift and separation levers and the Y-axis control knob.

- d. While in separation mode, you can now adjust the sample using the X-, Y-, and Theta-knobs to match the mask.
- e. Use the oculars to view the mask and wafer for alignment.
- f. Begin with the X and Y to get it mostly in place, then adjust the theta, then make slight adjustments as needed with X and Y.
- g. Once properly aligned, return the second lever slowly back to its first position so that there is no longer separation.

VI. Exposure

- a. When the alignment is complete, rotate the objectives so that the open space without an ocular is towards the center.
- b. Press the Load button. The alignment stage will move back under the UV source.
- c. Make sure that your time is set properly based on your previous calculations. Remember that the smallest digit is the tenths of a second digit.
- d. **Before pressing Expose, confirm that the spin coater is closed and that you have said "Exposure" so other people in the lab are aware.**
- e. Press the Expose button then look away. You will hear it turn on and turn off when it is done.

VII. Unload Wafer

- a. When the exposure is finished, press the Align button to bring the Aligner back to the front.
- b. Slowly press down the lever on the left side to have separation. The "Kontakt" light will turn off.
- c. Slide out the tray and pull out your wafer so that it can be developed.
- d. If you are running multiple wafers, place your next wafer on now and go through the same process of alignment and exposure.

VIII. Shut Down Process

- a. Once all samples have been exposed, return everything to how you found it.
- b. The two levers on the left should be returned to their starting positions.
- c. The X, Y, and Theta settings should be returned to their starting positions. To confirm these last three settings, there is a guide on the right side of the aligner that shows how far off you are from base alignment.
- d. To remove the mask, loosen the knobs on the left until the upper tray can be slid out. Pull it out, flip it over, and switch the vacuum control to release the vacuum. Carefully place your mask back into its case and return the tray into its slot. Tighten the knobs again to hold the tray in place.
- e. With everything in place, press the power button on the MA6 to turn it off.
- f. Turn off the UV light control box and the vacuum pump by turning off their switches.
- g. Go behind the MA6 and close the air and vacuum lines.



A view of the X-axis control knob, the Theta control knob, and the alignment guide.

IX. Quality

- a. Substrates and thin film materials used in this machine are intended to provide a wide variety of alternatives to AggieFab users. Please leave the mask holder and tool surfaces in a clean condition.

X. Signatures and Revision History

- a. Author of this document: Samuel Mote
- b. Author Title or Role: AggieFab student worker
- c. Date: 3/29/2016
- d. Revision: Original Issue

Approvals:

Technical Manager Signature: _____

Date: _____

Revision History:

Revision	Author	Date
Original Issue	S. Mote	3/29/2016
Rev A		
Rev B		