

Standard Operating Procedure

for MJB3 Suss Mask Aligner

Facility: MJB3 Mask Aligner
C17 Engineering Research Complex
Electrical and Computer Engineering

Lab Director: Brian Wright
3234 Engineering
355-5233

Scope: This SOP details the general procedure for operation of the departments MJB3 Mask Aligner

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Introduction:

Mask aligners are used in photolithographic processes to transfer a pattern from a mask to a photoresist coating on the substrate. The MJB-3s are suitable for handling wafers up to 3 inches in diameter and can be used for other samples with dimensions not exceeding 3 inches in any direction.

A mask aligner is used to expose a photoresist-coated substrate to ultra-violet light through a photo mask, which casts a shadow on the surface to define the photoresist mask. Different photoresists are sensitive to light at different wavelengths. It is important to select an aligner with an output wavelength optimized for your resist.

The SUSS MJB3 UV300 is the model in the ECE clean room. It is configured to have useable wavelengths only from 280-350nm. Resolution is 0.4 microns under optimum conditions.

This machine is to be used by authorized personnel only. To obtain training on this instrument, please contact the Lab Manager directly (rm C138 353-1959)
If at any time during use unknown problems occur, stop all work immediately.
Leave notice that the machine is not to be used and contact the Lab Manager (email eceshop@egr.msu.edu/353-1959)

Exposure Mode Selection:

Soft Contact:

In this mode, the vacuum that holds the substrate to the chuck is kept on during exposure, leaving an air gap between the mask and substrate. This mode may result in lower resolution comparing to other exposure modes but less damage to the mask. This mode is selected by pressing **ST** and then **SOFT CONT** buttons (both buttons should be illuminated).

Hard Contact (Standard Mode):

In this mode, the vacuum holding the substrate to the chuck is switched off and positive nitrogen pressure is used to press the substrate against the mask. This mode results in better resolution than soft contact but more mask damage. This mode is selected by pressing **ST** button only (**SOFT CONT** should be deselected).

Vacuum Contact (High Precision):

In this mode, a vacuum is drawn between the mask and the substrate during exposure, resulting in highest resolution but potential mask damage as well. This mode is selected by pressing **HP** button only.

Typical Operation:

1. Open the three regulator valves mounted on the side of the Laminare flow hood above the mask.
2. Sign in to the login book for the Mask Aligner. This is used to track usage for maintenance purposes, etc.
3. Turn on (move upward) the two gas switches at the Manometer Box on the Mask Aligner
 - a. Druckluft air pressure (Pneumatic Switch Compressed Air)
 - b. Stickstoff nitrogen (Nitrogen)
4. Turn on the vacuum pump under the table.
5. Turn on the microscope illuminator, which is beside the mask aligner. Turn it on by reaching the back part of it and finding the switch for power.
6. Turn on also the UV power supply that is under the illuminator (here the switch is at the front)
7. If the Mask Aligner has been used recently (last three hours), give it 10-15 minutes to cool down. Wait until the word “rdy” comes on.
8. BEFORE THE NEXT STEP, DOUBLE CHECK THAT THE POWER TO THE MASK ALIGNER IS TURNED OFF. The power to the UV power supply should be on, however the power to the Mask Aligner should be off (power surges during the firing process can damage the electronics in the Mask Aligner).
9. Press the “Start” button under the switch that you just turned on.
10. It might display “Fire”, or “Cold”. If it says “Fire”, wait until the word “rdy” comes again, and then press “Start” again. This might happen more than once.
11. Once the word “Cold” comes, after a couple of minutes it will display a number (i.e. 274).

12. Turn on the Power of the Mask Aligner.
13. Place your mask on the mask holder. It should be placed in such a way that the patterned side faces “up” (Eventually it will face down and your sample).
14. Press the vacuum Mask button.
15. Slide the Mask Holder with your mask, on the stage.
16. Tighten the mask holder clamping knobs. They are located at the left of the Mask Holder stage.
17. Pull the Transport Slide (sample holder) “out”, (take it away from the bottom of your mask holder).
18. Place your sample on the Transport Slide.
19. Push the Transport Slide back “in” (under the mask holder and your mask). At this moment, the patterned side of the mask will be facing the side of your sample that will be patterned.
20. Now you are ready to align your sample. For controlling the contact and separation mode, you need to move the handlers (Contact and Separation Levers) at the lower left side of the mask aligner.
21. The Separation Lever (bottom one) only moves forward and backward. The Contact Lever (the one above) will turn toward or away from you.
 - a. The Contact Lever controls the Z-axis movement of the chuck. It is used for bring the substrate into contact with the mask.
 - b. The Separation Lever is used to move the substrate in and out with the mask in order to perform alignment, once the contact lever has been engaged.
22. While you are in the “Separation mode” you are ready to align your sample. NEVER MOVE YOUR SAMPLE WHILE IN “CONTACT”. This will result in scratching your sample with the mask.
23. You can align your sample by using the Alignment Knobs. Alignment for X-position is below the Transport Slide, the Y-position knob is at the front of the Mask Aligner, and the θ -position knob is just above this last one.
24. Use the microscopes eyepieces for looking at the aligned area, and the Microscope Manipulator Brakes for moving the Microscope Objectives around the area of interest. For moving the manipulator brakes, you will need to press the two buttons on the handler.
25. Select the time interval for which you want to expose your sample.
26. Exposure can only be initiated when the Separation Lever is in the “CONTACT” position (Contact Light is on)
27. Once you have aligned your sample with the mask and you are in the contact mode, you can hit the “EXPOSURE” button. DO NOT LOOK AT THE MASK ALIGNER AFTER YOU PRESS EXPOSURE. UV light is dangerous.
28. Once the exposure is finished, move the Contact lever to separate your sample from the mask. Once your sample is no longer in contact with the mask, you can pull the Transport Slide out and retrieve your sample.
29. Loosen the Mask Holder Clamping Knobs, and take the mask holder out. Place it somewhere with your mask facing up (so it does not get scratched).
30. Press the Vacuum Mask button. Retrieve your mask.

31. Turn off the Vacuum under the table, the Illuminator, the Mask Aligner, and the UV Power Light in that order.
32. Do not turn off (move downward) the Druckluft air pressure and the Stickstoff nitrogen yet.
33. Let it cool for about 20 minutes.
34. Cover the Mask Aligner
35. Now you can turn off the Druckluft air pressure and the Stickstoff nitrogen.
36. Sign out.
37. Close the three regulator valves mounted on the side of the Laminaire flow hood above the mask.