University of Pennsylvania
ScholarlyCommons

Standard Operating Procedures Browse by Type

11-15-2021

ABM Mask Aligner standard operating procedure

Eric Johnston
ericdj@seas.upenn.edu

Follow this and additional works at: https://repository.upenn.edu/scn_sop

Recommended Citation

Johnston, Eric, "ABM Mask Aligner standard operating procedure" (2021). *Standard Operating Procedures.* Book 10.
https://repository.upenn.edu/scn_sop/10

This paper is posted at ScholarlyCommons. https://repository.upenn.edu/scn_sop/10
For more information, please contact repository@pobox.upenn.edu.

ABM Mask Aligner standard operating procedure

Summary/Description

The ABM mask aligner is a manual top-side mask aligner that can accommodate up to 100mm substrates. It can also be used for aligning PDMS components for PDMS-to-PDMS bonding.

Keywords

ABM mask aligner lithography

Creative Commons License

This work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License.

This other is available at ScholarlyCommons: https://repository.upenn.edu/scn_sop/10

Standard Operating Procedure (SOP)

ABM 3000HR Mask Aligner

(MA-03)

In case of emergency please call 911

For any other major safety concern contact EHRS at: 215-898-4453 or via email: ehrs@ehrs.upenn.edu

If there is an error on the system/tool please report it on IRIS, we will take care of it

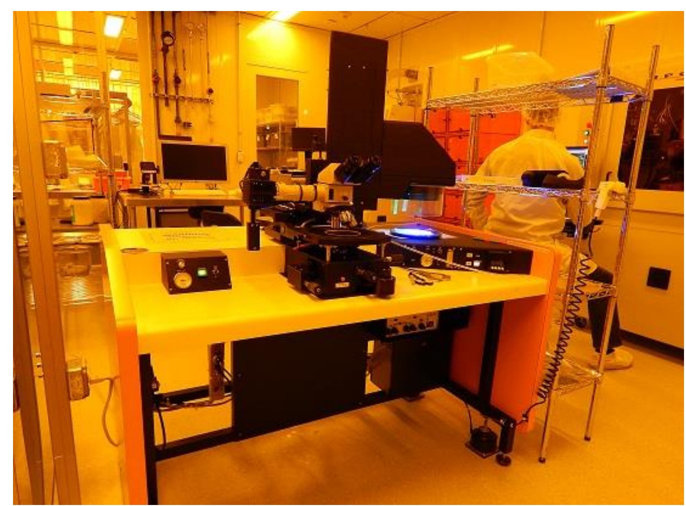
Please *DO NOT* run diagnosis without a staff member's approval

General safety tips and common mistakes

1) Do not place items where they can be knocked off during lamp assembly rotation.
2) Be sure to login through IRIS before trying to operate the tool.
3) SKIP button bypasses the exposure step to return the lamp assembly to the mask-setup position.
4) If you are using the long pass filter, don't forget to put it over your mask before exposure!
5) Make sure it is in contact mode before exposure.

Last Modified: November 15, 2021 by Eric Johnston
Last Reviewed: November 15, 2021 by Eric Johnston

ABM Mask Aligner



Primary tool owner: Eric Johnston.

For questions regarding resist processing, contact Eric Johnston at ericdj@seas.upenn.edu

Problems with the tool ***MUST*** be reported on IRIS. Do not contact primary tool owner with tool issues directly.

Procedure Overview

1) Turn power and nitrogen on.
2) Place mask on mask chuck, chrome-side down.
3) Place substrate on substrate chuck.
4) Use Z-adjustment to bring substrate close to mask.
5) Use CYCLE to move between aligner modes.
6) Use SKIP to bypass exposure.
7) Switch on contact mode, while holding in WEC button, after any alignment has been completed.
8) Adjust exposure time based on resist dose and intensity of lamp.
9) Turn power and nitrogen off. Do not turn off power to light source.

Tool Overview:

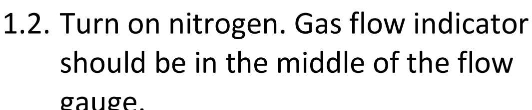
The ABM is a manual top-side mask aligner that can accommodate up to 100mm substrates. It can also be used for aligning PDMS components for PDMS-to-PDMS bonding.

Tool video training:

Standard procedure:
https://www.youtube.com/watch?v=cRzLljt0VLs

Special alignment for film masks:
https://www.youtube.com/watch?v=Q1DvZBQgKhI&list=PLiihbHV9HgpX_9m5Khz2wn-XaxM5-yErU&index=16

Full procedure:

Log into the tool via IRIS	
1. Start up 1.1. Press power button. If it does not light up, you may need to login to IRIS. 1.2. Turn on nitrogen. Gas flow indicator should be in the middle of the flow gauge. 	
2. Mask Set Up 2.1. Remove any dust from mask with N2 gun. 2.2. Place mask on mask chuck, chrome-side **down**. Locate against (not on) the three banking pins. 2.3. If the substrate chuck is interfering with the mask, you may need to lower the substrate chuck by rotating the z-adjustment CW.	

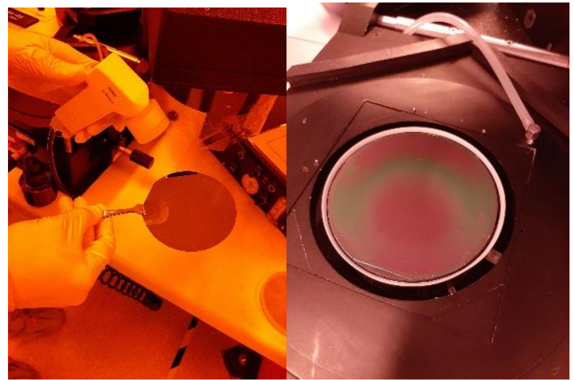
2.4. Turn on mask vacuum by pressing the MASK PUSH ON button. A vacuum level above 20 inHg should register. If there is a hissing sound, try adjusting the mask location.

3. Substrate Setup

3.1. Press the "MASK" button on the right side of the tool. The button will light and the mask holder will tilt upward.

3.2. Remove any dust from substrate with N2 gun.

3.3. Place the substrate on the wafer chuck. If alignment will be involved, the flat must be in a reproducible orientation.



3.4. Turn on the substrate vacuum, SUB ON. Press the MASK button again to lower the mask chuck.

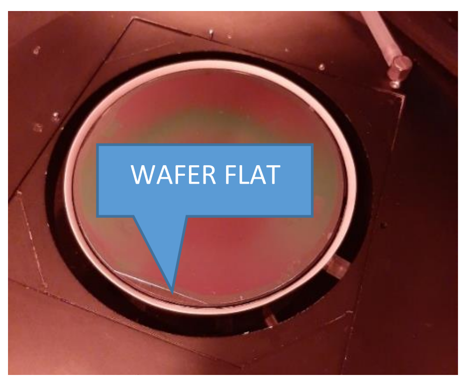
3.5. If necessary, raise substrate closer to the mask using the Z-adjustment. CCW will raise the chuck. Rotate until there is resistance. If the mask is pressed away from the mask chuck (loud hissing sound), lower the substrate chuck and replace the mask in the correct position.

4. Alignment

4.1. Press the CYCLE button once to put the lamp assembly in the alignment position.

4.2. **If there is no alignment, proceed to step 5. Exposure**

4.3. If using a full wafer, orient it such that the flat is in a repeatable orientation.



4.4. Be sure the contact switch (CONT) is OFF to allow free movement between the mask and the substrate.

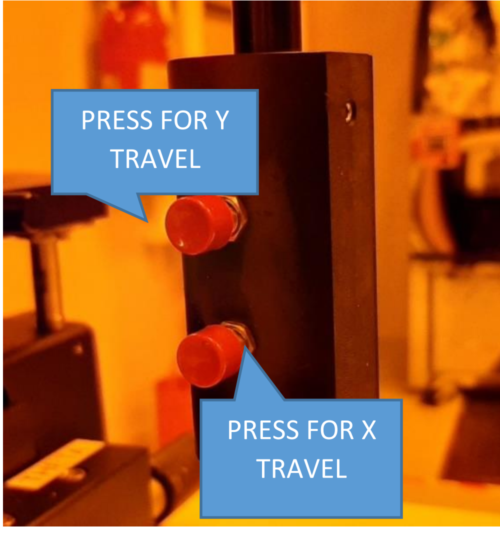
4.5. Turn on the microscope lamp. Do **not** set the brightness to the highest position. This will cause the bulb burn out prematurely.

4.6. Use the handle to move the microscope over the mask.

4.6.1. The top button allows free motion in the X axis.

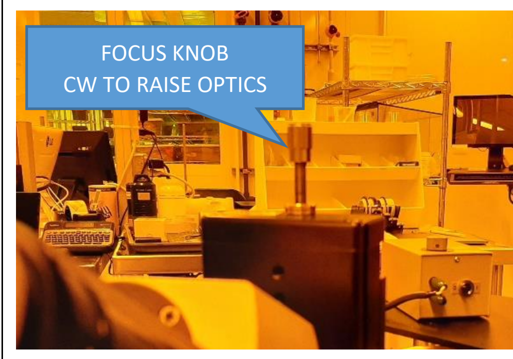
4.6.2. The bottom button allows free motion in the Y axis.

4.6.3. Pressing both buttons allows free motion in both axes.



4.7. Position the microscope over the one of the alignment marks on the **mask**.

4.8. Rotate the focus knob to bring the **mask** features into focus.



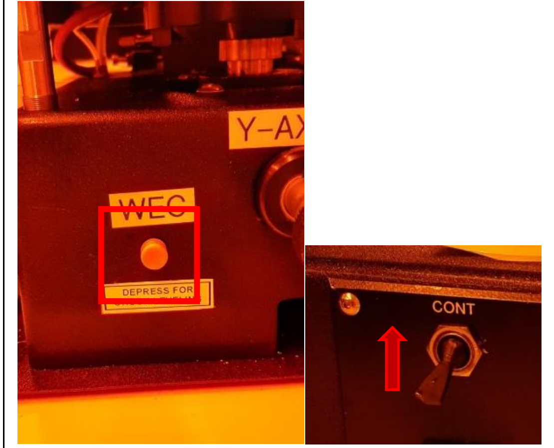
4.9. Use the **substrate** micrometers to find the corresponding alignment mark in the **substrate** features and align it under the **mask** alignment mark.

4.10. Use the handle to move the microscope to the other **mask** alignment mark and proceed as follows:

- Locate the **substrate** alignment mark. This may require adjusting the focus or bringing the substrate closer to the mask.
- Use the theta micrometer to move the **substrate** alignment mark 50% of the distance to the **mask** alignment mark.
- Use the X or Y micrometer to move the **substrate** alignment mark the rest of the way until it is aligned with the **mask** alignment mark.
- Fine tune the alignment from here.
- If it appears that the substrate is rubbing against the mask, lower the Z until the substrate moves freely.

5. Exposure

5.1. When the substrate is in the proper Z location, hold in the WEC button and switch on the contact mode. Then release the WEC button. Interference fringes indicate good contact.

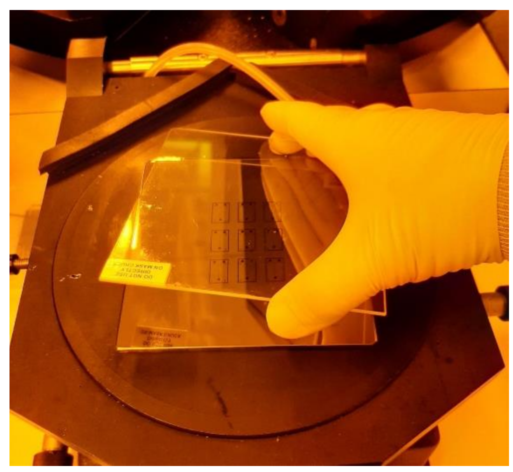


5.2. Set the exposure time using the digit control levers. Digits can be raised or lowered pressing the levers down or up.

The dose can be determined from the resist data sheet. The exposure time = dose (mJ/cm^2) ÷ intensity (mW/cm^2).

NO MASK	20 mW/cm^2
GLASS MASK	17.5 mW/cm^2
GLASS + FILM MASK	13.7 mW/cm^2
GLASS + LONG PASS FILTER	9.4 mW/cm^2
GLASS + FILM + LONG PASS FILTER	7.4 mW/cm^2

5.3. If using the long pass filter, place it on the mask before proceeding to the next step. Do not use the filter directly on the mask chuck. The vacuum generated can crack the filter.



5.4. Press the CYCLE button to advance the lamp assembly to the exposure position. The shutter automatically opens and the exposure begins. After the exposure, press the CYCLE button again to return the lamp assembly to the mask position.

> Note: If the exposure needs to be skipped in order to return to the mask position, press the SKIP button then press the CYCLE button. This will move the lamp assembly through the exposure position and back to the mask position without any exposure. Once it has returned to the mask position, press the SKIP button again to disengage it.

6. Shut Down

6.1. Turn off the mask vacuum and remove the mask.

6.2. Turn off substrate vacuum and remove the substrate.

6.3. Shut off the power.

6.4. Shut off the nitrogen.

6.5. Logout of IRIS.