



ABM Contact Aligner

Safety

- The ABM uses ultraviolet light. Avoid exposure to skin and eyes. **Never press any of the exposure buttons when the exposure system is in its home position.**
- The ABM has moving parts. Make sure that nothing interferes with the movement of the exposure or alignment systems. Interfering with the movement of mechanical parts could damage the instrument or could cause physical harm to the user.
- Do not overcharge the UV lamp during start-up; this will burn out the bulb.
- The UV bulb contains mercury vapor and has the potential to explode. If this happens, evacuate the lab, inform staff, and wait at least one hour before reentering. Do not attempt to clean up the bulb or mercury.

Allowed Materials and Processes

The ABM contact aligner is designed for single or multi-layer photolithography. All UV sensitive resists that have been properly pre-baked should be safe to use. If you have any questions about the compatibility with new resists or substrates, contact staff to get approval.

Restricted Materials and Processes

Do not use wet chemicals or uncured resists on the ABM. The instrument has sensitive components and has no ventilation hood to protect you from fumes. If the ABM needs to be cleaned, spray IPA onto a cleanroom cloth and wipe the instrument.

Operating Procedures

1. SETUP:
 - a. If it is not already on, turn on the lamp power supply switch and allow it to warm up for 5 minutes before turning on UV bulb. To turn on the bulb, press and hold the “Start” switch for approximately 2 seconds. You should see the indicator go up, then back down slightly. You should hear a “tick” sound, indicating that bulb has turned on. UV bulb usually takes about 30 minutes to reach full power, 15mW/cm², measured at 365 nm.
 - b. Turn on system vacuum and nitrogen by opening the valves attached to the wall to the right of the tool.
 - c. Switch on ABM power (red switch) and turn on ABM nitrogen switch. Verify that the flow is between 5 and 10 on the meter. The alignment lights and TV screens should turn on automatically with the red switch.
 - d. Check that there are no filters in place and then load a filter if necessary. Unscrew the two black thumbscrews on the front of the exposure system, remove the dark cover, and slide the filter in from the left. Replace the cover and screw it back on. We have a long pass filter (PL-360-LP) and an I-line filter.
 - e. Verify that the gasket on the substrate chuck is at or below the level of the mask holder. If it is not, lower the substrate chuck until this condition is met. Otherwise the mask vacuum will not work.



- f. Check that the x, y, and theta micrometers are approximately in the middle of their travel and that the substrate chuck is approximately centered in the mask holder opening.
2. LOAD MASK:
 - a. Place your photomask onto the contact aligner with the metal side down and push the mask vacuum button. The mnemonic is “brown goes down.” Check the vacuum gauge and attempt to slide the photomask with your hand to verify a proper seal.
 - b. Note: you may need to rotate the mask after you start alignment. During training you will learn how to rotate the mask.
 3. LOAD SUBSTRATE:
 - a. Raise the mask frame using the switch and place your substrate onto the substrate chuck. There is a metal alignment key to align with the flat on your wafer. Make sure your wafer is not on top of this alignment key. If it is on the key instead of next to it, the wafer could break.
 - b. Turn on the substrate vacuum and verify the vacuum on the substrate vacuum gauge.
 - c. Lower the mask frame.
 4. PLANARIZE THE MASK AND SUBSTRATE:
 - a. Raise the substrate chuck so the separation of the wafer from the mask is ~1mm. Press the leveling button, then switch on the contact vacuum, then release the leveling button, and finally switch off the contact vacuum. This method is more reliable than using the clutched z-height knob.
 5. ALIGN:
 - a. The display monitors and illumination should already be on. The ABM is equipped with two cameras connected to a dual-display on the rear of the instrument. There are three different illumination systems. One light system is the light sources below the display that should come on automatically with the red switch. Next, there is a system underneath the right standard lamp. The last lighting system projects IR light through the wafer for backside alignment. Depending on the type of substrate you are working with, one light source may work better for alignment than the others. We encourage you to experiment.
 - b. Align substrate and photomask using the metal alignment peg for the flat of the wafer or other wafer alignment feature. Photomasks should have alignment markers on the left and right-hand side of the mask. Camera 1 should align with the left alignment marker and Camera 2 should align with the right alignment marker.
 - c. Raise your substrate to less than 1 mm from the bottom of the photomask without touching.
 - d. Before moving the alignment system over, the photomask frame is in the down position and nothing is in the way of the movement of the alignment arm.
 - e. Flip the Alignment switch to move the cameras into position.



- f. Move the objectives in an out using the knobs on the sides behind and above the objectives.
 - g. Align the cameras to the alignment marks on your photomask, by adjusting the vertical focus knobs and the zoom knobs.
 - h. Align the substrate to the photomask using the micrometers on the contact aligner chassis. Alignment is complete when both markers on the substrate are aligned to the photomask.
 - i. Raise the substrate to make contact with the mask and verify that the wafer did not move substantially.
 - j. Turn on the contact vacuum and verify the vacuum on the gauge.
6. EXPOSE:
- a. Check that the exposure switch is set to automatic.
 - b. Adjust the exposure time to ensure proper dosage for your resist and substrate. Be sure to check the manufacturer's protocol for recommendations for your specific resist. (Note: if you are using a new resist or a new thickness, we suggest performing an exposure matrix. Ask staff for help.)
 - c. Flip the exposure switch to move the lamp housing into position and expose the substrate for the set amount of time. Look away from the lamp to avoid exposure to eyes and skin. The lamp will make a loud click when the exposure starts and another click when the exposure stops.
7. UNLOAD:
- a. Home the exposure system.
 - b. Turn the contact vacuum off and lower the substrate if necessary.
 - c. Raise the mask frame. It may need a little bump to get it moving.
 - d. Turn off the substrate vacuum and remove your wafer. If you are done, move on to SHUTDOWN. If you are exposing additional wafers, move to LOAD SUBSTRATE.
8. SHUTDOWN
- a. Turn off the system vacuum and nitrogen by closing the valves attached to the wall to the right of the tool.
 - b. Switch off ABM power (red switch) and turn off ABM nitrogen.
 - c. If you used a filter, remove it and put it away.**
 - d. Wipe down the contact aligner with IPA and clean room cloth.

Troubleshooting

- The alignment and/or exposure switch does not move the appropriate arm into position.
 - Check that the nitrogen and vacuum valves have been switched on.
- The exposure arm moves over but the lamp does not expose the substrate.
 - Check that the red ABM power switch has been flipped on.



- Check that the tool is set to auto-exposure below the timer.
- It is impossible to get the wafers into focus.
 - Check that the wafer is not on top of the alignment pin.
 - Contact staff to re-center the focus.
- The contact vacuum is taking too long to release.
 - Verify that the N2 switch is on and that the flow reads between 5 and 10 when the contact vacuum is off.

Version History

2020.1 – Initial document written by Joshua Heinemann.