Table of Contents

1.0 Purpose/Scope

1.1 Designed for maximum versatility, the OAI Model 808 high-resolution mask alignment and exposure system is a high-performance contact mask aligner developed for ultra-precise, submicron, level-to-level alignment lithography. The system can process a wide range of materials including glass and ceramic ranging in substrate size from 5mm to 200mm.

It is suggested that you review this document thoroughly before proceeding with the operation of this tool.

2.0 Reference Documents

2.1 Chemical Safety & Hazardous Waste Management Rules & Procedures Handbook

3.0 Equipment/Supplies/Material

3.1 2”, 4”, 6” or 8” Wafer Chuck
3.2 4”, 5”, 7” or 9” Mask Holder
3.3 4”, 5”, 7” or 9” Glass Mask
3.4 Resist coated substrate
3.5 Logbook
3.6 Depth gauge
3.7 Tweezers
3.8 UV Protection Safety Glasses or Goggles

4.0 Safety

4.1 The system employs a high-pressure 350W mercury lamp. This lamp is to be changed only by a CSSER staff member. The aligner must be operated with all of its protective shields in place. If a catastrophic failure of the lamp should occur, avoid touching glass debris or inhaling mercury vapor fumes. Notify a CSSER staff member immediately.

4.2 The UV light produced by the lamp can cause Erythema of the skin (similar to sunburn), conjunctivitis and possible retinal burn that could result in blindness. Though the operator is protected from direct exposure to UV light, it is recommended that the operator does not look at the mask/wafer assembly at the time of the exposure; indirect UV light may also harm the eye retina.

4.3 Broken wafers also represent a potential eye hazard. Wear safety goggles/glasses when using the aligner and when removing wafer pieces from the equipment.

5.0 Set Up Procedures

5.1 Reserving the Tool

5.1.1 Reserve the OAI 808 Aligner by using the online equipment calendar. Only 1hr blocks are allowed unless prior approval by Photolithography Engineer.

5.2 UV Lamp

5.2.1 Insure that the lamp is glowing by checking for illumination in the window from the back of the lamp housing. If you cannot see the glow of the lamp, notify the Photolithography Engineer immediately and submit a Service request.

5.2.2 Fill out OAI Logbook with all necessary information. Be sure to complete all fields at the end of your session. Any fields left blank can result in loss of tool privileges or maximum charge.

5.3 Park Objectives

5.3.1 Be sure objectives are placed to the far back of the Mask Holder. This insures better ability when loading and unloading the Mask Holder. Failure to park may cause damage to the objectives.

5.3.2 To manipulate the objectives, use the joystick above the stage. Press the two buttons on the back of the handle to release air brakes and move objectives in place. They enable the objectives to move in either x or y direction.

5.4 Mask Holder Unload/Exchange

5.4.1 Loosen 4 thumb screws on top of mask holder until they pop up. Gently slide the mask holder out until it clears the objectives. Carefully lift the mask holder towards you using the handles provided. Carefully flip the mask holder over and set down on table. Be careful when loading/unloading as the mask holder is very heavy and has vacuum line attached.

5.4.2 If exchanging the mask holder, disconnect vacuum line from front left of stage. Gently turn vacuum connector 1 click to the left and gently pull straight out.

5.4.3 Select the correct size Mask Holder you require.

**The OAI has 4 different Mask Holder sizes 4", 5", 7" and 9". Mask sizes are different thicknesses. If you change maskholder or mask size, you will need to calibrate. Thickness is critical. If you are not sure what your thickness is, Calibrate to be safe or ask a staff member.

5.4.4 Load with correct size mask holder and connect vacuum line. Line up and insert vacuum connector and turn connector 1 click to the right. You are now ready to load your mask.

5.5 **Loading Mask**

5.5.1 Place mask mirror side down within the 3 metal pins on the mask holder. The printed side of the mask should face up. Clamp the mask by pushing the black lever on the mask holder.

5.5.2 Press "Mask Vacuum" on the LCD screen. Mask vacuum is located in the "Manual Test" screen. Go to "Main Menu" to locate manual test screen.

5.5.3 Verify you have mask vacuum. Vacuum gauges are located on the left side of the aligner. Mask vacuum gauge should read greater than -20inHg. If it does not, check to be sure mask is loaded correctly and free of any debris. Contact a staff member if no vacuum can be achieved.

5.6 **Unloading Mask**

5.6.1 Loosen 4 thumb screws on top of mask holder until they pop up. Gently slide the mask holder out until it clears the objectives. Carefully lift the mask holder towards you using the handles provided. Carefully flip the mask holder over and set down on table then press "Mask Vacuum" on the LCD screen to release vacuum. Unclamp and remove your mask.

5.7 **Load Mask Holder onto Aligner**

5.7.1 Gently flip mask holder over and set it in the mask holder platform on the aligner.

5.7.2 Slowly slide the mask holder back until it stops. The mask holder will now be under the objectives. Gently raise the mask holder slightly 1/8" using the handles and slide it the remainder of the way back until it stops. DO NOT raise mask holder too much or you will damage the objectives.

5.7.3 Tighten all 4 thumb screws by pushing them down and turning clockwise until secure.

5.8 **Stage and Wafer Chuck Positioning**

5.8.1 Pull the stage out into the load position using handle on bottom of stage assembly.

5.8.2 To change wafer chuck, disconnect all 3 (CONT, SUB, BALL) vacuum lines attached to the Wafer Chuck and stage. Gently turn each vacuum connector 1 click to the left and gently pull straight out.

5.8.3 Loosen all 3 thumb screws attached to the Wafer Chuck.

5.8.4 Turn the Wafer Chuck slightly until you can lift it off the stage.

5.8.5 Place selected wafer chuck on the 3 legs of the stage with the back of the chuck loaded first. DO NOT FLIP WAFER CHUCKS OVER. Each Wafer chuck is 2 separate pieces. It will separate and fall causing damage to the chuck.

**The OAI has 4 different wafer chuck sizes 2", 4", 6" and 8". Each chuck is specific to a Mask Holder. They are not interchangeable. Be sure you are using the correct chuck with the correct mask holder. Refer to Mask Holder & Wafer Chuck table.

5.8.6 Rotate the wafer chuck until the 2 front legs are secure and centered then tighten the 3 thumb screws.

5.8.7 Connect all 3 (CONT, SUB, BALL) vacuum lines attached to the Wafer Chuck and stage. Each vacuum line is labeled. Match each to the correct connector on the stage. Line up and insert vacuum connector and turn each connector 1 click to the right. You are now ready to load your substrate.

5.9 Loading Substrate for Calibration

5.9.1 If you do not need to exchange wafer chuck or you are ready to load your substrate, place substrate on chuck and center using the wafer alignment pins affixed to the chuck. The 2" chuck does not have alignment pins for wafer positioning. The 4", 6" and 8" chucks have alignment pins to position your substrate.

5.9.2 Press "Substrate Vacuum" on the LCD screen. This is located in the Level Screen. Go to "Main Menu" to locate Level Screen. Gently push in the stage to the align position.

5.10 Level

5.10.1 Be sure stage and mask holder are in a center position before leveling and calibrating.

5.10.2 Press "Level" on the LCD screen. Wait until Level is complete and LCD screen will automatically go to "Run Screen" You are now ready for calibration.

5.11 Gap setting and Calibration

5.11.1 Be sure stage and mask holder are in a center position before leveling and calibrating.

5.11.2 Refer to previous run on logsheet to assist in determining what mask thickness, mask holder, wafer thickness and wafer chuck was used prior and when tooling was last calibrated.

5.11.3 Press "Cal Gap" on LCD screen. You will automatically go to Gap Calibration screen.

Failure to calibrate the gap will damage the tooling and your materials. If this happens, you may lose your access to the tool until the tool is repaired and you may also receive a strike.

5.11.4 Attain the OAI "Depth Gauge" from the storage rack. Turn power on and make sure it is set to mm. Gently place on top of the mask holder and mask.

5.11.5 Set the Jog size to 10um by pressing "Set Jog Size" on the LCD screen and select 10 on the key pad and press enter. Press "Jog Down" on the LCD screen until the Gap reads an additional 100um and no change to the reading on the depth gauge. Zero depth gauge by pressing the "Origin" button and holding until it reads 0.000

5.11.6 Press "Jog Up" until the depth gauge reads 0.001mm then reset the jog size on the LCD screen to 3um and continue to press "Jog Up" until the Depth Gauge reads 0.005mm. Press "Zero Gap" on LCD screen. Calibration is now complete. Select "Run Screen" and unload the stage. This resets the tool to YOUR materials after

calibration. If there are any problems with calibration, contact Carrie Sinclair for assistance.

5.12 **Recipe Creation**

5.12.1 Select "Main Menu" from the LCD screen. Press "Process Settings". Change Process Mode by selecting "Front Side Aligning" using the ↓↑ up/down arrows. Select "Exposure Time in Seconds" and enter your time and using the keypad and press enter. Select "Additional Settings" to change your gap. Select "Gap" and enter your setting in microns using the keypad and hit enter. Select "Return" then "Level Screen" then level.

5.12.2 Place the Optics Toggle switch to the up position for "Top Optics" use (located on the left side of the tool next to the vacuum gauges).

5.13 **Monitors**

5.13.1 If no alignment is necessary, there is no need to turn on monitors. Continue to step 6.3.1

5.13.2 Turn power on to monitors. Switch is located at top left side toward the back of the Digital Video Pattern Generator (DVPG).

5.13.3 Unlock DVPG by pressing the "Lock" button on Camera 1 console until you see a "1" in the top left corner of the monitor. Do this for both the left and right consoles.

5.13.4 Press the "Mode" button on camera 1 console until no reticle patterns appear on the screen. Do this for both the left and right consoles. You are now ready to begin alignment. Turn off monitors when not in use.

6.0 Procedure

6.1 Mask Alignment

6.1.1 Position cameras above your mask by using the joystick. Depress the 2 buttons on the Joystick handle for X & Y direction. Your pattern will be displayed on the monitors. Adjust focus and magnification as needed. These control dials are located on the objective columns. Adjust the distance between the cameras by using the 2 silver thumb screws located to the left and right of the camera assembly. Adjust theta by using the micrometer located behind the camera assembly. Adjust camera illumination as needed using the illumination knobs to the left of the tool. Continue to adjust using all these functions until desired alignment is achieved.

6.2 Load Substrate for Alignment/Exposure

6.2.1 Pull out wafer stage to the load position. Place substrate on wafer chuck and center. Press "Substrate Vacuum" on the LCD screen. Push in wafer stage to the align position. Press "Level" on the LCD screen. When level is complete, it will automatically take you to the Run Screen.

6.3 Align & Expose Substrate

6.3.1 Begin alignment using "X – Y – Z" Micrometers located on the lower front and sides of the wafer stage. To verify alignment, press "Move to Contact Position" on the LCD screen. Gap will go to "0". To realign, separate substrate and mask contact by pressing "Move to Contact Position". Focus, zoom and illumination can be adjusted at anytime during alignment. Once alignment is complete or no alignment is necessary, select the desired contact mode by pressing one of the following on the LCD screen:

Proximity = "Gap Set At" ----0 Microns (this has to be set in Process Settings)

Soft Contact = select "Move to Contact Position"

Hard Contact = select "N2 Hard Contact"

Vacuum Contact = select "Contact Vacuum"

6.3.2 Press "Cycle" to expose your substrate. The housing will move over the stage and shutter will open to begin your exposure. DO NOT stare at the lamp housing while exposure in process. When exposure is complete, the lamp housing will home itself and the stage will unload. Do not pull out stage until unload is complete. When unload is complete, the LCD screen will display the Level screen.

6.4 Unload Substrate

6.4.1 Pull out wafer stage to unload position. Press "Substrate Vacuum" on LCD screen and remove substrate. Push wafer stage in.

6.5 **Unload Mask**

6.5.1 Unload mask holder per step 5.4.1. Unload your mask and put it aside. Re-load mask holder and tighten all thumbscrews.

6.6 **Shut Down**

6.6.1 Be sure mask holder has been loaded, wafer stage is in the align position, objectives are in the park position and monitors are shut off.

6.6.2 Complete logbook. All fields of the logbook MUST be completed.

6.6.3 Clean up all materials. Make sure the tool, work station and surrounding area is clean. Please report anything out of sorts to CSSER staff.

If changing the "Gap" during alignment: Go to Main Screen /Process Settings/Additional Settings. Change to your desired gap setting. Now, go back to Run Screen and select "Move to Contact Position" and de-select. This has to be done in order for the gap to actually be set.

If running a Flood Exposure: **You will need a timer to manually do your exposure. Set the timer to the necessary exposure time you require.** Remove the Mask Holder and leave it off during exposure. Place Substrate on Chuck, apply Substrate vacuum and move stage in. DO NOT LEVEL! Go to Main Screen and Select "Manual Test". Select "Move to Expose Position". Select "Lamp Test" to open the shutter and start the exposure. Immediately start your timer. When your timer alarms, select "Lamp Test" again to close the shutter and stop the exposure. Unload your substrate and select "Move to Align Position" to home the lamp housing.

7.0 Tables

7.1 OAI 808 Aligner Logsheet

Date:	**Full Name:**	**Start Time:**	**End Time:**
Wafer Chuck Size:	**Wafer Thickness:**	**Did you calibrate wafer & Mask thickness?** **Yes / No**	
Mask Holder Size:	**Mask Thickness:**		
Process Mode: **Frontside / Backside**	**Exposure Time (Secs):**	**Photoresist:**	**Gap (um):**
Comments:		**Filter:**	**Lamp hrs:**

Date:	**Full Name:**	**Start Time:**	**End Time:**
Wafer Chuck Size:	**Wafer Thickness:**	**Did you calibrate wafer & Mask thickness?** **Yes / No**	
Mask Holder Size:	**Mask Thickness:**		
Process Mode: **Frontside / Backside**	**Exposure Time (Secs):**	**Photoresist:**	**Gap (um):**
Comments:		**Filter:**	**Lamp hrs:**

Date:	**Full Name:**	**Start Time:**	**End Time:**
Wafer Chuck Size:	**Wafer Thickness:**	**Did you calibrate wafer & Mask thickness?** **Yes / No**	
Mask Holder Size:	**Mask Thickness:**		
Process Mode: **Frontside / Backside**	**Exposure Time (Secs):**	**Photoresist:**	**Gap (um):**
Comments:		**Filter:**	**Lamp hrs:**

Effective Date	Originator	DESCRIPTION OF REVISION	Issue
2/15/10	CS	Initial Release	A
2/01/11	CS	UPDATED	B
4/23/13	CS	Updates/Corrections throughout	C