EVG610 Wafer Bond Aligner – User Manual

Scope

This manual outlines the procedure to operate the EVG610 wafer bond aligner to mount and precisely align two 4-inch wafers on the EVG bonding fixture. After alignment, the bonded pair is transferred to the EVG510 bonder for final bonding.

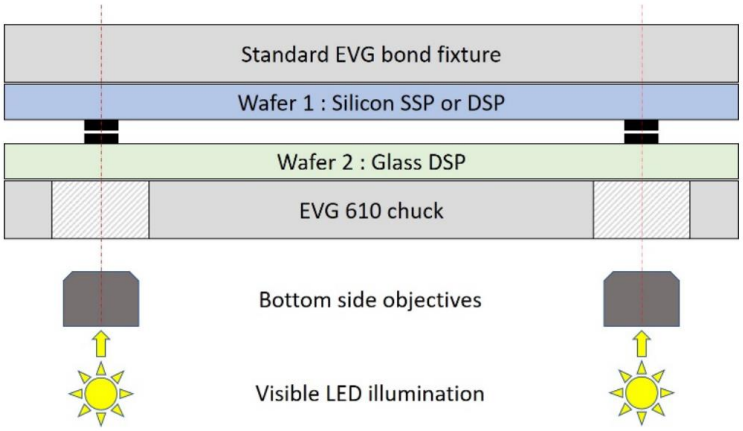
Safety

- Only trained and authorized users may operate this procedure.
- Reserve time on **EVG510** prior to beginning your EVG610 session. Ensure the bond tool is cooled down and ready to use.
- Contact an AggieFab staff member to check out the **quartz plate** before use, and return it promptly after your session.
- The tooling for this tool is extremely expensive. Use extreme caution when installing/uninstalling any tooling. Store extra mask holders and chucks in containers or shelves provided by AggieFab. Avoid scraping or moving anything across smooth surfaces used for vacuum or sealing.
- If you are unsure about any part of the procedure, or encounter errors during operation, contact an AggieFab staff member immediately.

Alignment mode options and requirements

A . Silicon wafer to glass, visible illumination

This mode is used when one of the wafers (typically glass) is transparent to visible light. It is the standard method for **anodic bonding** of borofloat glass to silicon.



Requirements:

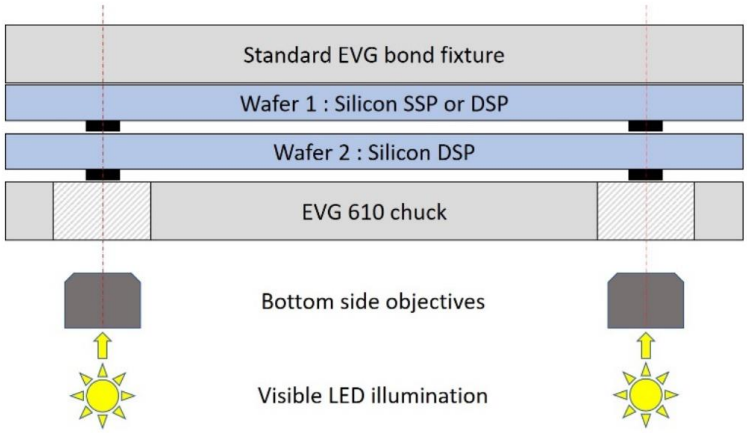
1) The glass wafer is double-side polished (DSP).
2) Alignment marks must be on the bonding interface of both wafers.
3) Alignment mark positions must fall within:

   ±15,000 µm < X < ±45,000 µm,

   ±10,000 µm < Y < ±10,000 µm.

B . Silicon wafer to silicon wafer, visible illumination

This configuration is used when both wafers are silicon, opaque to visible illumination. The fabrication will require additional process steps since the alignment marks will need to be replicated on the opposite side of wafer 2.



Requirements:

1) The bottom silicon wafer (wafer 2) is double-side polished (DSP).
2) Alignment marks are present on the bond interface of of wafer 1, and on the opposite

side of wafer 2.

3) Alignment mark positions must fall within:

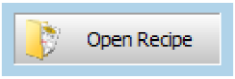
   ±15,000 µm < X < ±45,000 µm,

   ±10,000 µm < Y < ±10,000 µm.

In this operation mode, the first wafer is loaded and the alignment mark positions are found with the bottom side objectives. The positions are recorded by placing a visual indicator on the mark (crosshair) or by grabbing an image (overlay). The second wafer is then loaded and aligned with the crosshair or the overlay image.

Starting a job with the EVG610 user interface

The EVG610 user interface opens automatically with the application. Select the **"Open Recipes"** tab to access available recipes.

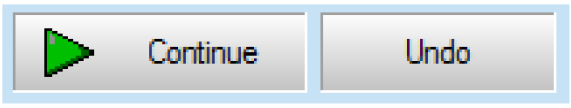


All recipes will be available in the users' individual folder:

Do not change the parameters in the recipes unless it has been discussed and approved by the Staff. Any modified recipe must be saved in your personal "User" folder.

Sequence example: borofloat to silicon with overlay alignment

This process consists of 28 guided steps. Follow each step carefully. Animations and text descriptions are provided in the interface. Use **"Undo"** if alignment is unsatisfactory.

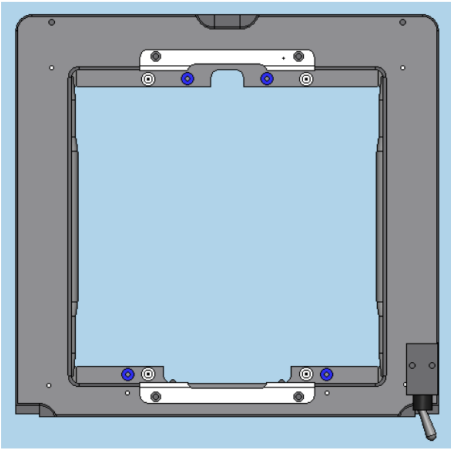


STEP-BY-STEP INSTRUCTIONS

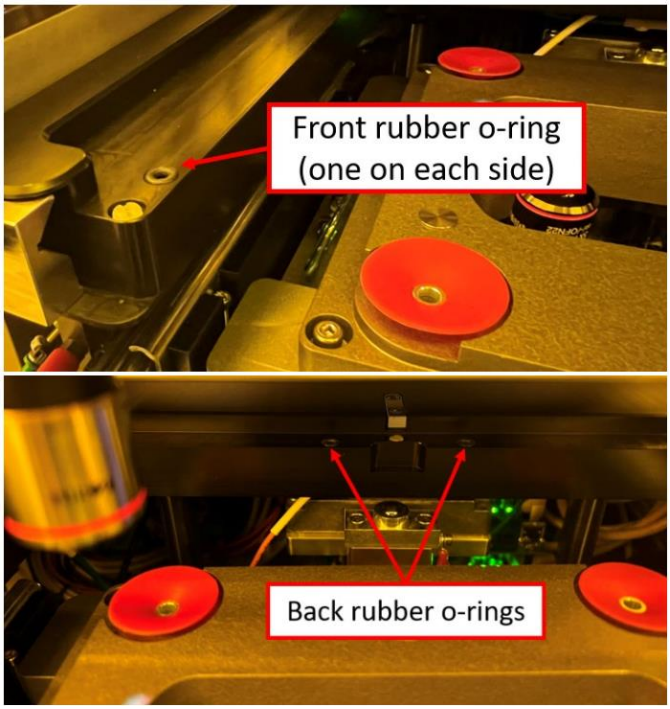
Step 1: "***Configure Optic***" → no action needed.

Step 2: "***Move Tray out***" → Pull the tray out completely

Step 3: "***Insert Adapter Frame***" → Gently insert the adapter frame

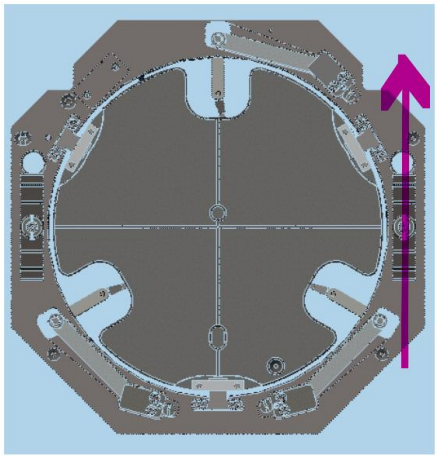


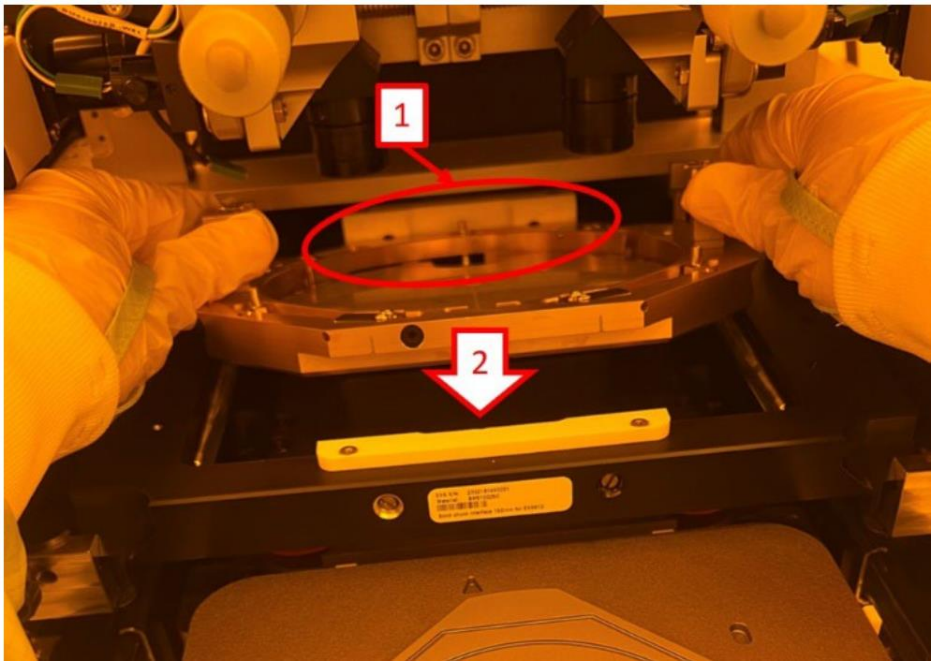
⚠ **Warning!** Check all **four o-rings** are present. Missing o-rings can compromise alignment. Report to staff if any are missing.



Step 4: "***Fix Adapter Frame***" → make sure to screw the adapter frame in place with the clamps.

Step 5: "***Insert Bond Tool***" → Insert the fixture. The schematic depicts how the fixture should be inserted into the frame. Pay attention to the position of the spacers. The fixture is first pushed in to contact the back of the fixture with the frame, and then the front section is pushed down to fit correctly inside the frame.





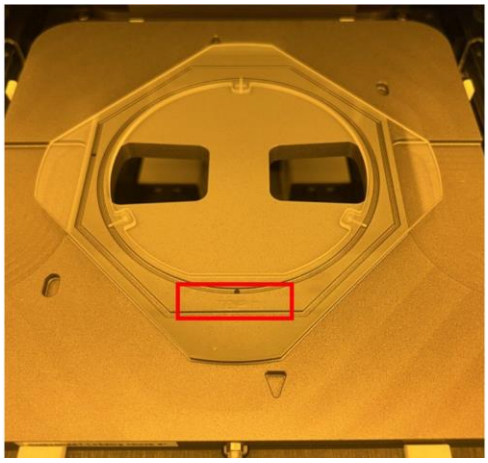
Step 6: "***Remove Clamps***" → Rotate the clamp knobs as depicted in the animation.

⚠ **Warning!** Make sure that the clamps are out by also checking visually. Clamps that are still in can damage the tool and the first loaded wafer!

Step 7: "***Remove Separation Spacer***" → Push the spacer levers as depicted in the animation.

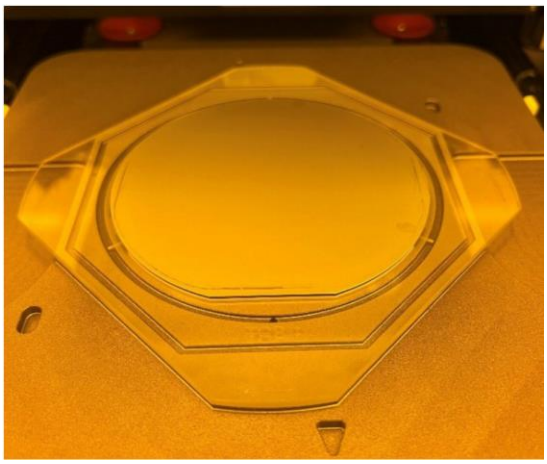
Step 8: "***Insert Chuck, Connect Vacuum***" → Do not forget to connect the vacuum tube.

Step 9: "***Insert Ruler***" → The ruler is a simple tool to align the wafer on the chuck. Since it is extremely clunky to use, we will not insert it. Instead we are going to insert the quartz plate at that step, as shown below:



⚠ **Warning!** The operator should be able to read "TOP" in the frame highlighted in the image above. If it is inverted, then the orientation of the quartz plate is wrong! This quartz plate is **fragile and expensive**, once it has a crack, it cannot be function anymore, please contact Aggiefab member for the use in your wafer bond aligner session and return it back when you session is over.

Step 10: "***Load Top Substrate***" → Load wafer 1 on the three contact points. The substrate is loaded with the bond interface facing DOWN. Make sure to align the flat with the quartz plate.

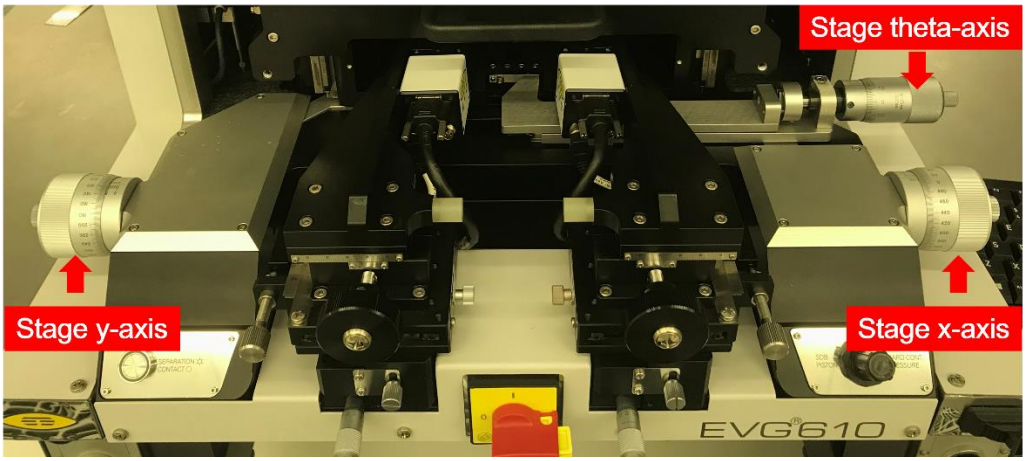


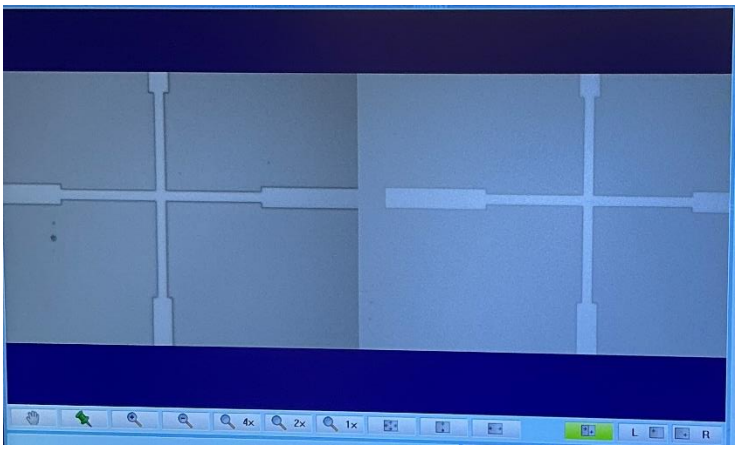
Step 11: "***Remove Ruler***" → No action needed.

Step 12: "***Load Tray In***" → Push the tray all the way in the machine.

Step 13: "***Move Stage In Center Position***" → Adjust the knobs as required. x- and y-axis zero positions are 5mm, theta axis zero position is 7.5mm. The wafer will now be pushed in contact with the fixture (Wedge Compensation …)

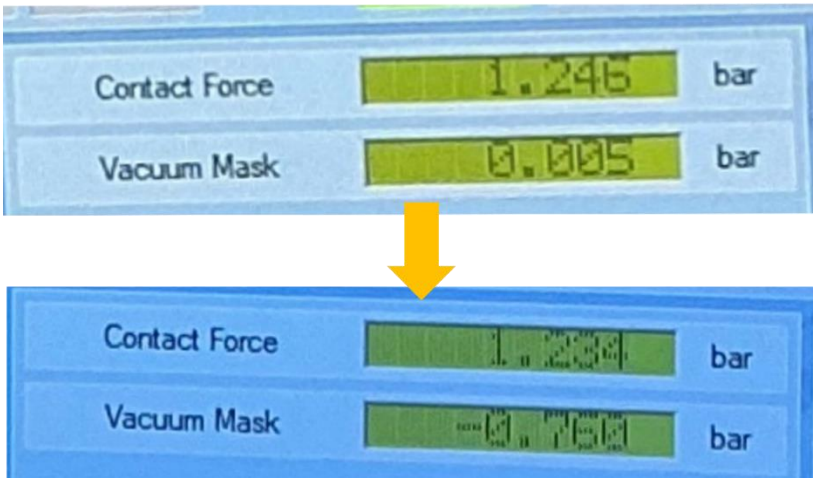
Step 14: "***Adjust Microscope***" → Adjust the position and focus of the bottom-side left and right microscope objectives until the alignment marks are centered in the field of view.





⚠ **Warning!** The backside microscopes x- and y- position should no longer be moved after this step!

Step 15: "***Adjust Substrate Focus***" → Optimize the focus. In this step, wafer 1 is transferred from the chuck to the fixture.



Step 16: "***Adjust crosshair***" → Align the green crosshair with your alignment marker.

Step 17: "***Move Tray out***" → Pull the tray out completely

Step 18: "***Insert Ruler***" → no action needed. The quartz plate is already on the chuck. Do not use the ruler!

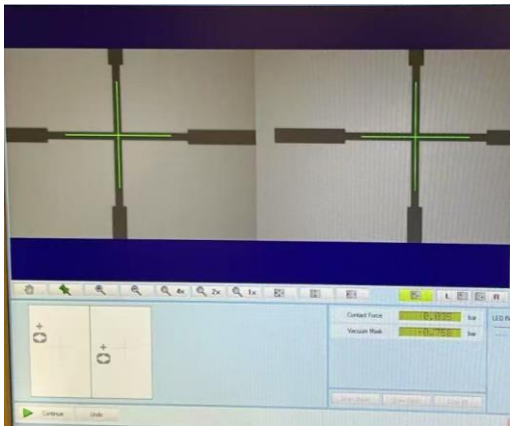
Step 19: "***Load Bottom Substrate***" → Load wafer2 on the three contact points. The substrate is loaded with the bond interface facing UP. Make sure to align the flat with the quartz plate.

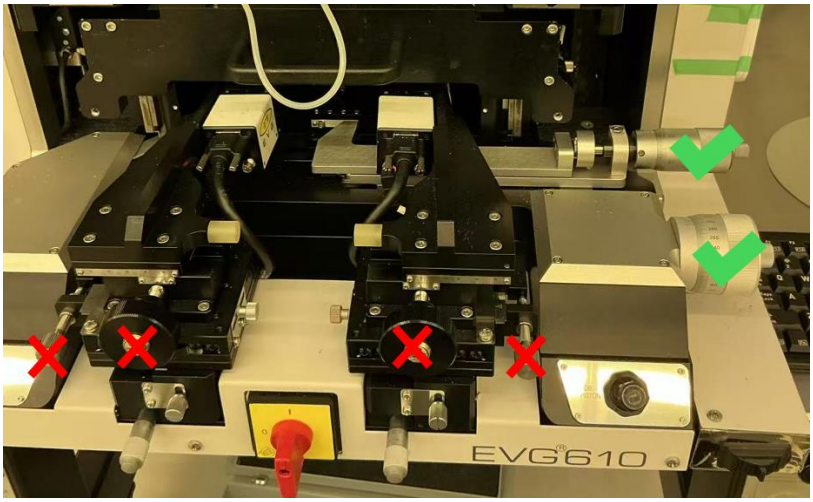
Step 20: "***Remove Ruler***" → no action needed.

Step 21: "***Load Tray In***" → Push the tray all the way in the machine.

Step 22: "***Pre-align Substrate***" → Adjust wafer2 to align with the crosshair. Wafer2 should now be visible in the field of view of the microscope objectives, assuming the alignment marks have been correctly replicated on the wafer backside. The wafer is moved with the stage knobs on both sides of the machine. Move the wafer until it is correctly pre-aligned on the both sides.

⚠ **Warning!** Make sure not to touch the objective knobs!!

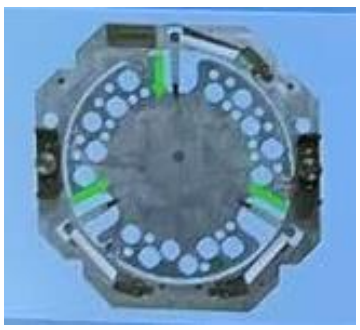




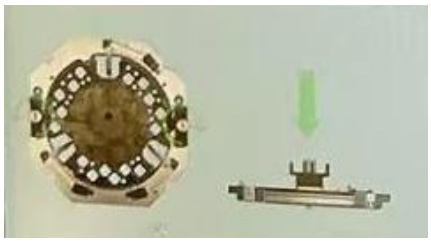
Step 23: "***Align Substrate***" → Align wafer2 with the crosshair. Repeat the alignment as in the previous step.

Step 24: "***Check Contact Mode***" → Repeat step 23 with an alignment offset until the wafers are correctly aligned.

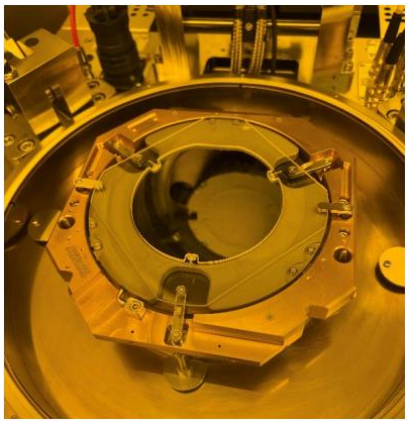
Step 25: "***Insert Separation Spacer***" → Insert three separations beneath the wafer 1. If you feel resistance while inserting a spacer, it may be touching the edge of wafer 1. In that case, gently press down on the tip of the spacer to guide it smoothly underneath the wafer.



Step 26: "***Insert Clamps***" → Insert clamps as shown in the animation. Make sure to push the clamp knobs all the way down in order not to touch the quartz plate during rotation. Try to release the knobs simultaneously on both clamps. If done properly this action should not induce any loss of the fine alignment.



Step 27: "***Remove Bond Tool***" → Remove the fixture from the frame. Try to pull up the front of the fixture first. Proceed carefully in order to avoid any shocks that could affect the alignment. The fixture can then be rotated and transferred to the bonding chamber of the EVG 510 equipment.



Step 28: "***Move Tray out***" → Pull the tray out completely.

Step 29: "***End Of Process***" → Press Exit. Make sure to press "EXIT" to complete the sequence and not "Continue", as "Continue" will restart the sequence from step 1.

Signatures and Revision History

Author: Yu Chen, Research Engineer

1. Date: May, 5th, 2025
2. Revision: A
3. Updates: Initial version; incorporates full EVG610 wafer bonding alignment steps.

Approvals

Technical Manager Signature: Sandra G Malhotra

Date: 5/8/2025

Revision History:

Revision	Author	Date
Original version	Yu Chen	05/05/2025