

Heidelberg MLA-150 Standard Operating Procedure

CORAL Name: **MLA-150**
Model: Heidelberg MLA150 Maskless Aligner
Location: TRL Photo-Au Room
Purpose: Direct-Write Lithography
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Introduction

The Heidelberg MLA-150 Maskless Aligner is a direct-write photolithography tool for samples ranging from small pieces (minimum 5x5 mm²) to 150mm wafers or 7" photomasks. The tool utilizes diode lasers (365 nm or 405 nm) and a high-precision stage to directly pattern photoresists from a CAD file. Both lasers can write a minimum feature size of 1 micron with alignment accuracy between layers of 500 nm. Write time will depend on the pattern, substrate size and the laser source; a small piece can be patterned in <5 minutes while a 150 mm wafer can take up to 60 minutes.

Design files should be one of the following formats: GDSII, DXF, CIF, GERBER. CAD files are converted to "Job Files" which the tool uses to write the pattern on a substrate. Users should refer to the MLA-150 Exposure SOP (Quick Guide) for more information on setting up job files and running exposures. This document describes the procedure for loading and unloading substrates.

Safety

Read and understand this SOP before use. Only trained personnel may operate this system. The MLA-150 uses two types of lasers: one for position measurement of the stage and one for design exposure. When the window is closed the system is a Class 1 laser. When the window is open for sample loading and unloading the stage interferometer laser is accessible and the system is a Class 2 laser.

The exposure lasers are very powerful diode lasers which are normally covered by optics covers and should not be accessible to users. If the optics covers are removed then the 405 nm (<10 W) and 375 nm (<3 W) are rated Class 4 and can be damaging to eyes and skin. The exposure lasers should not be accessed by unqualified users under any circumstances.

To protect the operator from hazards, interlock circuits prevent stage movement and access to laser light as soon as the window opens. A safety switch stops the stage, holds it in position, and closes the laser shutter even if an exposure has been running at the moment the window is opened. Users should observe safety labels and not make any attempt to bypass safety measures.

Procedure

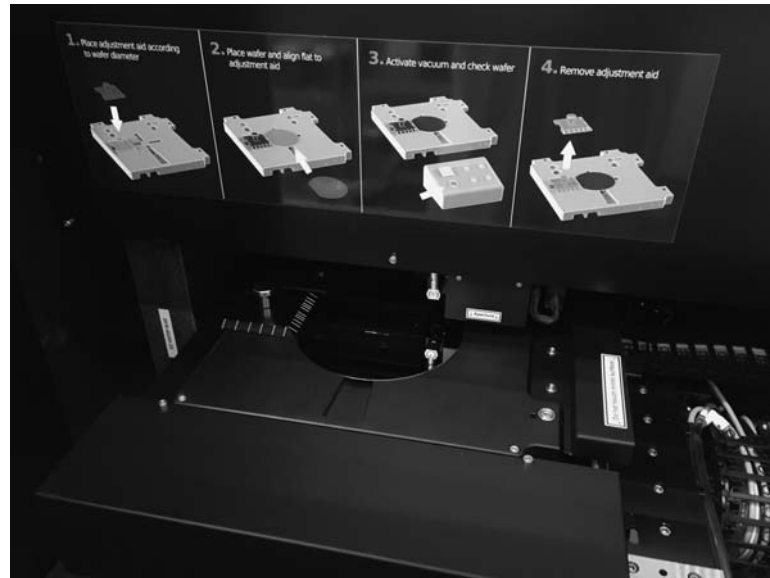
1. Check reservations in CORAL to ensure you have reserved the correct machine at the correct time. Engage the tool in CORAL.
2. Load your sample onto the stage:
 - a. Press the Yellow Light Button to illuminate the interior of the tool, then press the Red Window Up/Down Button to open the window.



- b. Select the Wafer (left) or Piece (right) adjustment aid and place it on the stage according to the wafer size. The Piece aid locks into place for pieces 10x10 mm² or smaller (minimum 5x5 mm²); the Wafer aid has notches for 150 mm, 125 mm, 100 mm, 75 mm, 50 mm, and 25 mm. The aid centers your sample on the chuck and aligns the flat parallel to the stage.
 - i. NOTE: The system uses air to focus on the substrate so transparent substrates can be run without issue. However, pieces smaller than 5x5 mm² are not suitable because there is not enough surface area for the system to focus properly.



- c. Place wafer or piece on the stage and center the flat on the alignment tool.



- d. Activate the vacuum by pressing the round, silver vacuum button. The button will illuminate RED and the gauge will indicate the vacuum level. Check that the vacuum level indicator text is GREEN and check the substrate with your tweezers to ensure it is held in place.



Good Vacuum



Bad Vacuum

- e. Remove the adjustment aid (system will not run if aid is still in place), close the window by pressing the Red Window Up/Down Button, and turn off the system light by pressing the Yellow Light Button.
3. Refer to the MLA-150 Exposure SOP (Quick Guide) for step-by-step instructions for creating a New Job, running an existing Job, running dose-exposure tests, running aligned exposures, and converting design files.

- a. Make sure the substrate is placed under the write-head (red spot on substrate); this is particularly important for small substrates. Please observe a minimum substrate size of 5x5 mm²; substrates smaller than this do not have sufficient surface area for the pneumatic auto-focus. This can result in the write-head crashing into your sample and causing damage to both your substrate and the system.
 - b. Start the exposure.
 - c. A countdown clock will appear with an approximate time for job completion. Please note that the actual time is typically shorter than the time displayed.
4. When the exposure is complete a window will pop up and ask if you want to unload the substrate (or will auto-unload if that option was selected). Click Unload. The stage will move back to the home position.
 - a. Press the Yellow Light Button to illuminate the interior of the tool.
 - b. Press the Red Window Up/Down Button to open the window.
 - c. Press the round, silver vacuum button to release the chuck vacuum and remove your substrate.
 - d. Press the Red Window Up/Down Button to close the window.
 - e. Press the Yellow Light Button to turn off the chamber light.
5. Ensure the system is in a safe state and Disengage the tool in CORAL being sure to enter the correct data in the report fields.