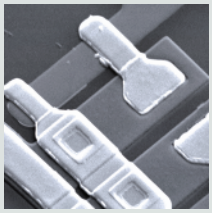
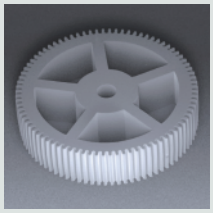
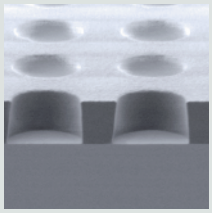
HEIDELBERG INSTRUMENTS

MLA 150

THE ADVANCED MASKLESS ALIGNER







heidelberg-instruments.com

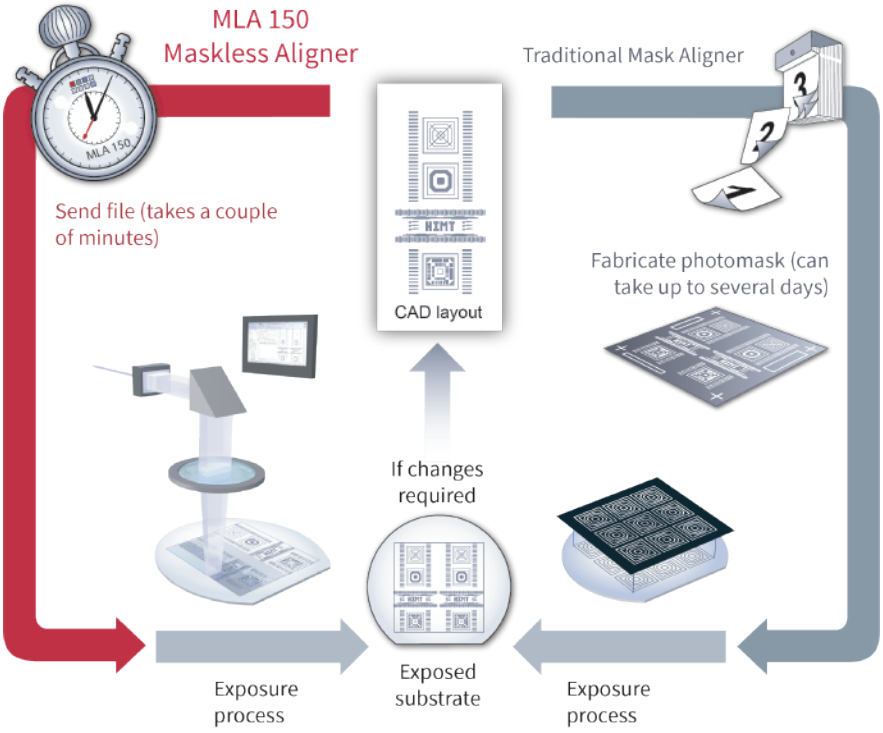
MLA 150

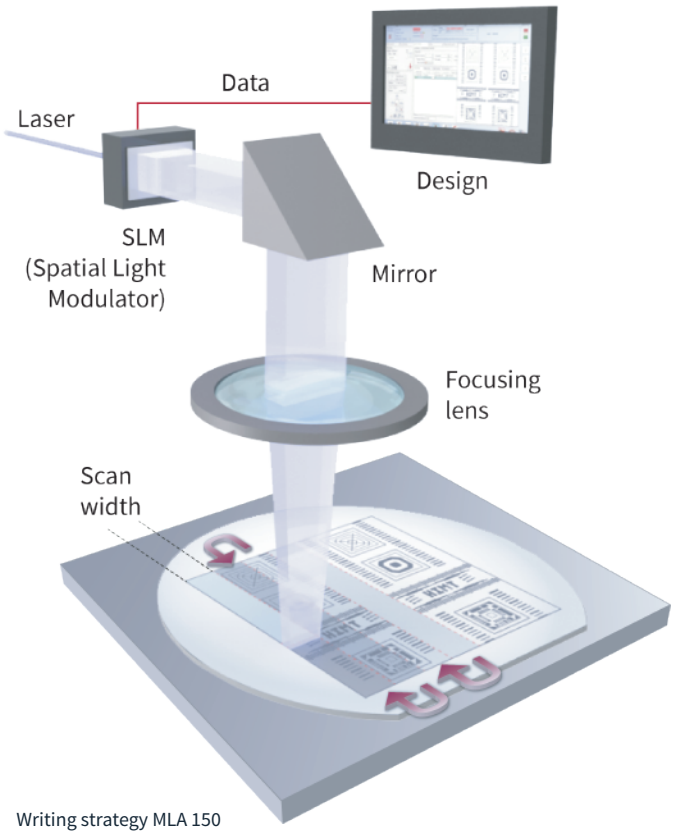
THE ADVANCED MASKLESS ALIGNER

The Maskless Aligner MLA 150 takes you into the future of photolithography: the traditional photomask becomes a thing of the past as your design file is exposed directly onto the resist-coated wafer via a 2-dimensional spatial light modulator.

THE NEW PHOTOLITHOGRAPHY CYCLE

In addition to flexibility and economy, the MLA 150 provides non-contact exposure, outstanding ease of use, and high speed, making it the ideal tool in rapid prototyping environments, for low- to mid-volume production, and Research & Development. The Maskless Aligner was first introduced in 2015. Since then, the revolutionary, state-of-the-art maskless technology has become firmly established. Today, the MLA 150 serves as a trusted, indispensable workhorse in many multi-user facilities, nanofabrication labs, and national institutes. Application areas include MEMS, micro-optics, diffractive optical elements, sensors, electronic components, and many more.





Writing strategy MLA 150

THE RASTER SCAN WRITING STRATEGY

Directly modulated light illuminates the resist-covered surface according to the design data; this precise exposure immediately generates the pattern. This process is called “direct writing” – as opposed to projecting an image through a mask. The design layout is converted into a pixel image and during exposure, the image is created by projecting each pixel onto the photoresist through the optical system while the stage advances continuously. The spatial light modulator effectively takes on the role of a programmable photomask.

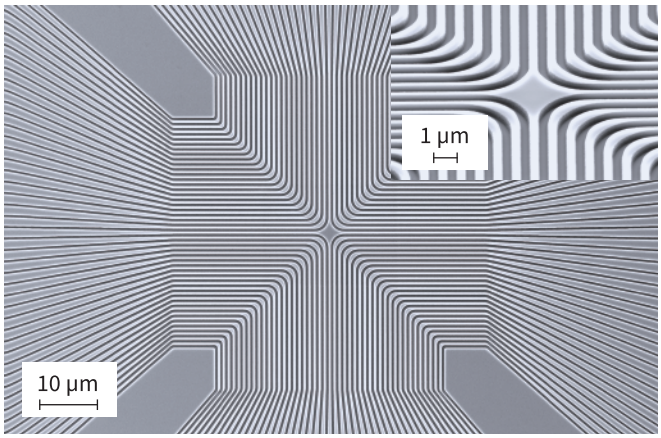
- High-speed spatial light modulator (SLM)
- Bi-directional writing process
- “Empty stripes” optimization
- Ultra-fast x-y stage

MLA 150 EXPOSURE TIMES*

Laser wavelength	405 nm
50 x 50 mm²	4 minutes
100 x 100 mm²	9 minutes
150 x 150 mm²	17 minutes
200 x 200 mm²	36 minutes

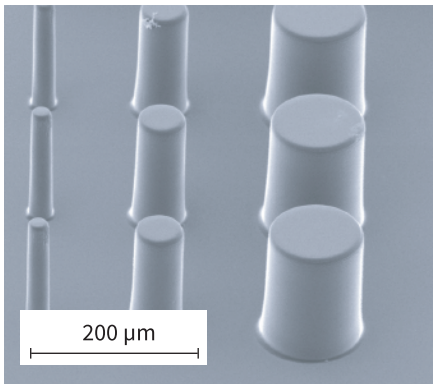
*For exposure at 80 mJ/cm² and minimum feature size of 1 µm

HIGH RESOLUTION



450 nm lines & spaces, Resist AZ MIR 701, wavelength 375 nm

HIGH-ASPECT RATIO

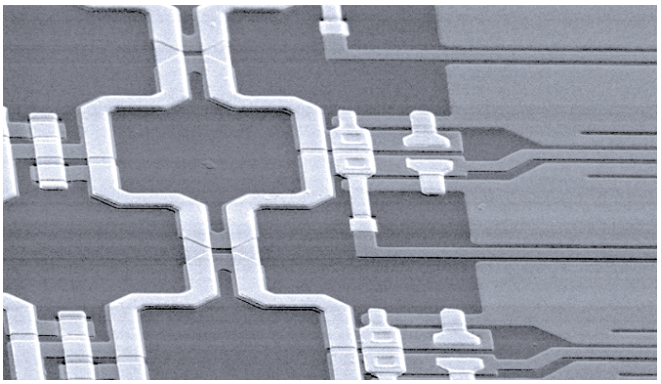


High-aspect ratio: pillars. Resist: 160 µm SU-8

- Adjustable depth of focus
- Aspect ratio up to 1:20
- Applications: micro-fluidics, MEMS, waveguides

FAST AND HIGH-PRECISION ALIGNMENT

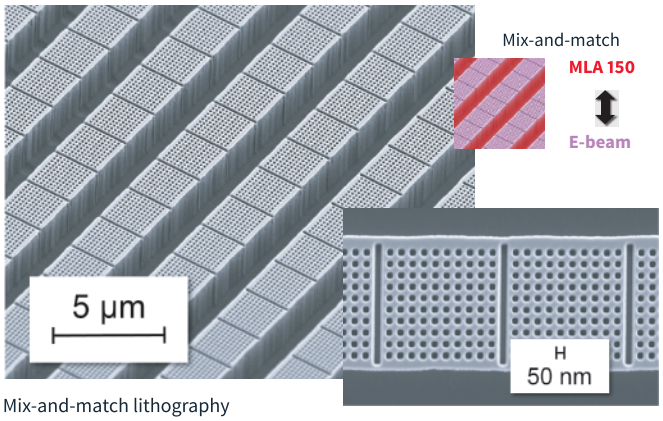
- Global and field-by-field alignment
- Backside alignment
- Alignment accuracy of better than 500 nm
- Fast and easy alignment procedure
- Alignment error compensation: corrects for rotation, offset, scaling and shearing.
- Allows mix-and-match between different tool-sets, e.g. e-beam or thermal scanning probe lithography and laser lithography.



SQUID magnetic flux sensor; 18 layer process

Courtesy of the Kirchhoff Institute for Physics, Heidelberg

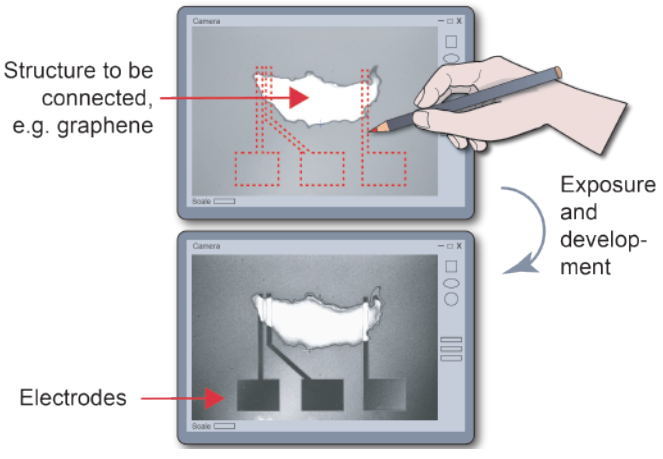
MIX-AND-MATCH APPLICATIONS



Mix-and-match lithography

Courtesy of EPFL LMIS1, Lausanne

FLEXIBILITY



The Draw Mode

- The available solid-state laser sources (405 and 375 nm) make the system compatible with all broadband UV photoresists (including SU-8) and can both be installed in the MLA 150 at the same time.
- Different exposure modes: Fast – Quality – High Quality
- Optional: additional vacuum chucks for small substrates, foils, and warped substrates
- The Draw Mode: add individual features to a previously patterned substrate. Using graphic elements, or even a bitmap, simply “draw” the desired structures – such as labels, markers, or electrical connections – directly into the camera image.

MLA 150

SYSTEM SPECIFICATIONS

	Write Mode I*	Write Mode II*
Writing performance		
Minimum feature size [µm]	0.6 Optional 0.45	1
Minimum lines & spaces [µm]	0.8 Optional 0.45	1.2
Global 2nd layer alignment [nm]	500	500
Local 2nd layer alignment [nm]	250	250
Backside alignment [nm]	1000	1000
Max. write speed 405 nm laser [mm^2/min]	400	1400
Max. write speed 375 nm laser [mm^2/min]	400	600
System features		
Light source	Diode lasers: 8 W at 405 nm, 2.8 W at 375 nm, or both	
Substrate sizes	Variable: 3 x 3 mm^2 to 9″ x 9″ Customizable on request	
Substrate thickness	0 - 12 mm	
Maximum exposure area	150 x 150 mm^2 | Optional: 200 x 200 mm^2	
Environmental chamber	Temperature stability ± 0.1 °C	
Real-time autofocus	Air-gauge or optical	
Autofocus compensation range	180 µm	
Grayscale	128 gray levels	
Software features	Exposure wizard, resist database, automatic labeling and serialization, Draw Mode for CADless exposures, substrate tracking / history	
System dimensions (lithography unit)		
Height × width × depth	1950 mm × 1300 mm × 1300 mm	
Weight	1100 kg	
Installation requirements		
Electrical	230 VAC ± 5%, 50/60 Hz, 16 A	
Compressed air	6 - 10 bar, stability ± 0.5 bar	
Economical considerations		
Saves on the cost of photomasks		
Low running costs for maintenance, energy consumption, spare parts		
Solid-state laser light sources with lifetime of several years		

*Only one write mode can be installed on the system

Please note:

may vary according to equipment configuration. Write speed depends on exposure area. Design and specifications are subject to change without prior notice.

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