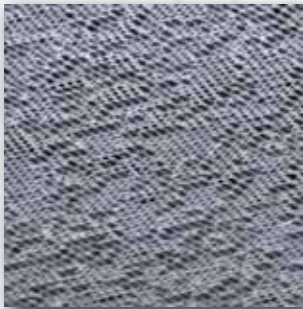
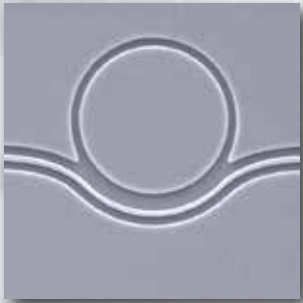


# **HEIDELBERG** **INSTRUMENTS**



pioneers in photolithography

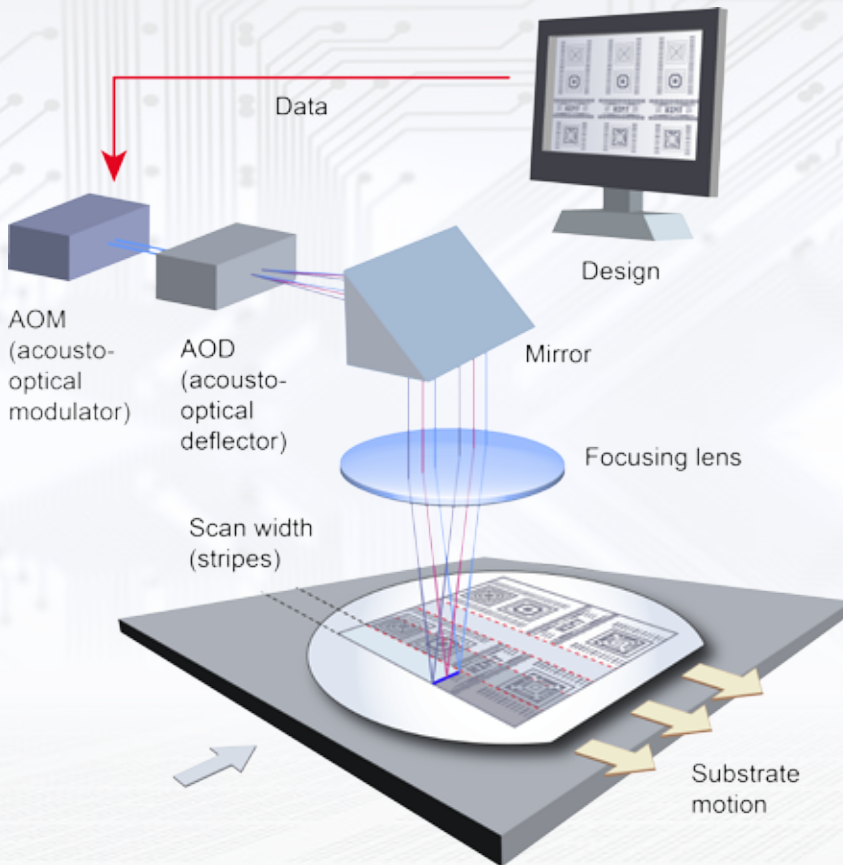


## **DWL 66+**

***The Ultimate  
Lithography  
Research Tool***

The DWL 66<sup>+</sup> laser lithography system is a highly versatile, high-resolution pattern generator for low-volume mask making and direct writing. Its customer base includes over 250 leading universities, research facilities, and companies worldwide.

The system features powerful standard options such as the *High-Resolution Mode*, backside alignment (BSA), and the optical autofocus. In addition to high-resolution 2D patterns, the system also supports the creation of complex 3D



structures in thick photoresist with the help of the grayscale exposure mode. The DWL 66<sup>+</sup> can be equipped with either a 405 nm laser for work with all broadband resists, or with a 375 nm UV laser that in addition allows the use of SU-8 and other i-line-resists. Advanced professional options like the *High-Accuracy Coordinate System* and an automatic loader are also available.

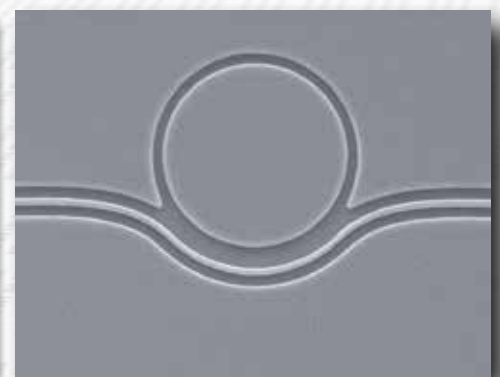
With a minimum structure size of 300 nm, the DWL 66<sup>+</sup> provides the ultimate in high resolution, outperforming the most powerful optical lithography systems in the Research & Development market segment. The system's main application areas can be found in optical sciences, material research, micro-engineering and micro-electronics.

## The high-resolution mode

This is one of the six write modes that are available for the DWL 66<sup>+</sup>. The optimized optics and electronics setup of the *HiRes Write Mode* provide ultimate stability and resolution and enable exposures of structures with a minimum feature size of 300 nm.



Minimum feature size: 300 nm - or even less. The image shows the result of a high-resolution test exposure with a nominal linewidth of 250 nm!



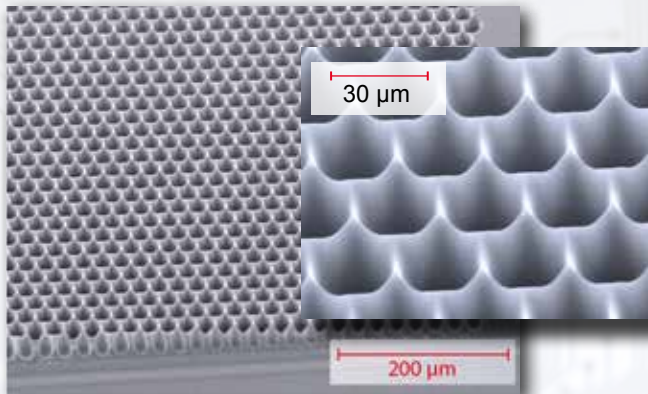
A channel waveguide coupled to a ring resonator. The waveguide is approximately 320 nm wide, the resonator diameter is 3 μm. The exposure laser wavelength was 405 nm. Design created with [1].



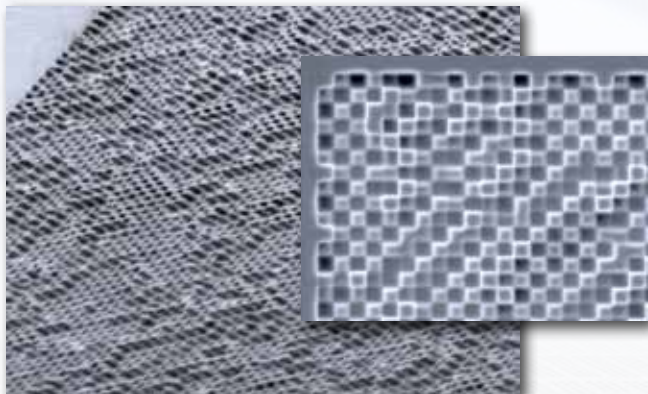
## A choice of grayscale capabilities

Grayscale lithography uses a low-contrast positive photoresist. The exposure intensity gradient transfers directly into exposure depth. The result after processing is a 3D topography on the microscale.

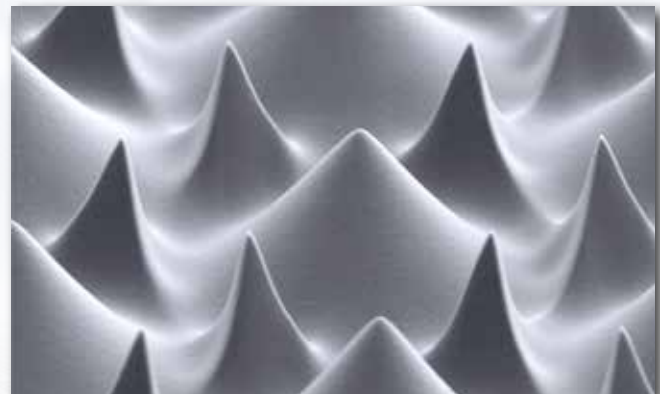
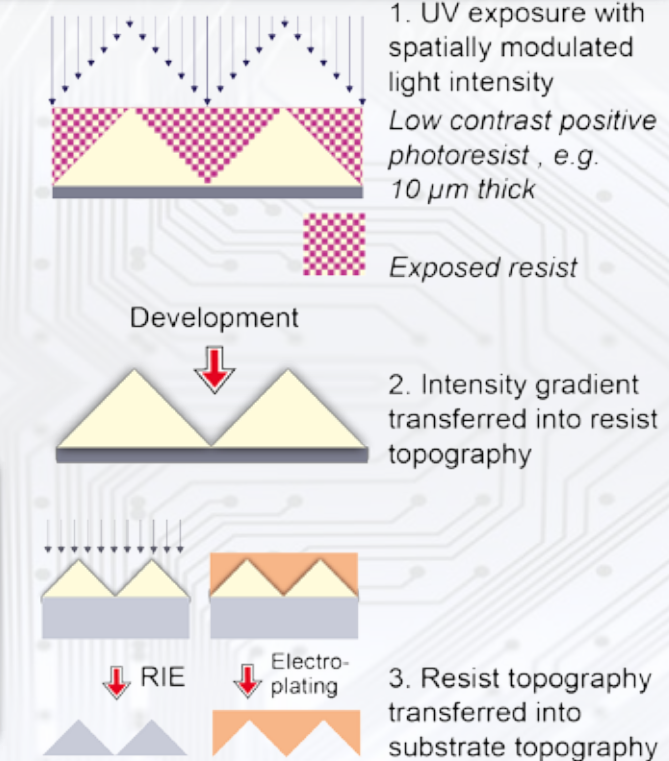
Whether basic, advanced or professional - the grayscale mode presents a powerful tool for the creation of **complex topographies** - for example for micro-optical components or MEMS.



**Microlens array** - width of lenses 20 µm, depth 30 µm



**DOE** - resist AZ 4633, resist thickness 4 µm, structure size 2 µm



**Diffuser** - resist AZ 4562, structure size < 5 µm

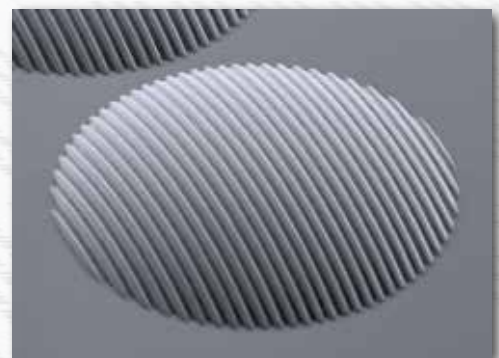
Image courtesy of IGI

## Advanced options and upgrades

- **Professional Grayscale Exposure Mode**  
Allows the exposure of CAD files with up to 1000 gray levels in order to create complex topographies for applications such as micro-optics. Includes highly sophisticated software package.
- **High-Accuracy Coordinate System**  
Includes various technical measures to improve the thermal stability and position accuracy of the stage's coordinate system. Provides improved specifications for 2nd layer overlay accuracy.
- **Automatic Loader**

Handling of masks up to 7" and wafers up to 8". Optional second cassette station. Pre-aligner and wafer scanner available.

- **Basic Freeform (BFF)**  
Exposures on non-planar substrates with features down to 3 µm. Typical applications are microstructures on top of convex or concave lenses.



Grating on concave lens

Courtesy of Fraunhofer IOF

## DWL 66+ system specifications

Write mode	HiRes	I	II	III	IV	V
<b>Writing performance</b>						
Minimum structure size [ $\mu\text{m}$ ]	0.3	0.6	0.8	1	2	4
Minimum lines and spaces [half pitch, $\mu\text{m}$ ]	0.5	0.8	1	1.5	3	5
Address grid [nm]	5	10	25	50	100	200
Edge roughness [ $3\sigma$ , nm]	50	50	70	80	110	160
CD uniformity [ $3\sigma$ , nm]	60	70	80	130	180	250
Alignment measurement accuracy [ $3\sigma$ , nm]	100	100	150	250	400	800
2nd layer alignment over 100 x 100 mm <sup>2</sup> [ $3\sigma$ , nm]	500	500	500	500	800	1000
Max. write speed 405 nm laser [mm <sup>2</sup> /min]	3	13	40	150	600	2000
Max. write speed 375 nm laser [mm <sup>2</sup> /min]	2	10	30	110	-	-
<b>System features</b>						
Light source	Diode laser with 405 nm or 375 nm					
Substrate sizes	Variable: 3 x 3 mm <sup>2</sup> to 9" x 9"   Customizable on request					
Substrate thickness	0 to 12 mm					
Maximum exposure area	200 x 200 mm <sup>2</sup>					
Temperature controlled flow box	Temperature stability $\pm 0.1^\circ$ , ISO 4 environment					
Real-time autofocus	Optical autofocus or air-gauge autofocus					
Autofocus compensation range	80 $\mu\text{m}$					
<i>Basic or Advanced Grayscale Mode</i>	128 / 255 gray levels respectively					
Vector mode	Enables the writing of stitching-free lines					
Backside alignment (optional)	Allows to align exposures to structures on the backside of the substrate					
<b>Advanced options - performance upgrades</b>						
<i>High-Accuracy Coordinate System</i>	Includes golden plate calibration and climate monitoring: 2nd layer alignment down to 350 nm					
<i>Professional Grayscale Mode</i>	1000 gray levels, professional data conversion software					
Automatic loading system	Automatic loading unit, optional additional cassette station, optional pre-aligner and wafer scanner					
<b>System dimensions of standard version</b>						
Height x width x depth	1950 mm x 1300 mm x 1100 mm (lithography unit only)					
Weight	1000 kg (lithography unit only)					
<b>Installation requirements</b>						
Electrical	230 VAC $\pm 5\%$ , 50/60 Hz, 16 A					
Compressed air	6 - 10 bar					

**Please note:** Specifications depend on individual process conditions and 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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