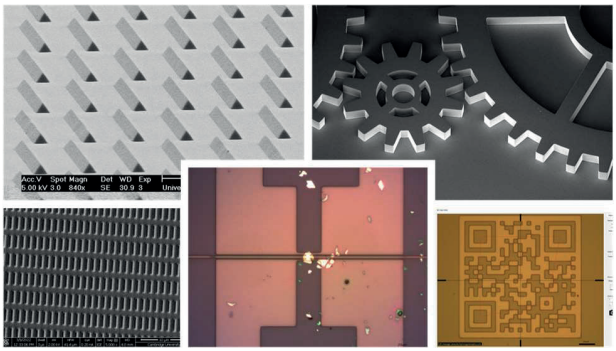
MicroWriter ML® 3 Mesa



The MicroWriter ML® products are a range of photolithography machines designed for rapid prototyping and small volume manufacturing in R&D laboratories and clean rooms.

Conventional approaches to photolithography are usually based on exposing through a chromium-glass mask manufactured by specialist vendors. In R&D environments it is often necessary to change the mask design frequently. Direct-write lithography tools (also known as digital mask aligners or maskless aligners) overcome this problem by holding the mask in *software*. Rather than projecting light through a physical mask, direct-write lithography uses computer-controlled optics to project the exposure pattern directly onto the photoresist.

MicroWriter ML®3 Mesa is a compact, high-performance, direct-write optical lithography machine which is designed to offer unprecedented value for money in a small laboratory footprint. It also has an excellent environmental footprint: power consumption of the machine even when exposing is comparable to that of a laptop.

Measuring only 70cm x 70cm at its base, the MicroWriter ML®3 Mesa sits on a standard laboratory bench or desk and plugs into a supplied laptop computer. Its only service requirement is a standard power socket. A light-excluding enclosure with safety interlock allows it to be used equally well in an open laboratory environment or in a clean room. Easy to use Windows® based software means most exposures can be set up and launched with just a few mouse clicks. Three different minimum feature sizes (0.6µm, 1µm, and 5µm) can be selected automatically via software. This allows non-critical parts of the exposure to be performed rapidly at 5µm minimum feature size while retaining high resolution writing for critical parts. The MicroWriter ML®3 Mesa also features an optical surface profilometer tool and an automated wafer inspection tool for examining fabricated structures.

EXCELLENT ENVIRONMENTAL FOOTPRINT

Power consumption of the machine even when exposing is comparable to that of a laptop.

WORLDWIDE USER BASE

Over 170 laboratories around the world, including national labs and international leading Universities.

INTUITIVE WINDOWS® USER INTERFACE

Designed for use by PhD students and post-docs in a research environment while offering high levels of flexibility.

COMPETITIVE PRICE AND LOW COST OF OWNERSHIP

Affordable price ideal for universities and industrial R&D.

For more information, please visit us on the Web at:
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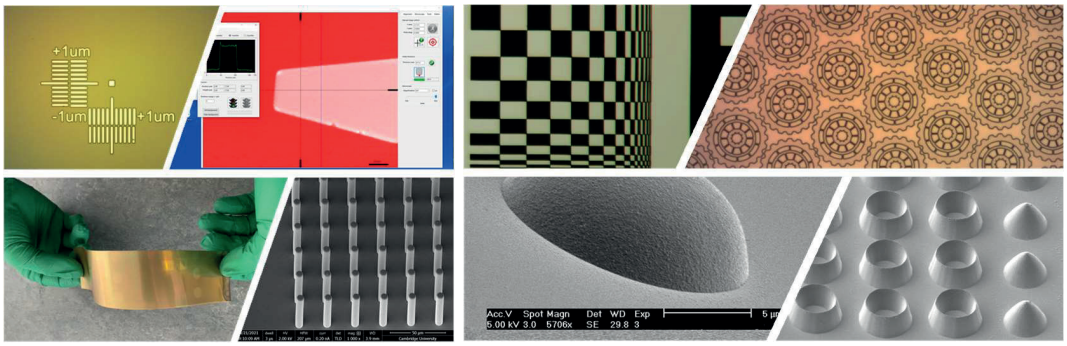
Key features and specifications



- 149mm x 149mm maximum writing area.
  195mm x 195mm maximum writing area available as an option.
- 155mm x 155mm x 7mm maximum wafer size.
  230mm x 230mm x 15mm maximum wafer size available as an option.
- 0.6µm, 1µm, and 5µm minimum feature sizes across full writing area.
- Automatic selection of minimum feature size via software – no manual changing of lens required.
- 405nm long-life semiconductor light source, suitable for broadband, g- and h-line positive and negative photoresists (e.g. S1800, ECI-3000, MiR 701). Replacement 385 nm and 365nm lightsources available as option, suitable for g-, h-, and i-line photoresists (e.g. SU8). Dual wavelength option (405nm lightsource and 365nm lightsource, software selectable) available for best performance across g-, h-, and i-line photoresists.
- XY interferometer with 15nm resolution for precise motion control.
- Extremely fast writing speed - up to: 15mm^2/minute (0.6µm minimum feature size), 50mm^2/minute (1µm minimum feature size), and 180mm^2/minute (5µm minimum feature size). These allow a typical 50mm x 50mm area combining critical and non-critical areas to be exposed in under 30 minutes.
- Optical autofocus system using yellow light with real-time surface tracking module – no minimum wafer size.
- High quality infinite conjugate optical microscope with x3 aspheric objective lens, x10 Olympus plan achromatic objective lens, x20 Olympus plan apochromat objective lens, and yellow light illumination for alignment to lithographic markers on the wafer (±1.0µm 3σ alignment accuracy).
- Automatic changing between microscope magnifications via software – no manual changing of lens required. Additional x4 digital zoom can be selected in software.
- Grey scale exposure mode for 3-dimensional patterning (up to 255 grey levels).
- Export image tool (also known as “Draw Mode”) allowing exposures to be designed directly on top of an image taken from the real-time microscope.
- Software API for external interfacing and control, allowing scripting and development of more advanced automatic procedures.
- 30nm minimum addressable grid. 15nm sample stage resolution.
- Acceptable file formats: CIF, GDS2, BMP, TIFF, JPEG, PNG, GIF; Oasis, DXF, Gerber RS-274X acceptable via KLayout conversion.

FAST WRITING SPEEDS

180mm^2/minute at 5µm resolution, allowing a typical a typical 50mm x 50mm area combining critical and non-critical areas to be exposed in under 30 minutes.

PROPER AUTOMATIC LENS CHANGER

Automatically changes microscope objective lenses and exposure resolution beams using a motorised motor.

DUAL WAVELENGTH EXPOSURE LIGHTSOURCE OPTION

Adds both 365nm light source and 405nm light source; software selectable.

HIGH PERFORMANCE LASER INTERFEROMETER

Uses a high performance XY laser interferometer for position control.

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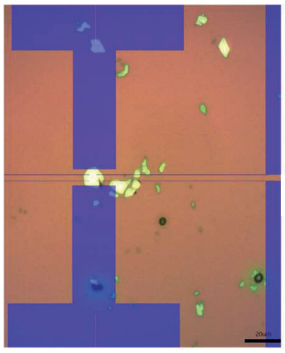
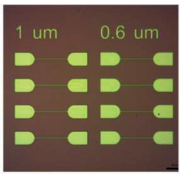
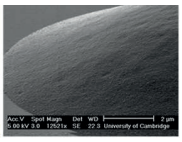
Virtual mask aligner option.



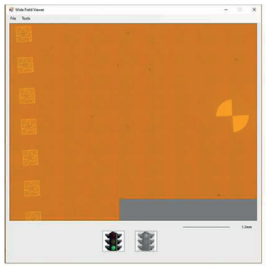
Combining resolutions.



Greyscale lithography.



Wide field viewer.

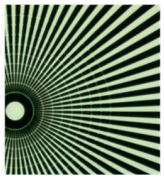


Barcode generation.

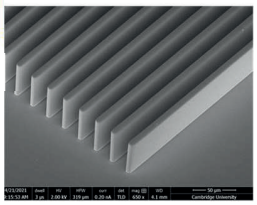
Multiple samples option.

Wafer inspection.

Producing photomasks.



Structures with a high aspect ratio.



Well-established user base around the world.

AUTOCALIBRATION

Autocalibration tool allowing users to check and correct calibration.

AUTOMIC MARKER RECOGNITION

Automatically identify the precise position of lithographic markers visible the real-time microscope.

AUTOMATIC BARCODE GENERATION AND RECOGNITION

Automatically create the exposure pattern for 2D barcode. Developed barcode can be identified automatically.

COMPACT LABORATORY FOOTPRINT

70cm (w) x 70cm (d) x 75cm (h).

TECHNICAL SUPPORT

International network of trained local service engineers to keep you running.

For more information, please visit us on the Web at: www.durhammagnetooptics.com

- Built-in 2-dimensional optical surface profiler (200nm thickness resolution) for examining exposed resists and MEMS process steps.
- Automatic wafer centring tool.
- Automatic wafer inspection tool allowing each die on a wafer to be imaged.
- Autocalibration tool allowing users to check and correct calibration.
- 2D barcodes can be automatically generated through software for exposures. The software can then identify the developed barcode patterns and reads the contents.
- Bulls-eye tool can automatically identify the precise position of lithographic markers visible under the real-time microscope.
- Enhance contrast tool can digitally enhance contrast and brightness of a microscope image for seeing low contrast structures.
- Estimate theta tool can automatically determine the rotation angle of the current microscope image.
- Built-in databases to store common lithographic marker positions and exposure parameters for different photoresists.
- Light-excluding enclosure with safety interlock.
- Easy to use, Windows® based control software supplied.
- Supplied with KLayout open-source mask design software (www.klayout.de).
- Supplied with pre-configured 64-bit Windows® 10/11 PC with monitor, keyboard, and mouse for ‘plug and play’ installation.
- Includes on-site installation by trained service technician.
- Extremely competitively priced for University and industrial R&D budgets.
- Can be later upgraded to MicroWriter ML® 3 Pro for higher performance.
- 90-260 VAC, 50-60Hz, 4A single phase power requirement.
- External dimensions: 70cm (w) x 70cm (d) x 75cm (h), excluding computer.
- CE-marked and compliant with EN-61010.

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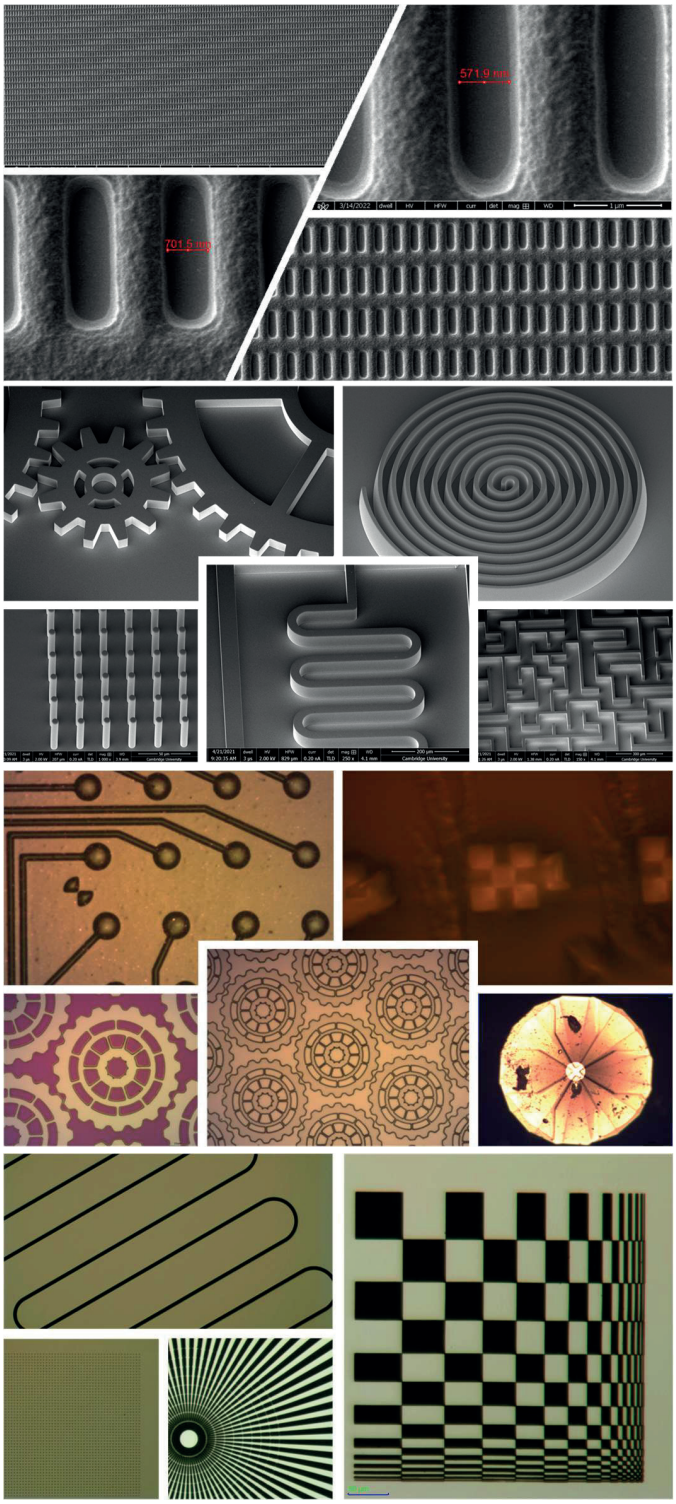
Examples of fabricated structures



- Scanning Electron Microscope images of resolution-limited structures.
  Top: Lines array with width of 0.6µm.
  Bottom: Lines array with width of 0.7µm.
  Structures were produced on Si/LOR/S1805 (0.5µm).
- Scanning Electron Microscope images of micro-moulds.
  Structures were produced on a 50µm thick SU8 layer.
  Aspect ratio of the dots array (bottom left) is 8.
- Optical Microscope images of patterns produced across varied types of substrates:
  Top left: AlN ceramic.
  Top right: Liquid polymer.
  Bottom left: Si/SiO_2.
  Bottom middle: Glass.
  Bottom right: Diamond.
- Optical Microscope images of patterns produced on a photomask.

FRICTION CHUCK

Carefully designed friction chuck allows MEMS devices with nitride windows or other delicate substrates to be used; no minimum wafer size.

CURVED SUBSTRATES

Perform exposures across a variety of substrates, including flat and curved forms, Si, glass, ceramic, diamond, and liquid polymers.

PHOTOMASKS

Produce photomasks conveniently and cheaply.

FREE SOFTWARE UPGRADE

Receives free software upgrades for the lifetime of the machine.

COMPANY CULTURE AND PHILOSOPHY

We are from a research and design (R&D) background based in Cambridge, UK and the Research Triangle Park, Durham, NC, USA.

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