

# MicroWriter ML<sup>®</sup>3 Mesa

Durham Magneto Optics Ltd

The MicroWriter ML<sup>®</sup> 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<sup>®</sup>3 Mesa is a compact, high-performance, low-cost direct-write optical lithography machine which is designed to offer unprecedented value for money in a small laboratory footprint. Measuring only 70cm x 60cm at its base, it 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<sup>®</sup> based software means most exposures can be set up and launched with just a few mouse clicks. Three different minimum feature sizes (0.6  $\mu\text{m}$ , 1  $\mu\text{m}$  and 5  $\mu\text{m}$ ) can be selected automatically via software. This allows non-critical parts of the exposure to be performed rapidly at 5  $\mu\text{m}$  minimum feature size while retaining high resolution writing for critical parts. The MicroWriter ML<sup>®</sup>3 Mesa also features an optical surface profilometer tool and an automated wafer inspection tool for examining fabricated structures.

## Key features and specifications:

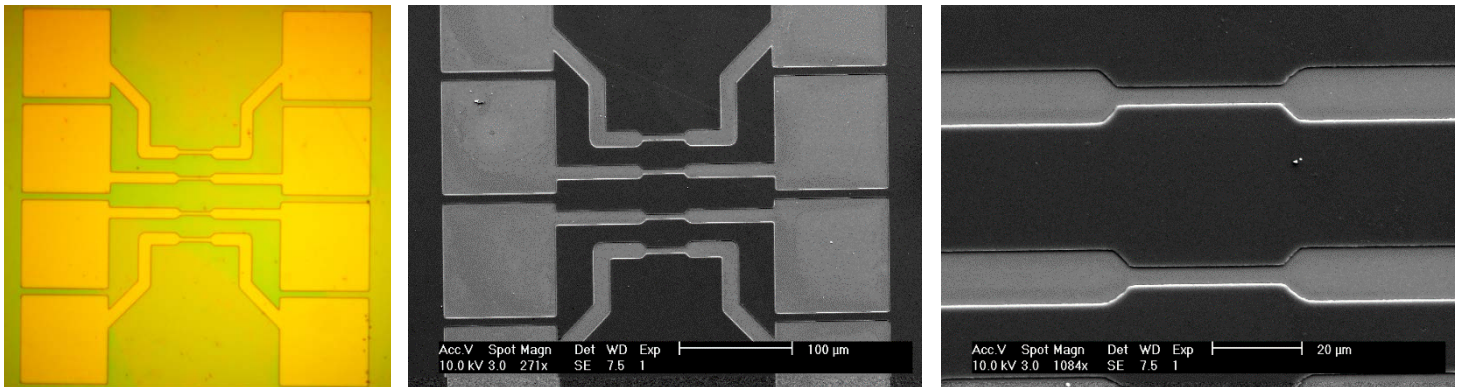
- 149mm x 149mm maximum writing area.
- 155mm x 155mm x 7mm maximum wafer size.
- 0.6  $\mu\text{m}$ , 1  $\mu\text{m}$  and 5  $\mu\text{m}$  minimum feature sizes across full writing area.
- Automatic selection of resolution via software – no manual changing of lens required.
- 405nm long-life semiconductor lightsource suitable for broadband, g- and h-line positive and negative photoresists (e.g. S1800, ECI-3000, MiR 701). Replacement 385nm and 365nm lightsources available as option, suitable for g-, h- and i-line photoresists (e.g. SU-8).
- XY interferometer with 15nm resolution for precise motion control.
- Fast writing speed: up to 17mm<sup>2</sup>/minute (0.6  $\mu\text{m}$  minimum feature size), 50mm<sup>2</sup>/minute (1  $\mu\text{m}$  minimum feature size) and 180mm<sup>2</sup>/minute (5  $\mu\text{m}$  minimum feature size), allowing a typical 50mm x 50mm area combining critical and non-critical areas to be exposed in under 30 minutes.
- Autofocus system using yellow light with real-time surface tracking laser– no minimum wafer size.
- High quality infinite conjugate optical microscope with x3 aspheric objective lens and x10 and x20 Olympus plan objective lens and yellow light illumination for alignment to lithographic markers on the wafer ( $\pm 1 \mu\text{m}$  3 $\sigma$  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 (255 grey levels).
- Software API for external interfacing and control.
- 100nm minimum addressable grid; 15nm sample stage resolution.
- Acceptable file formats: CIF, GDS2, BMP, TIFF, JPEG, PNG, GIF.
- Automatic laser-based wafer centring tool.

- Built-in 2-dimensional optical surface profiler (200nm thickness resolution) for examining exposed resists, deposited layers, etching and other MEMS process steps.
- Automatic wafer inspection tool allowing each die on a wafer to be imaged.
- External dimensions: 700mm (w) x 700mm (d) x 700m (h), excluding computer.
- Light-excluding enclosure with safety interlock.
- Designed for desktop use – no optical table required.
- Easy to use, Windows® based control software supplied.
- Supplied with KLayout open-source mask design software ([www.klayout.de](http://www.klayout.de))
- Supplied with pre-configured 64-bit Windows® 10 PC and monitor for 'plug and play' installation.
- All cables supplied.
- Extremely competitively priced for University and industrial R&D budgets.
- Can be later upgraded to MicroWriter ML®3 Pro for higher performance.
- CE-marked and compliant with EN-61010.
- 90-260 VAC, 50-60Hz, 4A single phase power requirement.

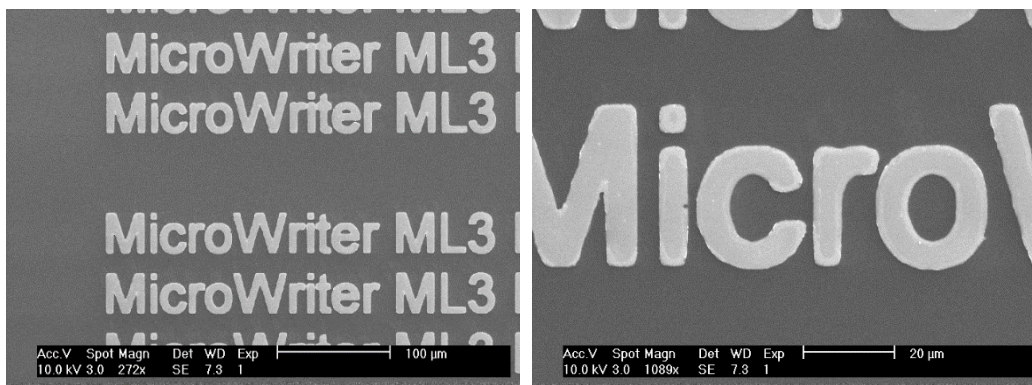
### Designed for R&D in:

- Microelectronics and semiconductors
- Spintronics
- MEMS / NEMS
- Sensors
- Microfluidics and lab-on-a-chip
- Nanotechnology
- Materials science
- Graphene and other 2-dimensional materials

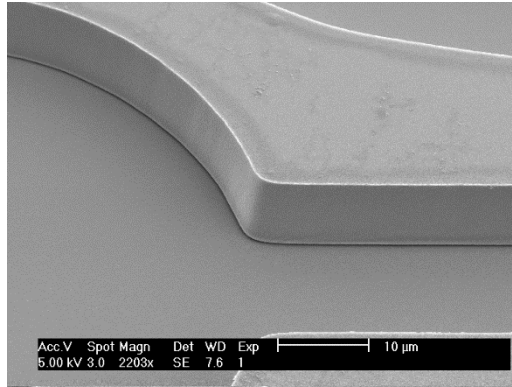
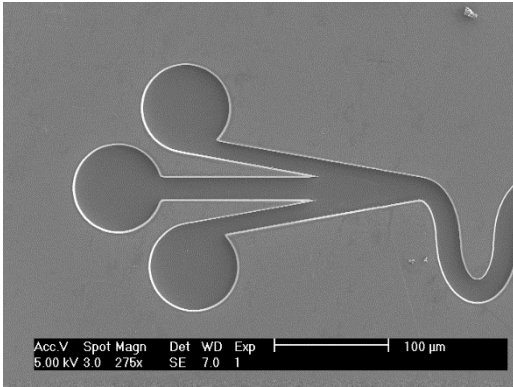
### Examples of fabricated structures



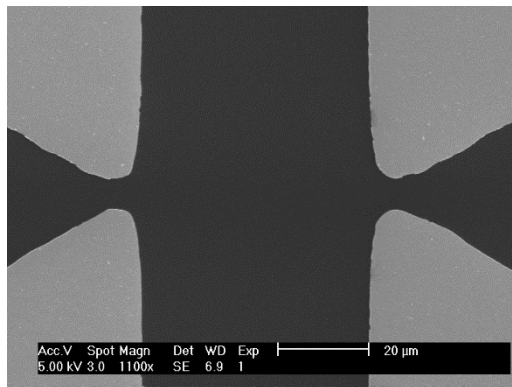
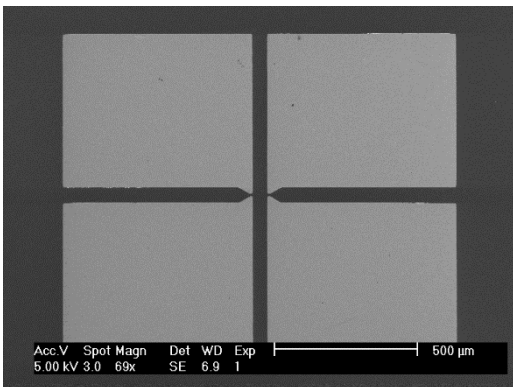
Electrical transport measurement chip: MicroWriter ML®3 Mesa built-in optical microscope image of exposed AZ® ECI 3007 positive photoresist developed in AZ® 326 MIF developer (left); SEM images after metallization with 20nm of gold (centre and right). Square contact pads are 100µm wide; central wires are 3µm wide.



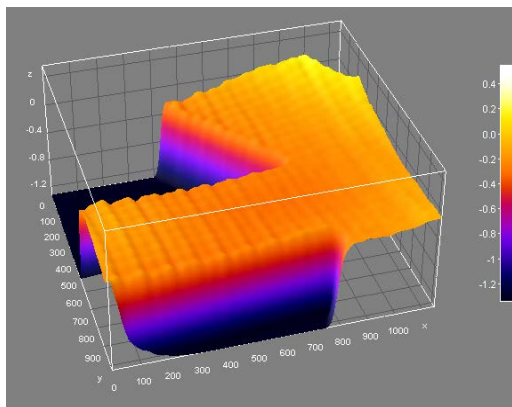
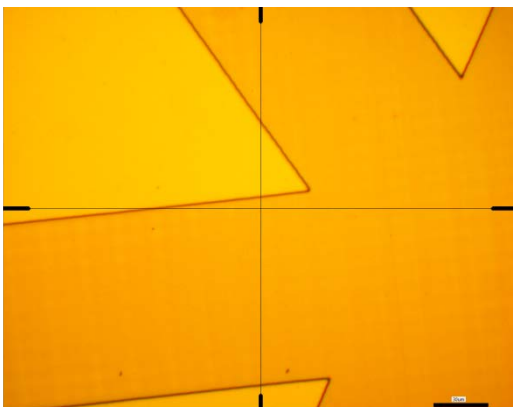
Micro-text: SEM images after metallization with 20nm of gold and lift-off. Lower case letters are 27µm high; gap between letters 'r' and 'o' is 1.5µm.



*Microfluidic device: SEM images after metallization with 20nm of gold of AZ® 9260 12μm thick positive photoresist developed in AZ® 326 MIF developer.*



*Large area contact pads: SEM image after metallization with 20nm of gold and lift-off of four 660μm x 540μm contact pads exposed rapidly using 5μm minimum feature size.*



*MicroWriter ML®3 Mesa built-in optical microscope image (left) and 3D rendered MicroWriter ML®3 Mesa optical surface profilometer image (right) of 1.4μm thick patterned resist. Scale bar is 30μm.*



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