

MicroWriter ML[®]3 Baby Plus

Durham Magneto Optics Ltd

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 Baby Plus 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[®] based software means most exposures can be set up and launched with just a few mouse clicks. Two different resolutions (1 μ m and 5 μ m) can be selected automatically via software. This allows non-critical parts of the exposure to be performed rapidly at 5 μ m resolution while retaining high resolution writing for critical parts. The MicroWriter ML[®]3 Baby Plus 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.
- 1 μ m and 5 μ m resolutions across full writing area.
- Automatic selection of resolution via software – no manual changing of lens required.
- 405nm long-life semiconductor LED lightsource suitable for broadband, g- and h-line positive and negative photoresists (e.g. S1800, ECI-3000, MiR 701). Replacement 385nm lightsource available as option, suitable for g-, h- and i-line photoresists (e.g. SU-8).
- XY interferometer for precise motion control.
- Fast writing speed: up to 20mm²/minute (1 μ m resolution) and 120mm²/minute (5 μ m resolution), 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 – no minimum wafer size.
- High quality infinite conjugate optical microscope camera with x3 aspheric objective lens and x10

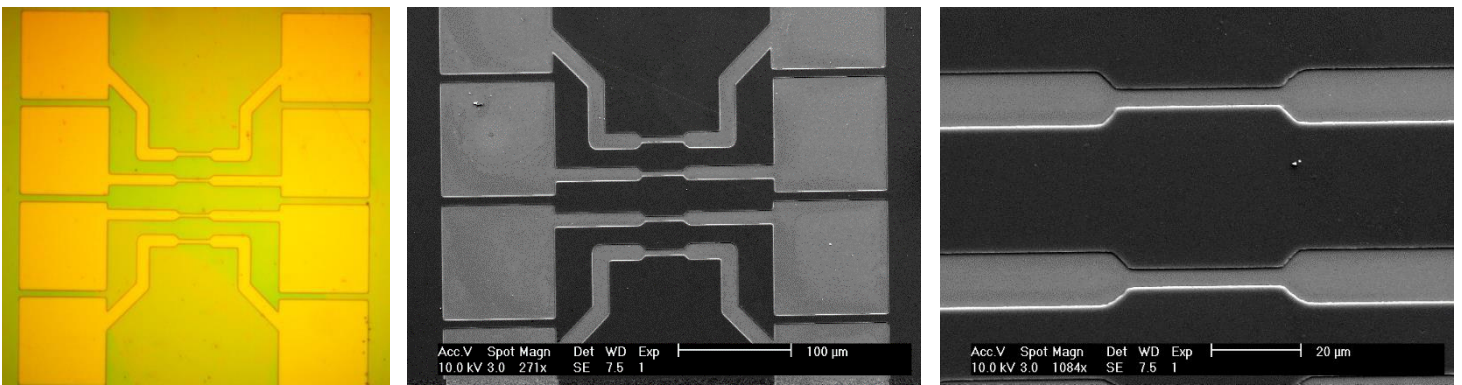
Olympus plan objective lens and yellow light illumination for alignment to lithographic markers on the wafer ($\pm 1\mu\text{m}$ 3σ alignment accuracy).

- 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 (255 grey levels).
- Software API for external interfacing and control.
- $0.2\mu\text{m}$ minimum addressable grid; $0.1\mu\text{m}$ minimum sample stage step size.
- Acceptable file formats: CIF, BMP, TIFF.
- 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 700mm (h), excluding laptop 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 pre-configured 64-bit Windows® 10 laptop computer 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 for higher performance.

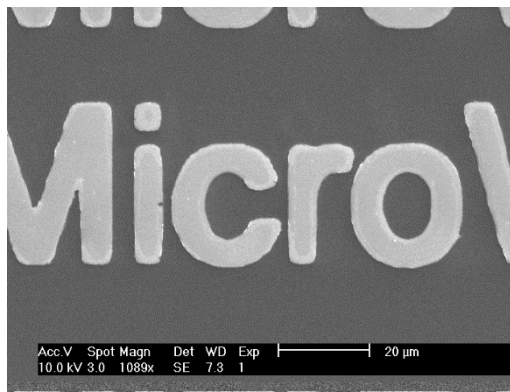
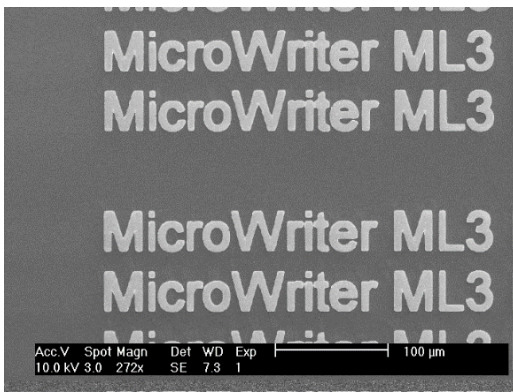
Designed for R&D in:

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

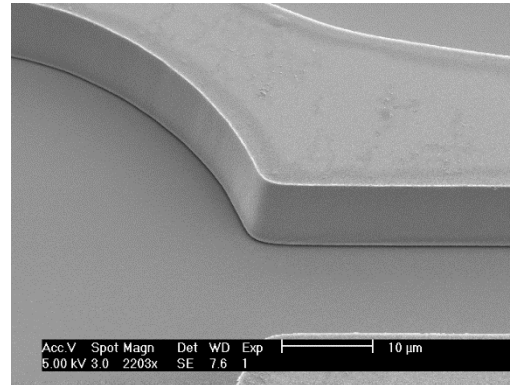
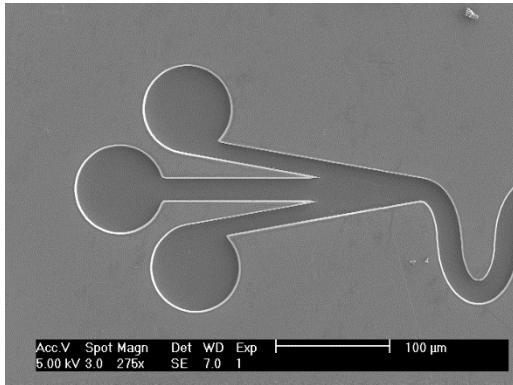
materials Examples of fabricated structures



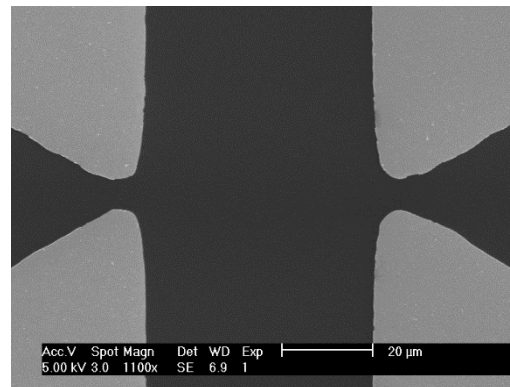
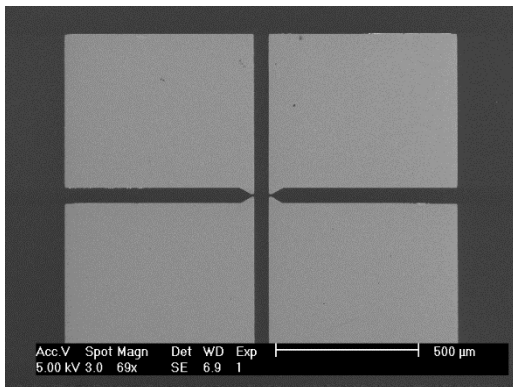
Electrical transport measurement chip: MicroWriter ML@3 Baby Plus built-in optical microscope image of exposed AZ® ECI 3007 positive photoresist developed in AZ® 326 MIF developer (left); SEM images after metallisation with 20nm of gold (centre and right). Square contact pads are $100\mu\text{m}$ wide; central wires are $3\mu\text{m}$ wide.



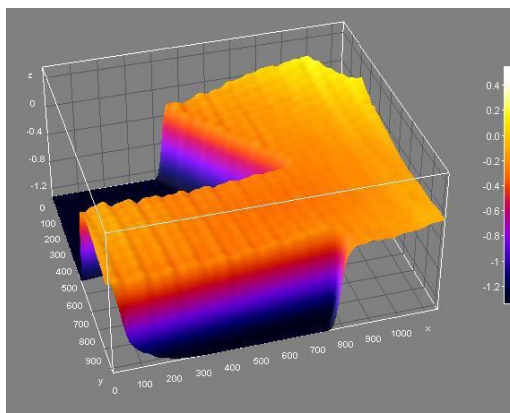
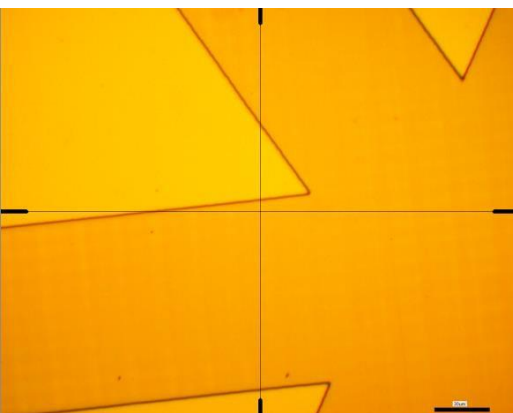
Micro-text: SEM images after metallisation with 20nm of gold and lift-off. Lower case letters are 27μm high; gap between letters 'r' and 'o' is 1.5μm.



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



Large area contact pads: SEM image after metallisation with 20nm of gold and lift-off of four 660μm x 540μm contact pads exposed rapidly using 5μm resolution.



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