MANCHESTER 1824
The University of Manchester

HIGH-ENERGY EBL CAPABILITY

Raith EBPG5200 Electron Beam Lithography Tool

The Raith EBPG5200 is a dedicated system designed specifically for EBL with electron beam energy up to 100kV. The use of 100kV ensures that backscattered electrons remain mostly in the substrate and that the forwarding scattering angle is small, allowing for very narrow lines and dense arrays especially since proximity effects are also small at a high beam energy. Line widths down to 6nm are possible with this tool.

Other advantages with 100kV include a small spot size of <20nm even at a high beam current of 20nA as well as a high throughput which allows large area exposures such as a full 8-inch wafer or 6-inch photomask plate. This machine is isolated from vibrations both via an external platform and internal dampers as well as including beam position compensation for low frequency vibrations.

The Raith EBPG5200 is a fully automated machine with a 10-position airlock allowing continuous unattended operation with a high throughput. A laser interferometer stage is used to automatically calibrate the writefield and compensate for gain, rotation, keystone and pincushion errors. The laser stage also provides better than 12nm field stitching and 12nm overlay accuracy. The focus and stigmation are dynamically corrected over the entire deflection field and laser height measurement is used for continuous focus and writefield deflection correction during writing. This EBL tool is available for collaborative work with academic as well as commercial clients and is critical for the fabrication of a wide variety of nanoscale devices on various substrates. Applications currently include photovoltaic devices, LEDs, quantum dots, waveguides, plasmonic nano-optics, superconducting junctions, proton transport etc, which are in the focus of the work at Manchester.

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Specifications

Electron Source	Thermal Field Emission
Acceleration voltage	20, 50, and 100kV
Beam Current	0.1 to 200nA
Maximum Clock Rate	50MHz
Main Field Beam Deflection	20-bit DAC
Maximum Field Size	1mm x 1mm
Minimum Theoretical Spot Size	2.2nm
Stage Travel Range	210mm x 210mm
Laser Interferometer System	λ / 1024 (0.62nm)
Automation	10-Position Airlock
Rapid Pattern Data Channel	
User Interface	GUI + Linux Command Line
Thermal Stability	< 50nm / h (Open Loop)
Footprint	< 20m^2
Minimum Feature Size	6nm
Stitching and Overlay Accuracy	< ± 12nm
Wafer Writing	Holders for 3”, 4”, 6”, and 8” Wafer Writing
Photomask Writing	Holders for 5” and 6” Mask Plate Writing
Piece Part Writing	Various Holders + 6” Mask Plate to Piece Part
Adaptor	
NEP	1nW Hz-1/2