NanoBeam Ltd

Advanced Electron Beam Lithography

*n*B3

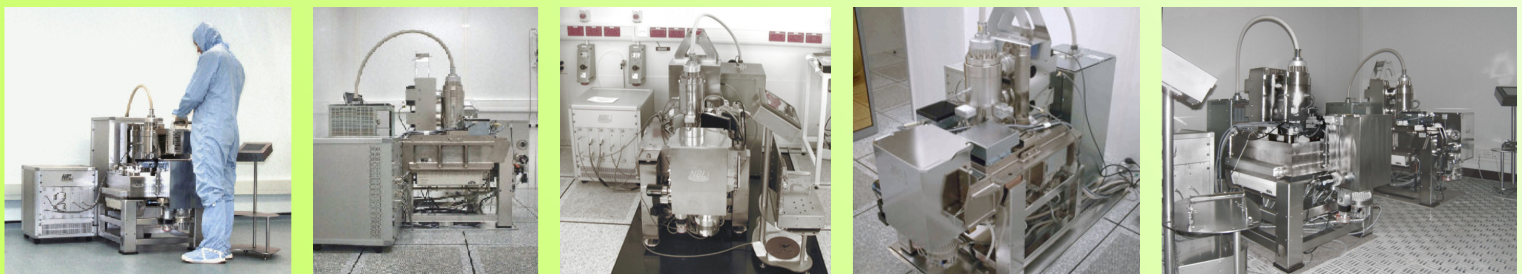
Electron Beam Lithography System

The ***n*B3** is a round-beam vector-scan system using a step-and-repeat method for nanopatterning, and has been specially designed for mix-and-match lithography. The innovative and modern design of the electron optics and automation system enhances throughput and reliability, making the ***n*B3** ideal for nano-device research and production. Its unique and compact vacuum structure ensures 95% uptime and robust operation.

The ***n*B3** has a short column and a small footprint, and requires undemanding cleanroom conditions, including room temperature, stray field, and floor vibration. The ownership cost is therefore largely reduced.

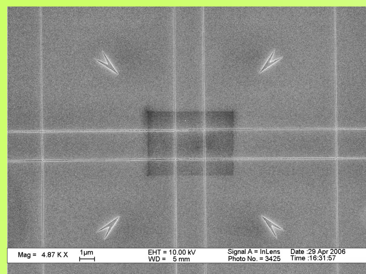
Reliable, easy to use application software, and an extensible GUI, make the ***n*B3** user friendly.

Advanced Features
Low Coulomb-effect electron optics
Unique auto-loading system
Advanced vibration tracking
Exceptional resistance to stray field
Innovative TFE gun design
Reliable system software
High throughput
Low machine weight (550kg)
Low ownership cost

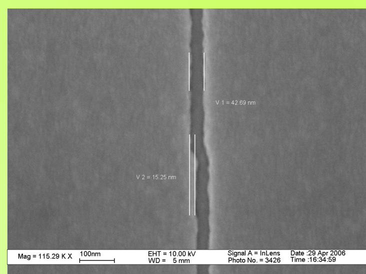


Typical Installations - ***Two machines in one 3.5 x 3.5m cleanroom at a semi-conductor facility***
- ***One machine in a 2nd floor cleanroom used for nano-patterning***

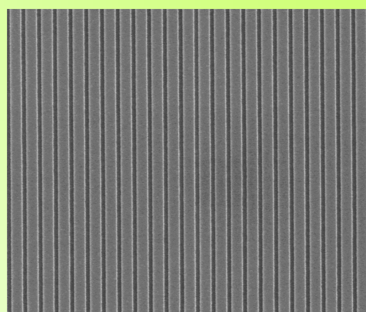
NanoBeam *n*B3



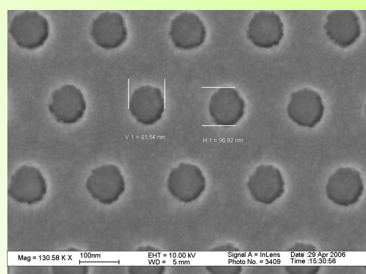
Stitching and Overlay Test Pattern
Four 500µm fields used to stitch 50nm gratings



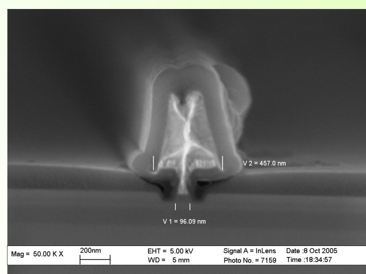
Stitching/Overlay Result
Maximum error is <20nm



100nm-Gratings
Written over a 5x5mm area with an 8nA beam at 80kV



100nm-Dot Optical Device
Position error < 3nm
Roundness < 5nm



100nm T-gate on GaAs
Repeatable overlay error <20nm
Registration marks spaced 5mm apart

The ***n*B3** guarantees metal-lift-off feature sizes of 20nm and can achieve 10nm scales. Repeatable results of <20nm stitching and overlay have been demonstrated in wafer production. The writing correction can process a sample rotation of up to 10 degrees.

The ***n*B3** mark locate facility includes multi-metal-layer selection and mark-defect rejection which in cooperation with low-noise electronics makes the ***n*B3** applicable to most semi-conductor processes without using specially-fabricated registration marks. This greatly improves the accuracy of mix-and-match lithography and simplifies the fabrication process.

With a flexible writing strategy and ultimate beam precision the ***n*B3** can routinely write optical dots with a roundness of < 5% and a position accuracy of <5nm.

Machine Specification	
Theoretical beam size	2.3nm
Metal lift-off line width	<20nm
Deflection	Vector scan, 55MHz
Address grid resolution	1nm, 20-bit DAC
Beam voltage	Selectable from 30kV to 100 kV
Writing area	195 x 195mm
Substrate size	5mm-200mm, rectangle or round
Automatic loading	10 chucks

Throughput	
Beam performance	<10nm spot at 5nA beam
Deflection settling time	<30µs (settling to <5nm)
Total stage move time	<110ms for 500µm

Environment Requirements	
Magnetic stray field	<600nT (<3nm beam noise)
Room temperature	± 0.3°C
Machine dimensions	0.7m x 1m and 1.3m high
Power dissipation	<2.5kW in total

Performance	
Overlay / Stitching	Repeatable <20nm over wafer
Beam stability	No calibration required in >48 hours
Writing of optical dots	Roundness < 5%, position < 5nm

50x30µm Logo
Flexible writing strategy allows complex patterns

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