

Micro and Nanofabrication Clean Room Techniques and equipment

NANOLITHOGRAPHY



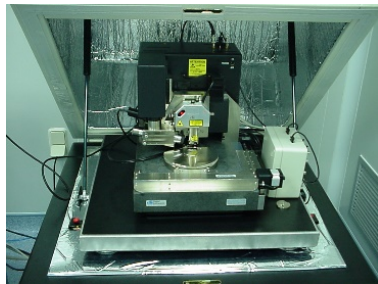
The nanolithography capabilities of IMB-CNM are included into the Integrated Micro and Nanofabrication Clean Room.

Techniques

- Electron beam lithography (EBL)
- AFM based nanofabrication
- Nanoimprint lithography
- Focused Ion Beam (FIB)
- Scanning Electron Microscopy (SEM)

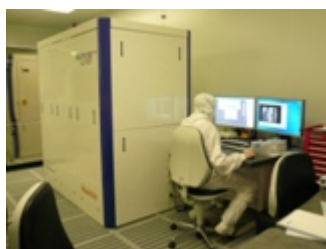


Equipment



AFM microscope.

- Nanoscope IV controller and Dimension 3100 head from Veeco
- Close-loop scanner
- Modules for electrical characterization (TUNA and SCM) and thermal characterization (SThM)
- Extension for nanofabrication / nanolithography (NANOMAN)
- Sample size up to a 150 mm wafer



Electron beam lithography

- RAITH 150 (TWO) dedicated electron beam lithography system, for up to 150 mm wafers.
- System based on a FE-SEM LEO 1530 microscope and RAITH ELPHY PLUS controller and software



Nanoimprint lithography (NIL)

Obducat thermal nanoimprint system

- Sample size up to 150 mm wafers
- Maximum pressure: 80 bars and temperature up to 350 °C



Focused Ion Beam

Zeiss 1560XB Cross Beam (from ICN-CIN2)

- Sample size up to a 150 mm wafer
- Circuit editing capability
- Nanomachining capabilities



Scanning Electron Microscopy

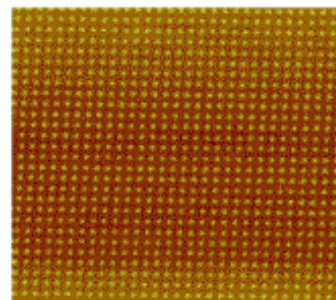
LEO1530 and Zeiss AURIGA 40 Field Emission SEMs

- 4" full acces (6 and 8 inch possible)
- EDS Oxford Detector

Processes

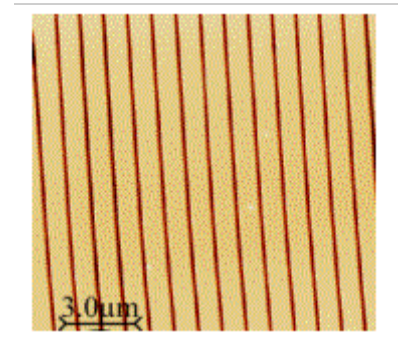
Nanopatterning by AFM

- Nanopatterning by AFM local oxidation
- Maximum size of pattern 30 μm x 30 μm
- Minimum resolution 10 nm
- Applicable to the following surfaces:
 - silicon
 - aluminium
 - other anodizable materials



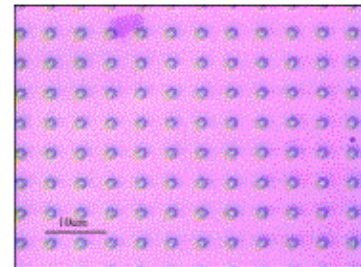
EBL nanolithography

- Lithography on positive and negative resists
- Resolution below 50 nm
- Up to 6 inch wafers in stich fields



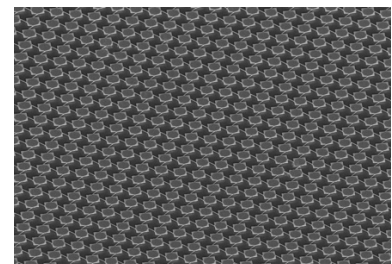
Nanoimprint lithography

- Imprinting of polymers (100 - 300 nm thickness) on different surfaces
- Imprinting of polymers foils (hot-embossing)
- Resolution below 100 nm
- Imprinting area up to 4"
- "In house" technology for mould fabrication and conditioning



Focused Ion Beam (FIB)

- Nanofabrication (Ga ions): Resolution below 100 nm
- Gas Injection System (GIS): Pt, C, TEOS deposition & O₂, F etching
- Electrical Characterization capabilities (3 nanomanipulators & feedthrough)



Characterization

Topographical characterization by AFM.

- Maximum sample size: 6 " wafer
- Maximum range of images: 30 μm (X) x 30 μm (Y) x 4 μm (Z)
- Lateral resolution (depending on surface features): 1 nm
- Vertical resolution: 0.1 nm AFM

Local electrical characterization

- Electrical current mapping of the surface (0.1 pA - 100 pA)
- Lateral resolution: 10nm

AFM local thermal characterization.

- Surface temperature mapping (From room temperature to 100 °C ± 0.5 °C)
- Resolution: 150 nm

SEM characterization.

- SEM characterisation of whole wafers up to 6"
- EDS detector

FIB characterization.

- FIB cross-sectioning
- TEM lamela preparation