

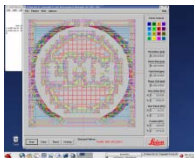


## Lithography Unit



### Vistec VB6 UHR EWF

- > 50 MHz writing speed and 20 bits addressing
- > Maximum field size : 1.2 x 1.2 mm<sup>2</sup> (↔ 1.25 nm max. grid size)
- > Stching accuracy < 5 nm to < 30 nm depending on the field size
- > Intelligent stage with 0.6 nm ( $\lambda/1024$ ) resolution
- > Laser height sensor for automatic focus during writing
- > TFE source, 1 to 100 kV beam energy field-size independent
- > typical current from 0.1 nA to 100 nA
- > Wafer holders: from 2" up to 8" (6" writing area). Piece holder.
- > Plate holders: 5", 6" (0.090, 0.120 & 0.250"), 65 x 65 mm
- > Load lock with 10 positions for batch processing of substrates
- > Pattern fracture and proximity effect correction



Fracture and Proximity Effect Correction done with CATS and Proxecco software

### Positive tone e-beam resist

PMMA, ZEP520A, ZEP7000

Ultrasonic and cold development available.

The LMN makes it possible to meet all the needs in fabrication and characterization of nanostructures with state-of-the-art equipment. Among them, its lithography unit consists of tools allowing, on one hand, the direct writing of patterns of micro- and nanometer dimensions using either electrons or photons and, on the other hand, their replication by lithography processes.

### Electron Beam Lithography

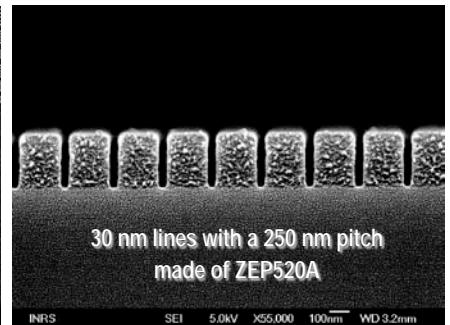
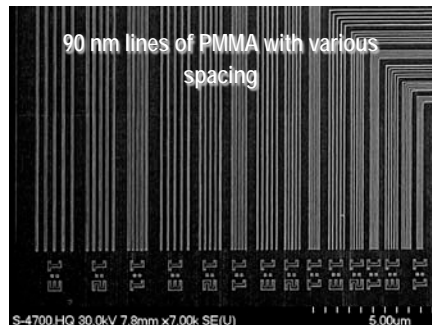
• The primary tool of the LMN lithography unit is the **VISTEC VB6 UHR-EWF (ultra-high resolution - extended wide field)**, one of the most advanced electron beam lithography (EBL) systems of the world providing direct writing of micro- and nanometer patterns with:

- a typical resolution of 25 nm (10 nm can be obtained for specific geometries and resists)
- a stitching accuracy with a maximum error of 5 to 30 nm depending on the field size
- a typical overlay accuracy of ~ 20 nm (maximum error)

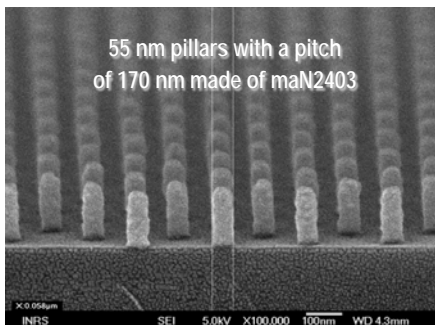
This e-beam lithography system is housed in a state-of-the-art Class 10 environment cleanroom :

- large anti-vibration seismic block
- electromagnetic free chamber
- temperature control of 20 °C ± 0.1 °C
- UV free chamber for mix and match lithography

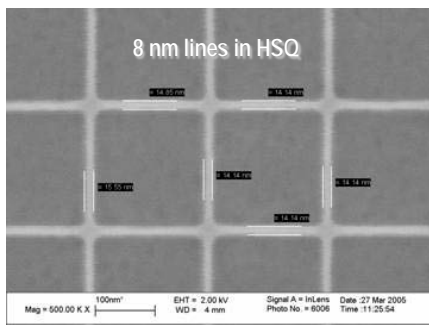
### Process development and optimization



55 nm pillars with a pitch of 170 nm made of maN2403



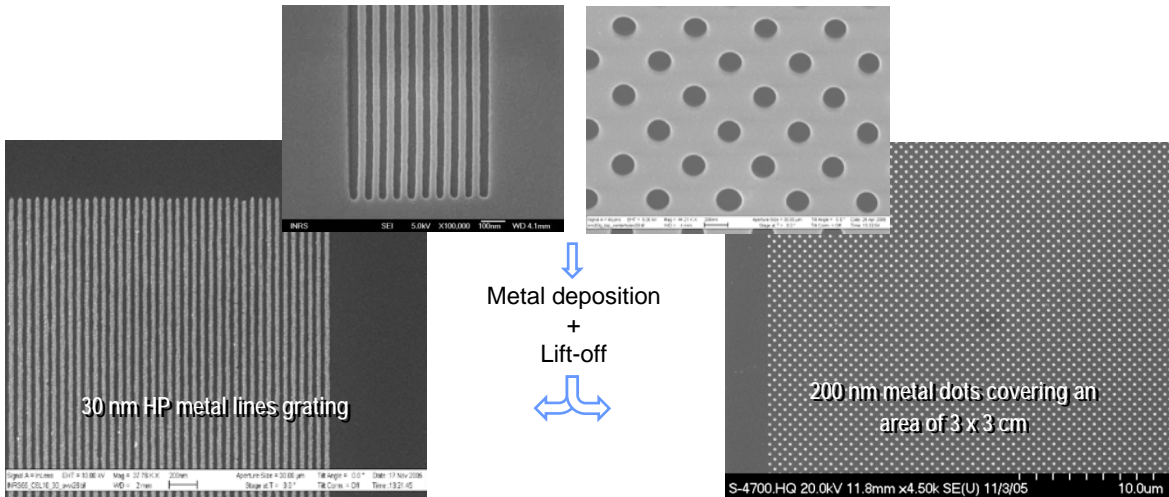
8 nm lines in HSQ



### Negative tone e-beam resist

Man2403, HSQ

## Examples of dense patterns writing by EBL



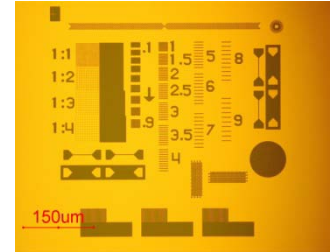
Sample ready for etching  
→ for nanoimprint templates

Sample ready for etching  
→ for photonic crystal applications

## UV lithography

• The lithography unit also includes various UV lithography tools that constitute the central core of any world-wide micro- and nanofabrication laboratory to produce micro- or nanostructures:

– a fast scan laser writer ( $\lambda = 442 \text{ nm}$ ) system (Heidelberg DWL-66 fs) with a  $0.8 \mu\text{m}$  resolution and a writing speed  $> 1 \text{ mm}^2/\text{min}$  (up to  $300 \text{ mm}^2/\text{min}$  for  $> 10 \mu\text{m}$  features). This tool has auto-positioning capabilities and a writing area of  $8 \times 8 \text{ inch}^2$



- a mask aligner EVG620 that is a multifunctional platform allowing simple or double-side lithography of multiple mask/wafer combination. This tool is also able to carry out UV nanoimprint lithography
- spin-coaters and an automated platform for the deposition, baking and development of photoresists and e-beam resists
- a plasma asher system (Gasonic Aura 1000) for cleaning and descum processes
- solvent and acid benches for cleaning and wet etching processes

## Deposition, Etching, Characterization and Analysis

These tools are complemented by a deposition unit (ebeam evaporator, PECVD, Sputtering and Pulsed Laser Deposition systems) and an etching unit (four Plasmalab System100 ICP380 from Oxford Instruments) together with equipment devoted to material modification (Ion implanters, furnaces, RTA, Polishing) and a large park of material characterization equipment (ellipsometers, profilometers, SEMs, AFMs, STMs, XRDs, XPS, EDX, ERD, RBS).

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