Laboratory of Micro and Nanofabrication

Etching and Deposition Units

The LMN makes it possible to meet all the needs in fabrication and characterization of nanostructures with state-of-the-art equipment : among them dry etchers based on the latest generation of high-density plasmas and complementary techniques for the deposition and synthesis of materials.

Dry Etching

• The etching unit is composed of **Four ICP etchers from Oxford Instruments** (Plasmalab system 100) installed in 2008 and dedicated to specific applications :

– very deep silicon etching (DSE) using Bosch process or cryogenic approach

– fluorine etching for some metals (W, Ti) and low-k materials (fluorinated glass, porous silicon oxide, organic materials)

– chlorine etching for materials such as III-V compounds (GaAs, GaN, InP), some metals (Cr, Al) and complex oxides (ferroelectric materials)

– research on plasma and plasma-surface interaction, a setup with a large panel of plasma diagnostics intended to understand the physical and chemical mechanisms involved in the etching process

Access to state-of-the-art tools

> ICP 380 mm high density plasma source (2MHz, 5kW generator)
> 240 mm lower electrode with automatch unit (13.56MHz, 600 W)
> Variable height cooled/heated electrode (-150 °C to 400 °C)
> Wafer clamping and He backside cooling
> Sample holder: from pieces up to 200 mm wafers - 6'' plates
> Typical process pressure: 1- 100 mtorr
> PC controlled and programmable recipes
> All systems equiped with airlocks and endpoint detectors

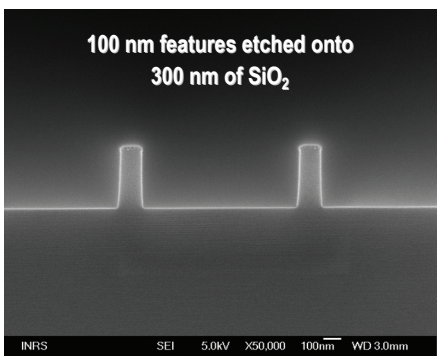
Process development and optimization

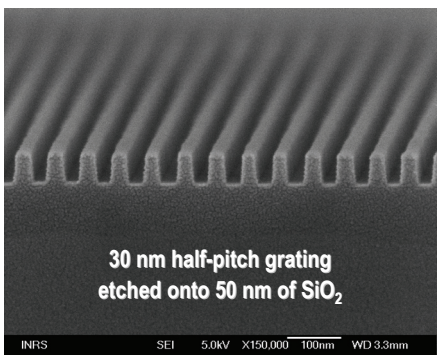
SiO_2 nanopatterning

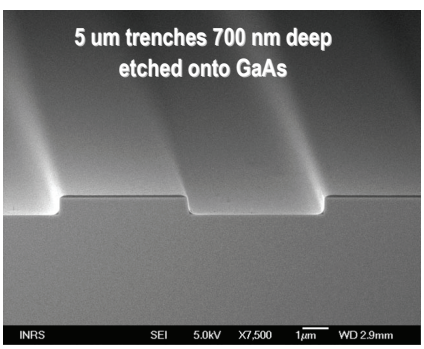
Dry etch process based on C_4F_8 / O_2 plasma chemistry with a 20 nm thick Cr mask.

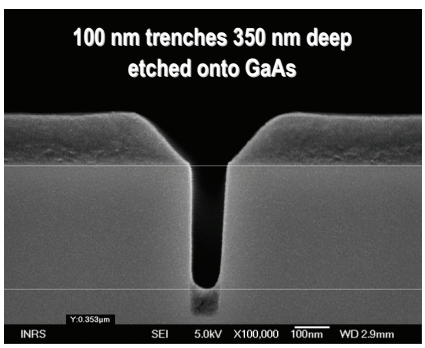
Chrome etched with a Cl_2 / He / O_2 plasma chemistry and an e-beam resist mask (ZEP520A or maN2403).

→ for UV nanoimprint templates manufacturing





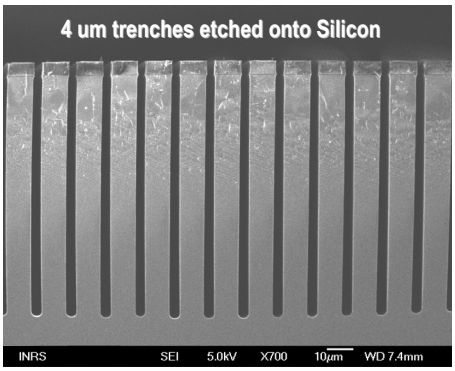




GaAs nanopatterning

Dry etch process based on Cl_2 / N_2 plasma chemistry with an e-beam resist mask (ZEP520A).

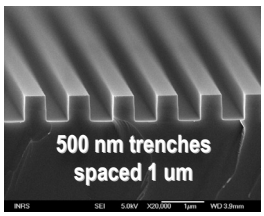
→ for III-V lasers, waveguides applications

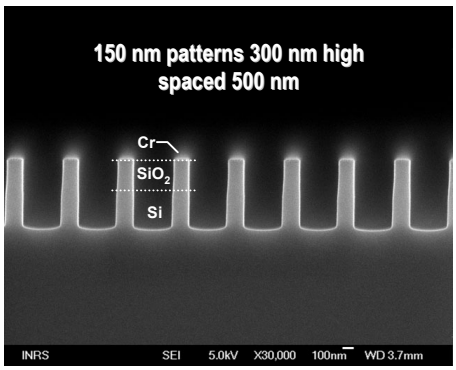


Deep Silicon Etching

Dry etch based on the Bosch process (C_4F_8 / SF_6 plasma chemistry) with a photoresist mask.

→ for MEMs and via holes applications





Silicon nanopatterning

Dry etch process based on C_4F_8 / SF_6 plasma chemistry.
Process uses either patterned SiO_2, Cr or ebeam resist mask.

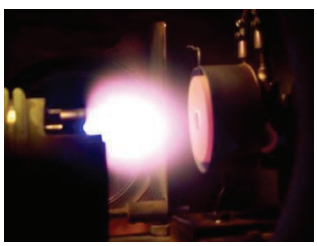
→ for SOI waveguides and thermal nanoimprint molds

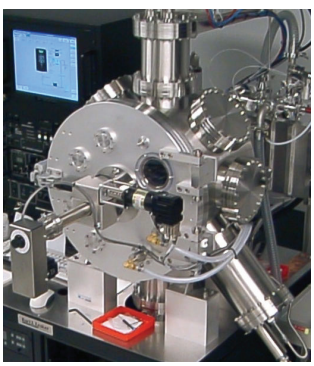
Other processes are available upon request.

Deposition

• The deposition unit is composed of **Eleven systems for the deposition and synthesis of materials**

– four pressure-controlled chambers, operating under vacuum and ultra-high vacuum combined with three laser sources (2 KrF lasers and an ultra-short pulse laser) and an atomic source for the synthesis of materials and nanomaterials by laser ablation (ferroelectrics, n-Si, …)



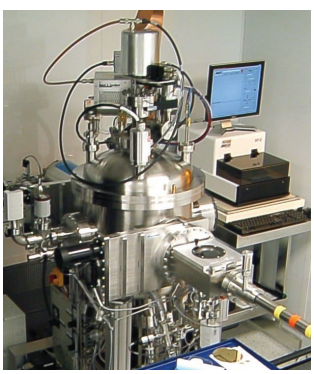


– two PECVD thin film deposition systems Applied Materials-Plasma II-A and Plasmalab System100 from Oxford Instruments, a PECVD equiped with a liquid delivery source

– two cathodic sputtering systems from K.J. Lesker (CMS-18-KJLC) for the deposition of metals and oxydes

– an e-beam evaporator AXXIS from K.J. Lesker designed for the lift-off of metals

– two Tystar furnaces, one operating at atmospheric pressure for oxidation and the other one at low pressure for nitride deposition



Lithography, characterization and analysis

These tools are complemented by a micro and nanolithography unit (Heidelberg DWL66fs laser writer, EVG620 mask aligner and Vistec VB6 UHR-EWF e-beam writer) together with equipment devoted to materials modification (Ion implanters, furnaces, RTA, CMP) and a large park of material characterization equipments (ellipsometers, profilometers, SEMs, AFMs, STMs, XRDs, XPS, EDX, ERD, RBS).

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