

# Micro- and Nanofabrication

## State-of-the-art process technology at your service

The Laboratory for Micro- and Nanotechnology (LMN) has gained, over 15 years, extensive experience in various fields of micro- and nanofabrication technologies under clean-room conditions for interdisciplinary research. LMN provides services from a single process up to fully processed devices for R&D projects in different fields.

### Established Micro- and Nano-fabrication technologies

The nanotechnology clean room consists of a 300m<sup>2</sup> (net) clean area (hybrid class 10/class 1000), professionally designed laboratory equipped with state-of-the-art process equipment for lithography, pattern transfer, thin-film technology, and metrology.

#### Pattern definition

- Photolithography
- Electron beam lithography
- EUV and UV Laser interference lithography
- Nano-imprint lithography (NIL)

#### Thin-film technology

- Si Oxidation (dry and wet)
- LPCVD and PECVD systems
- Metallization: Evaporation and sputtering
- Spin-coating of polymers

#### Pattern transfer

- Dry etching
- Wet etch of metal and silicon
- Lift-off process

#### Post-processing

- Fully automated dicing saw
- Wire bonding

#### Metrology

- Optical light microscopes
- Secondary electron microscope
- Mechanical profiler, incl. stress determination of thin films
- Reflectometer
- Atomic force microscope

High-resolution pattern definition using EUV interference lithography (EUV-IL) and electronbeam lithography (EBL), as well as high-resolution microscopy using scanning electron microscopy and scanning force microscopy, can be seen in separate documents.

#### Tools and Equipment

Typical substrate materials are silicon, metal, quartz and glass wafers with diameters of up to 100 mm. Some equipment is

capable of coating substrates with diameters of up to 200 mm. Available facilities are:

#### Pattern definition systems:

- VISTEC EPBG 5000+ HR electron beam nanopattern generator (100 KeV)
- LEICA Lion LV1 electron beam pattern generator (20 kV)
- Süss MA 6 double-sided mask-aligner
- Süss MA 8 single-sided, 200 mm wafer mask aligner

#### Pattern transfer systems:

##### Dry etching systems

- Oxford RIE80 and 100
- Oxford ICP incl. Bosch license
- Eisele RIE system
- BMP RIE Chlorine
- Tepla plasma asher



PSI clean room equipped for handling and processing of 200 mm diameter wafers.

### Thin-film deposition

- 2 multiple crucible e-gun evaporators
- Thermal evaporator for tilted substrates
- Steed Technology LPCVD furnace
- 2 multiple target sputtering systems
- Leica Au sputterer

### Nano-Imprint Technology

Two Jenoptik HEX03 imprinting systems for thermal nano-imprint lithography (NIL) and UV-NIL and micro-embossing are installed in the cleanroom. They feature:

- Substrates up to  $\varnothing$ 150 mm
- Temperature up to 320 °C
- Pressing force up to 200 kN (force/position controlled)
- Embossing under vacuum

### Projects and Services

Over the past few years, a large variety of applied projects have been completed with partners from academia and industry, such as:

- Development of bump-bond technology for particle detectors (including CMS at CERN)
- X-ray diffraction gratings (100 nm resolution) (Eulitha.com)
- High-resolution zone plates for X-ray microscopy

- Beam positioning and beam profile monitors for synchrotron beamlines based on CVD diamond (SLS)
- Nanopore chips (100 nm) for bio-analytics of lipid membranes
- Nanoimprint stamps with 3D surface reliefs using EBL, PL and EUV-IL
- Non-stick coatings on silicon and metal stamps for hot embossing and injection molding tools deposited by CVD
- Silicon grating fabrication for phase-contrast tomography

### INKA – Institute of Polymer Nanotechnology

INKA, a joint institute of PSI and the University of Applied Sciences Nordwestschweiz (FHNW) in Windisch, Switzerland, offers access for industrial users to processes such as hot embossing, and in particular injection molding of polymer microstructures and components on production-type equipment.

Injection moulding is an established high volume production process with a high degree of market penetration.

PSI and INKA offer to small and medium-sized companies the opportunity to transfer mature R&D processes to their own in-house fabrication for the benefit of commercialization.

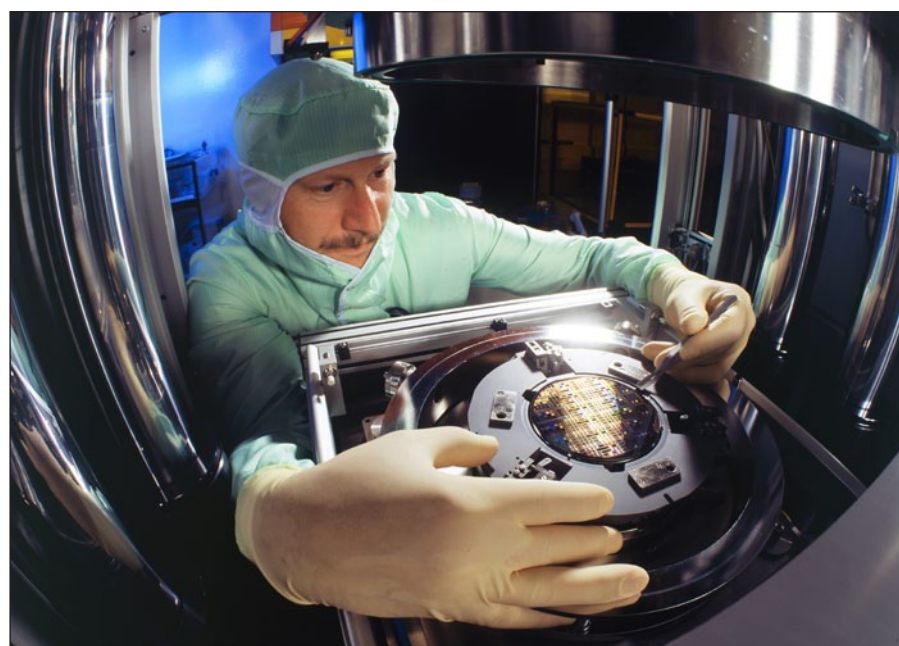


**Plasma enhanced chemical vapor deposition system for nitrides and oxides.**

### Consulting

The Laboratory of Micro- and Nano-technology has also gained considerable experience in manifold processes in the field of micro- and nanofabrication.

We are ready to make our know-how available for our clients benefit.



**Vacuum hot embossing equipment for nanoimprint lithography (NIL).**

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