MNF – Micro-Nano Fabrication Laboratory capabilities

Overview

MNF-Micro-Nano Fabrication Laboratory is structured in the following areas:

- Microfabrication - carrying out **silicon and quartz 6" wafer** (having a thickness ranging from 300 um through 1000 um) processing and related technologies; it is divided in two adjacent clean rooms:
  - CR Detectors, a 560 m^2 in class 10 and 100 dedicated to clean processes and technologies
  - CR MEMS, a 180 m^2 in class 100 and 1000 dedicated for micromechanics and polymer technologies
- Testing Lab, developing and executing both parametric and functional testing of manufactured devices as well as developing system prototypes
- Microsystems Integration Lab, developing solutions for advanced packaging and System engineering.

Each lab has a qualified staff with researchers, developing new processes and controlling standard technologies, and technicians, for equipment operation and maintenance and standard processing activities.
Following is a complete description of the equipments and processing details. This documentation is provided as a guide and may contain outdated information. Please contact us to further discuss your needs:
mnf.fbk.eu

Microfabrication

- Lithography
  - Stepper Nikon Mod. NSR-2205i11D
    - 6" reticle
    - Resolution : 0.35µm
  - Mask aligner Mod. MA150BSA Single & double side wafer lithography:
    - proximity cass-to-cass with back side alignment (2.5 µm resolution)
  - Track Mod. EVG150 e SVG8600
    - Positive Resist HIPR6512: 1.2µm thickness - 3nm 1σ
    - Positive Resist HIPR6517HC: 2.1µm thickness - 6nm 1σ
  - Lift off:
    - Negative resist MaN1420: 2.1µm thickness – 4nm 1σ
  - Thick resist processing:
    - SU8 negative resist (from 5µm to 200µm thickness)
    - AZ4562 positive resist (thickness 6.7µm)
- Doped & undoped film deposition:
  - LPCVD (Centrotherm furnaces):
    - Undoped TEOS (718 °C , +/- 3% - 20 nm to 2.0 µm)
    - P-doped TEOS (640 °C , +/- 3% - 20 nm to 2.0 µm)
    - BPSG (640 °C , +/- 3% - 20 nm to 2.0 µm)
    - Undoped Poly-Si (620 °C , +/- 4% - 20 nm to 1.0 µm)
    - in situ P-doped Poly (580 °C , +/- 4% - 20 nm to 1.0 µm)
    - Si Nitride (775 °C , +/- 3% - 20 nm to 0.3 µm)
  - PECVD (STS equipment):
    - Si Oxide 100 - 250 C
    - Si Nitride 100 - 250 C
    - Stress ctrl Si Nitride (- 800 to + 500 MPa) 250 C
    - Si Oxi-Nitride (SiON) 250 C
    - Si rich Oxide 250 C
    - Amorphous Si 100 - 250 C

- Diffusion (Centrotherm furnaces):
    - Dry oxidation
    - Wet oxidation
    - Boron from BBr_3
    - Phosphorus from $POCl_3$
    - N_2 annealing
    - 10% H_2 alloying/sintering

- Ion Implantation (Varian E220 medium current, energy range 40-180keV, uniformity 0.5%):
    - B^+, BF_2^+, P^+, As^+, Ar^+
        - Min. dose : 2e12
        - Max dose: B 1e15; BF_2 5e15; P 5e15; As 3e15; Ar 5e15
    - B^{++}, P^{++}
        - Min. dose : 2e12
        - Max dose : 5e13

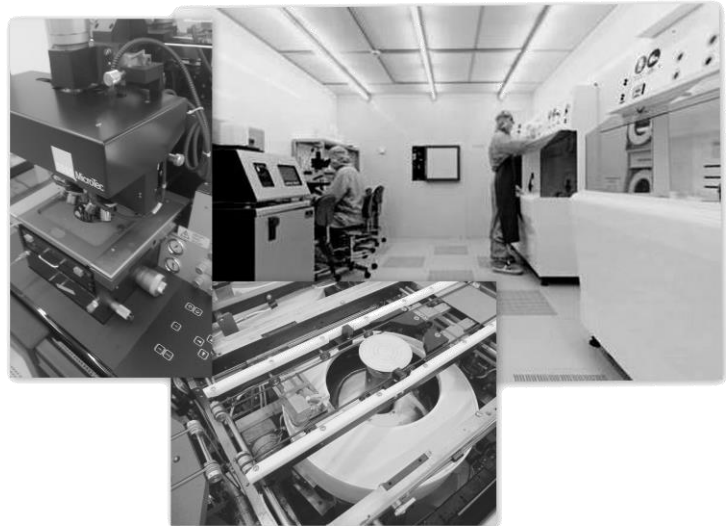
- Metallization
    - Sputtering MRC Eclipse, dep temp. RT-400 °C
        - Pure Alunimum (0.1-1.6 um)
        - 1% Si Aluminum (0.1-1.6 um)
        - Titanium (0.03-0.2 um)
        - Titanium nitride (0.03-0.2 um)
    - Ulvac EBX-16C with e-gun Ferrotec EV S-6 (minimum thickness: 3 nm)
        - Gold
        - Chrome
        - Palladium
        - Aluminum
        - Titanium
        - Platinum
        - Silver
    - Electrodeposition (Rena Wet bench)
        - Gold

- Anisotropic dry etching:

	Sel.	Equipment	Etch rate (nm/min)	Uniformity (%)
Silicon Oxide	6:1	TEGAL 900 ACS	382	0.83 (thermal oxide)
Silicon Nitride	*	TEGAL 6510	528	
Poly Silicon	*	TEGAL 6510	207	
Aluminum 1% Si	2.4:1	TEGAL 6520	671	

  - Deep Silicon and Silicon Oxide Etch –DRIE (Alcatel AMS200)

- Anisotropic wet etching:
  - TMAH Bulk Si   Wet



- Isotropic wet etching :
  - Silicon Oxide (no metal)
  - Silicon Oxide (metal)
  - Silicon Nitride
  - PolySilicon
  - Aluminum

- Resist stripping :
  - Photoresist   Dry   Matrix (single) 600 nm/min
  - Photoresist   Dry   Tepla (batch) 40 nm/min
  - Photoresist   Wet Etch (piranha)

- MEMS metrology main capabilities
  - Field Effect SEM   JEOL JSM-7401F
  - Ellipsometry   Jobin Yvon UVISEL 460 AGAS/RS
  - Inspection µScopes: Zeiss Axiotron, Leica INM100, Olympus MX50
  - Non contact profiling: Zygo NewView & Leica
  - 4 point probe
  - R. I. Measurement   Metricon 2010 Prism Coupler

Testing Lab

- Automatic cass-to-cass Probe station (EG2001 + Agilent) x 1
  - Double side automatic testing
  - 4 channels I/V SMU (Source Monitor Units) 100Volts, 100mA
  - 2 channels I/V SMU (Source Monitor Units) 200Volts, 1A
  - 4 channels VS (voltage source)
  - 2 channels VM (voltage monitor) for high precision measures
  - 1 channel CMU (capacitance monitor Unit) 10KHz-2MHz bridge
  - 13 x 48 Switching matrix for 48 pin max probecard connection
  - 150 mm wafer testing
- Automatic cass-to-cass Probe station (ACCRETECH UF200 + Agilent) x 2
  - Double side automatic testing
  - 4 channels I/V SMU (Source Monitor Units) 100Volts, 100mA
  - 2 channels I/V SMU (Source Monitor Units) 200Volts, 1A
  - 4 channels VS (voltage source)
  - 2 channels VM (voltage monitor) for high precision measures
  - 1 channel CMU (capacitance monitor Unit) 10KHz-2MHz bridge
  - 8 x 48 Switching matrix for 48 pin max probecard connection
  - 100,125, 150, 200 mm wafer testing (automatic loading)
- Manual Probe station (Agilent) x 2
  - 4 channels I/V SMU (Source Monitor Units) 100volts ,100mA
  - 2 channels VS (voltage source)
  - 2 channels VM (voltage monitor) for high precision measures
  - 1 channel CMU (capacitance monitor Unit) 10Hz-25MHz bridge
  - 1 channel LCR meter 5Hz-13MHz bridge
  - 1 channel High Voltage SMU , 1100Volts, 100mA
  - 8 micro-manipolator
- Electro-optical (LWIR) test facility
  - Low temperature Blackbody sources 20 - 90 C
  - 150 x 150 x 800 motorized precision XYZ stage
  - Keithley 2636 dual channel Picoammeter
  - Signal recovery 7265 Lock-in
  - NIR-LWIR monochromator Jobin-Yvon HR250
  - LWIR calibrated detectors (pyro-electric)
  - Full E-O device characterization SW
  - Automatic power measurement set-up
  - Automatic spectral measurement set-up

Microsystems integration lab:

- Wafer bonding AML:
  - Si fusion bonding
  - Anodic bonding
  - Au-Si eutectic bonding
  - Glas frit bonding
  - Adhesive bonding
- Screen Printer (AurelVS1520A)
- Wafer dicing: Disco DAD 2H/6T
- Assembly Station Tresky