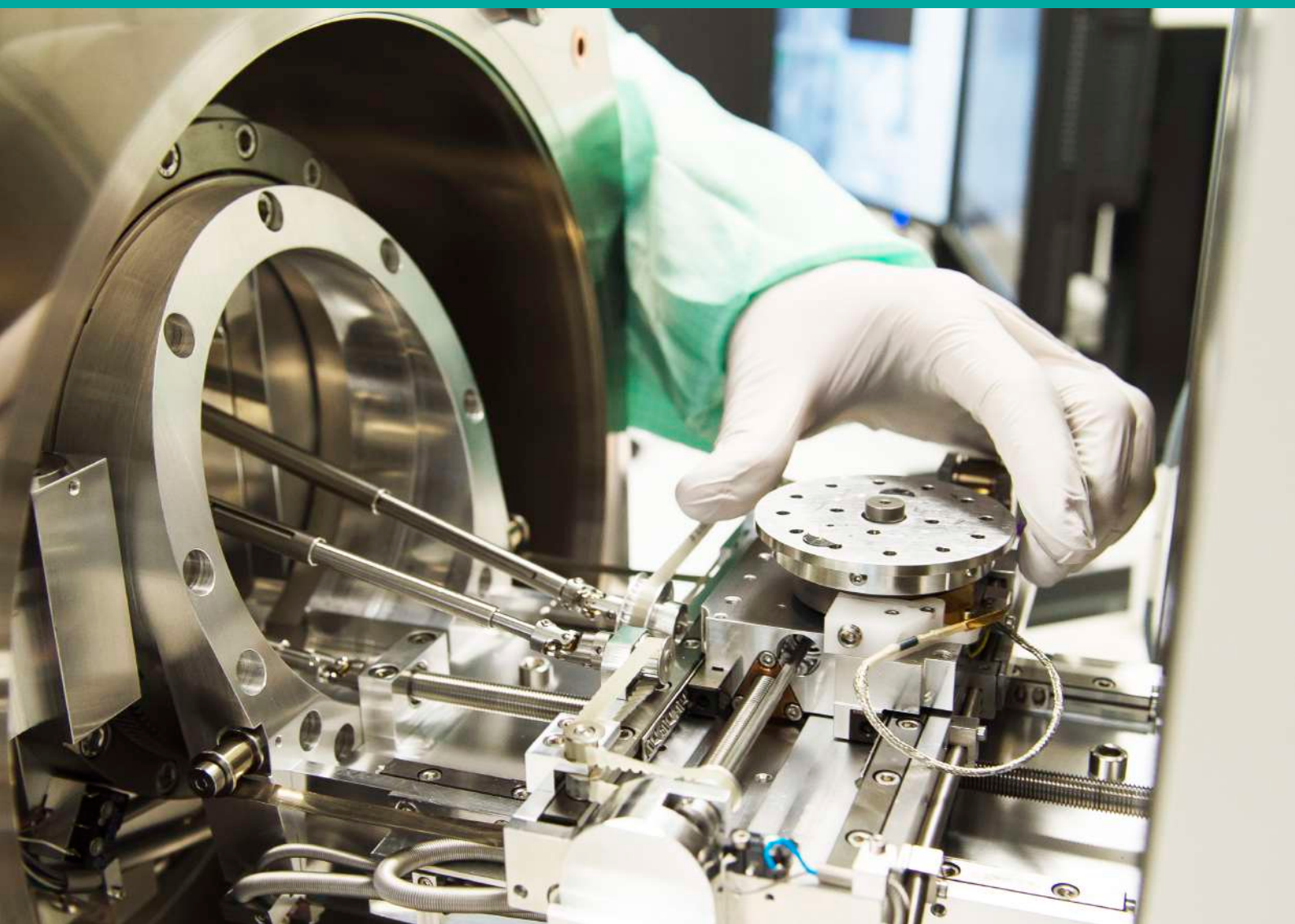
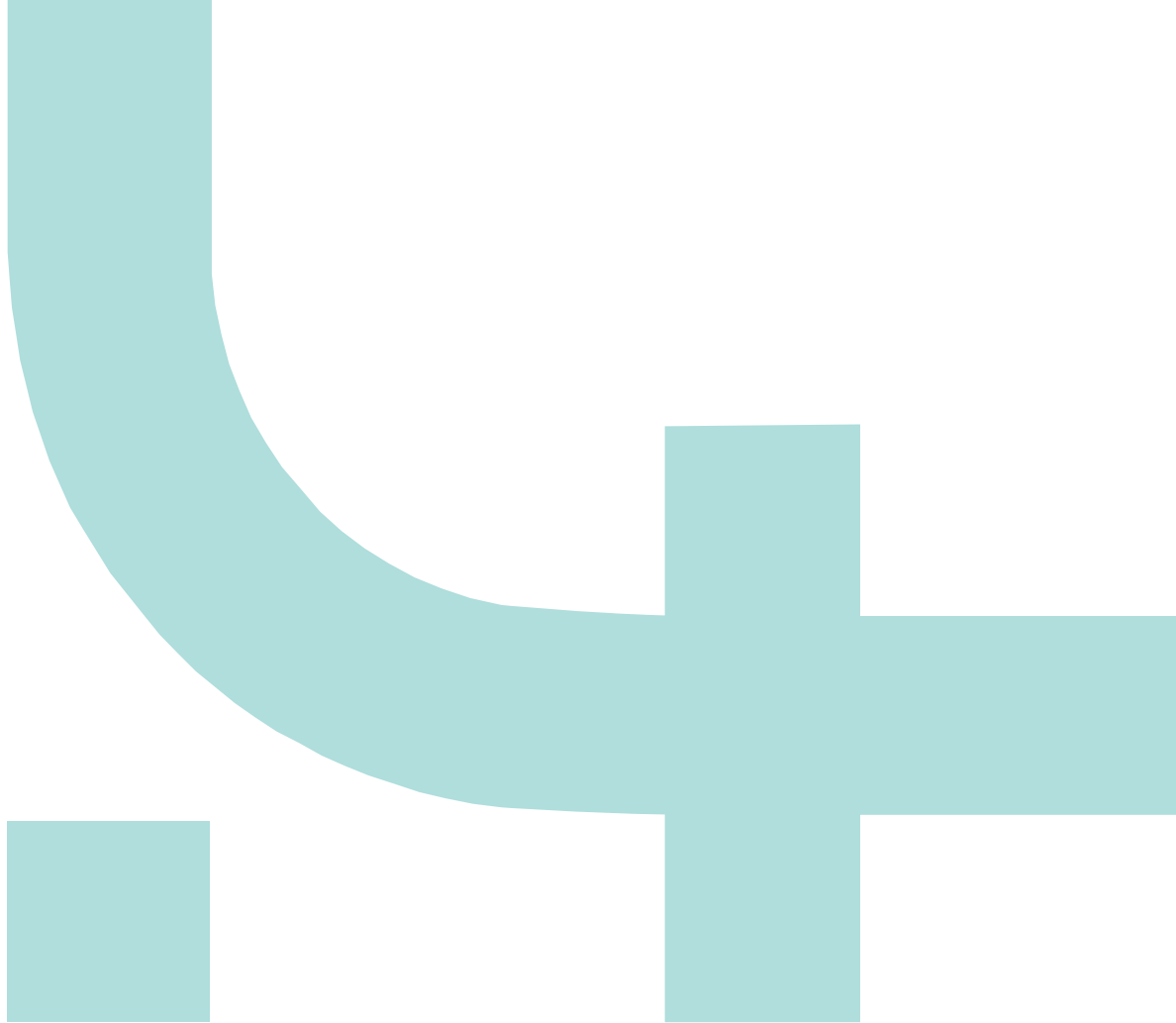


MIMENTO

Technology Center





MANPOWER SPONSORS

FEMTO-ST is a joint Research Institute from

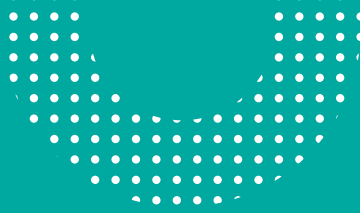


UNIVERSITÉ
MARIE & LOUIS
PASTEUR



FACILITIES SPONSORS





OUR CLEANROOM

4

WHAT DO WE OFFER?

5

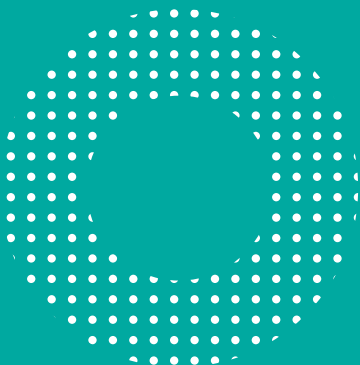
AN ACCESS TO INDUSTRY

5

TEMIS INNOVATION BUILDING

6

LITHOGRAPHY	7
INTEGRATION / PACKAGING	9
WET CHEMISTRY	12
3D LASER MICROFABRICATION	13
THIN FILM TECHNOLOGY	14
DRY ETCHING	16
PROCESS CHARACTERIZATION	18
NANOTECHNOLOGY	21
DICING/POLISHING	22
A FEW ACHIEVEMENTS	23
INDUSTRIAL LINE	25
MIMENTO TEAM	26



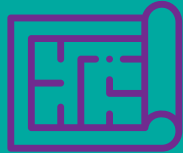
OUR CLEANROOM

MIMENTO technology center is identified as a reference centre for **Micro-nano-optics**, **Micro-nano-acoustics**, **Micro-Opto-Electro-Mechanical Systems** (MOEMS) and **Micro-Robotics**.

A FEW FIGURES

865 m²

OF CLEANROOM
(ISO5 TO ISO7 CLASSES)



18

ENGINEERS
AND TECHNICIANS

17 M€

OF HIGH TECHNOLOGY
EQUIPMENTS



HOW TO WORK WITH US

Within the framework of the French technological centres opening (Renatech network), the FEMTO-ST Institute is committed to support at MIMENTO projects from external laboratories or from industrial partners for research collaboration. Each request will be examined by a local committee and will lead to a discussion with the technical staff to check the feasibility of the project, its cost and the fabrication time. Depending on the technological project, external people will be invited to perform themselves some technological steps in the cleanroom.

TO SUBMIT A PROJECT
www.renatech.org/projet

CONTACT
mimento@femto-st.fr

Thomas BARON
+33 (0)3 81 40 28 96

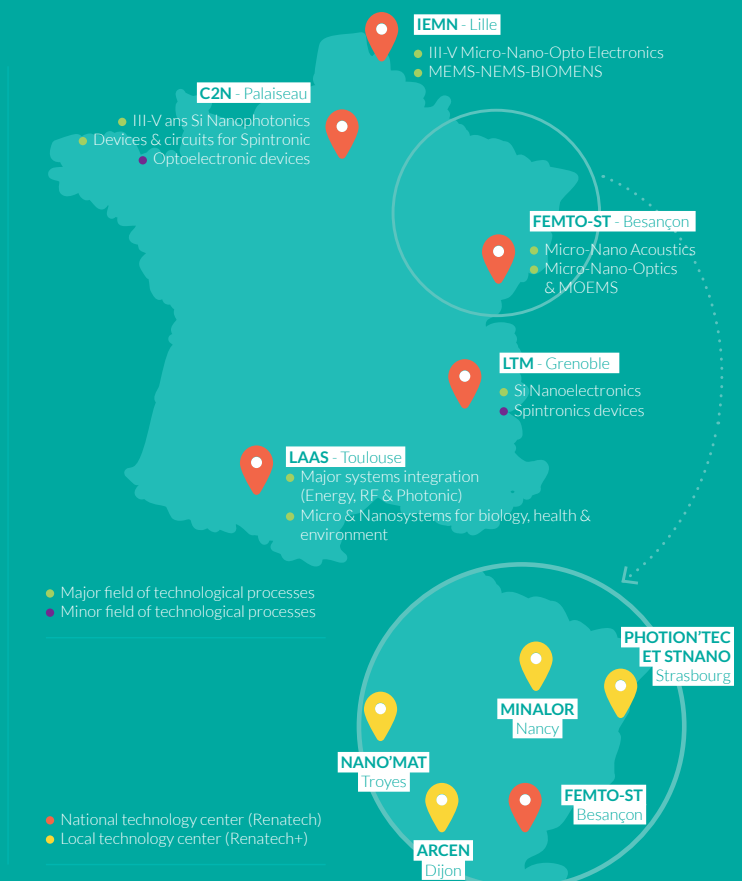
Jean-Claude JEANNOT
+33 (0)3 63 08 24 78



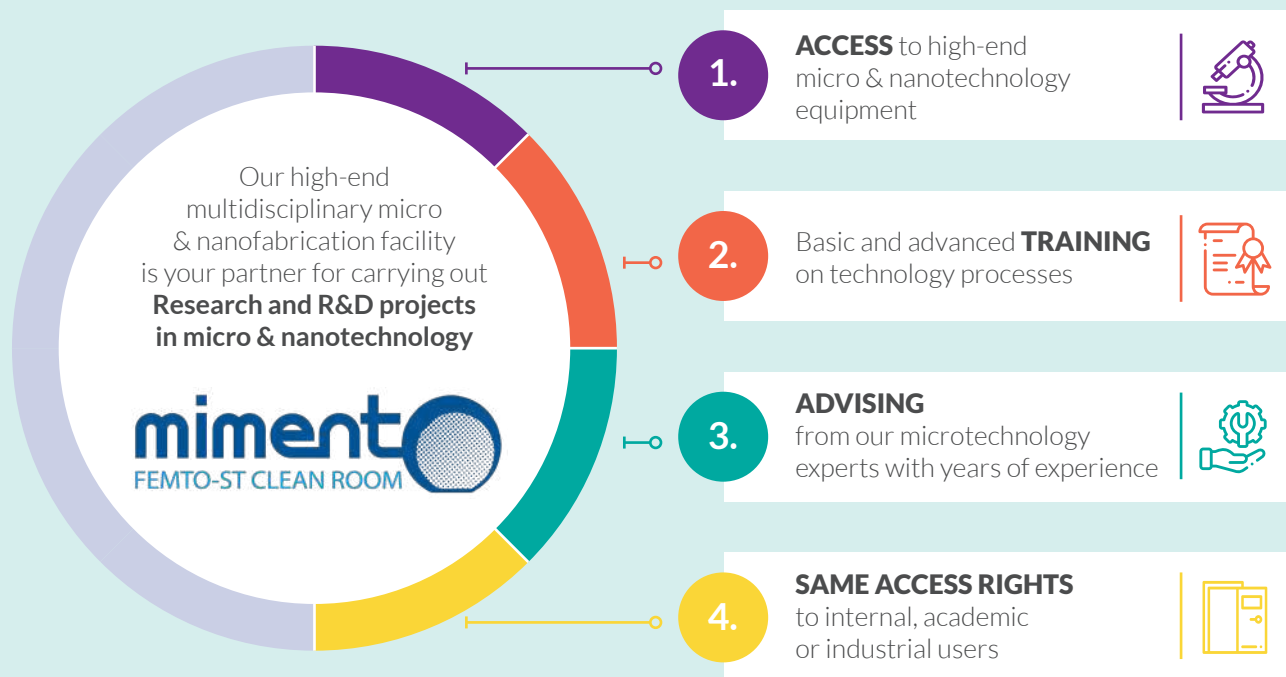
RENATECH NETWORK

MIMENTO is a member of the "RENATECH" network (French national network for large facilities involved in technological research in the field of micro and nanotechnology). This network is a partnership between five CNRS academic technology centers (LTM (Grenoble), C2N (Orsay / Marcoussis), IEMN (Lille), LAAS (Toulouse), FEMTO-ST (Besançon)) and CEA - LETI (Grenoble). The purpose of this network is to support French research by providing access to fabrication facilities and technology experts for interested research teams. It is also open to regional, national and international industrial partners for research collaboration.

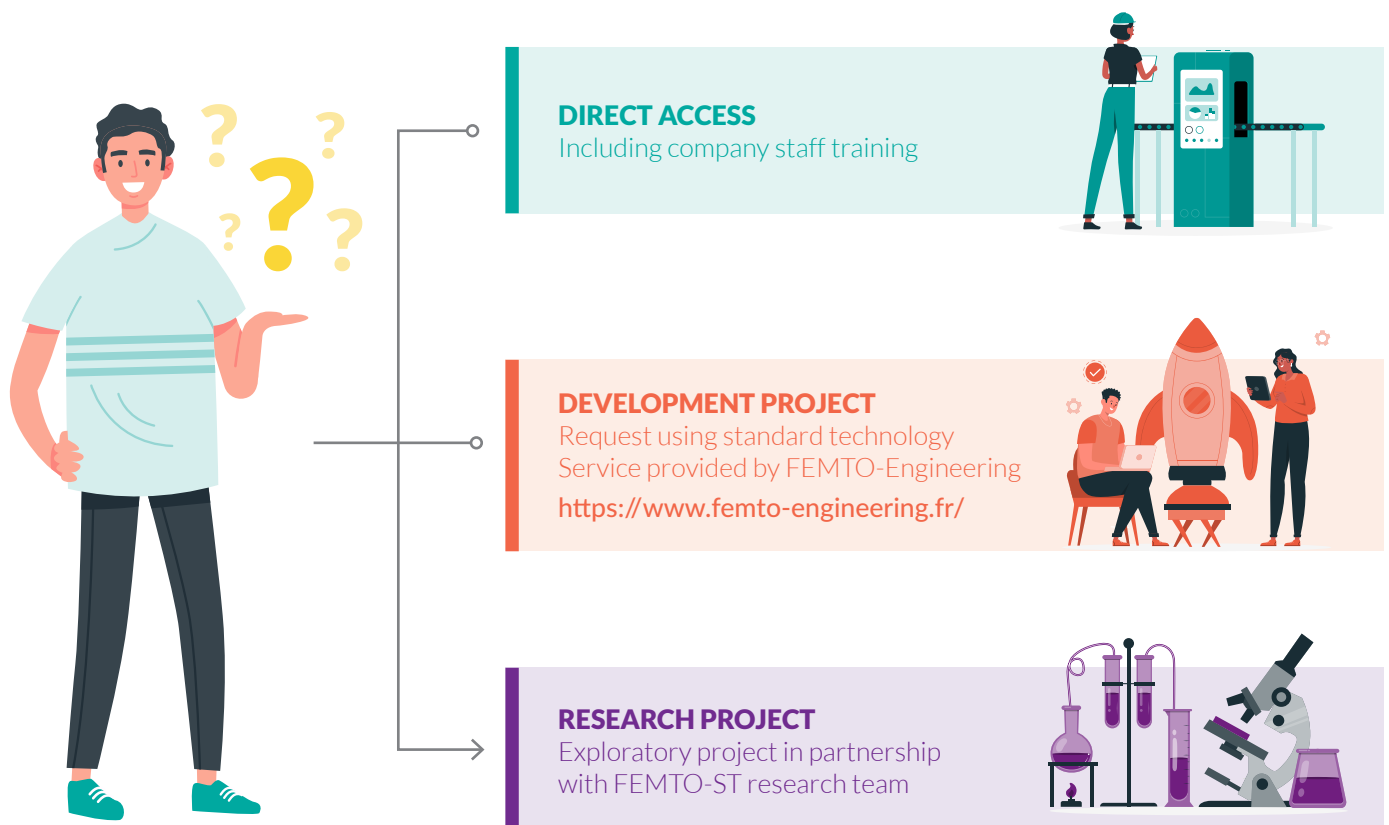
Regionally, the FEMTO-ST Institute is associated with the "Pôle des Microtechniques" (a regional cluster of microtechnology-based companies and research centres) and with the proximity Technological centers of Dijon, Nancy, Strasbourg and Troyes. It is also a partner of The Competencies Centre in Nanosciences and Nanotechnology Grand Est (C'Nano Grand Est).



WHAT DO WE OFFER?



AN ACCESS TO INDUSTRY



TEMIS INNOVATION BUILDING

LITHOGRAPHY

1. Spin-coater
2. Metrology platform
3. UV alignment system
4. DUV alignment system
5. Auto spin-coater
6. Laser marking system
7. Mask generator
8. Spray coater
9. Cleaning system

INTEGRATION / PACKAGING

1. Wafer aligner-bonder 6"
2. Megasonic wafer cleaner
3. Multi-wafer bonder
4. Multi-wafer bonder
5. Surface activation system
6. Flip-chip bonder
7. Mechanical micro bond tester
8. Die bonder
9. Wire bonder

WET CHEMISTRY

1. Metals electroplating
2. HF acid bench

3D LASER MICROFABRICATION

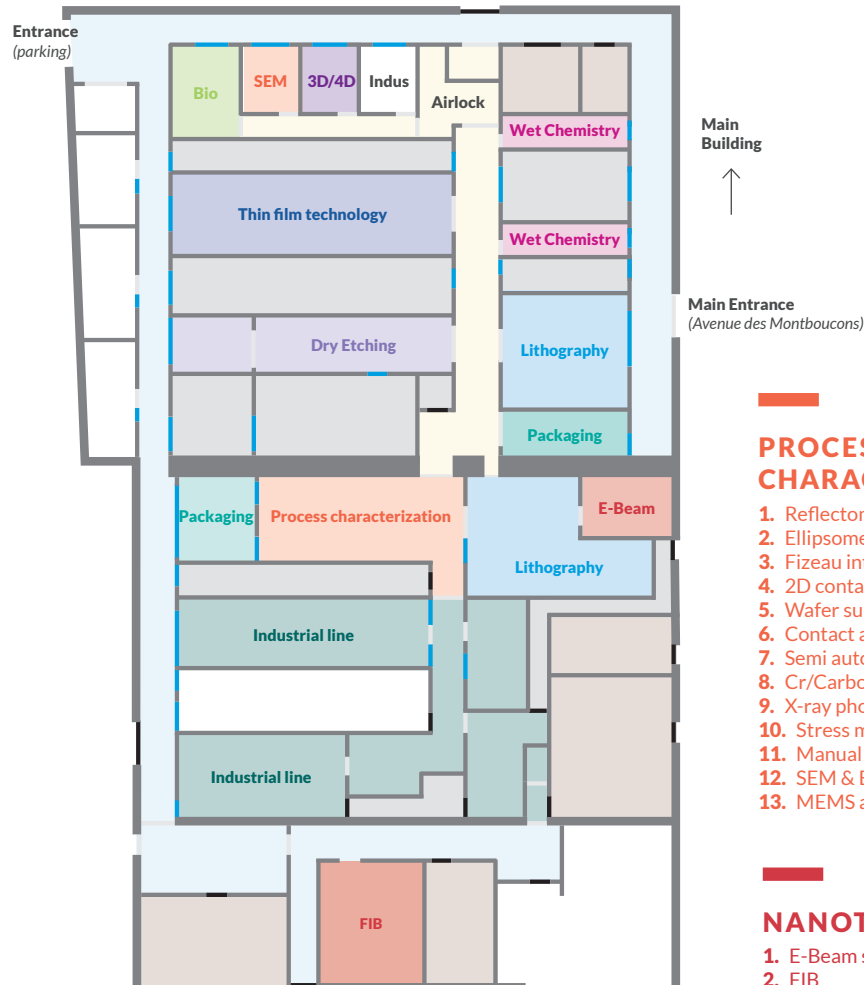
1. CO₂ laser 3D micromachining
2. High resolution 3D printer
3. 3D laser glass machining
4. Automated Critical Point Dryer

THIN FILM TECHNOLOGY

1. RF magnetron sputtering system
2. DC magnetron sputtering system
3. DC magnetron sputtering system
4. DC magnetron sputtering system
5. Plasma enhanced atomic layer deposition
6. E-Beam evaporator
7. ICPECVD
8. E-Beam evaporator
9. Oxidation and annealing furnace
10. RTP system

DRY ETCHING

1. Vapor HF
2. Stripping tool
3. RIE-CCP
4. Stripping tool
5. Surface treatment system
6. DRIE-ICP 4"
7. Si DRIE-ICP 6"
8. Si DRIE-ICP 4"
9. ICP-RIE etch system



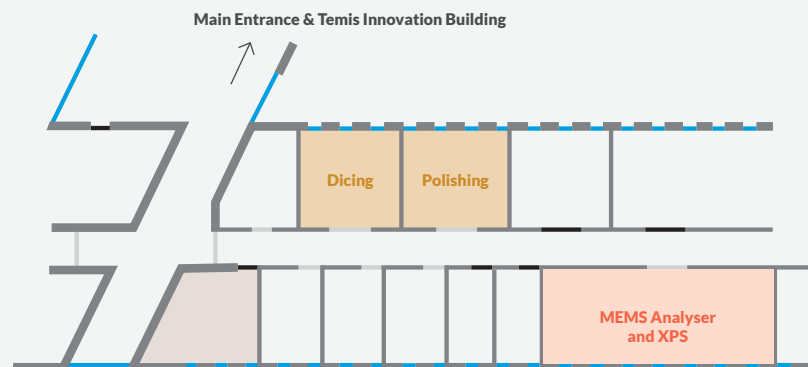
PROCESS CHARACTERIZATION

1. Reflectometer
2. Ellipsometer
3. Fizeau interferometer
4. 2D contact profilometer
5. Wafer surface measurement
6. Contact angle metrology
7. Semi automatic RF probe station
8. Cr/Carbon coater
9. X-ray photoelectron spectrometry
10. Stress measurement
11. Manual DC probe station
12. SEM & EDS
13. MEMS analyser

NANOTECHNOLOGY

1. E-Beam station
2. FIB
3. FIB

MAIN BUILDING



DICING/POLISHING

1. High precision dicing saw 8"
2. High precision dicing saw 8"
3. Lapping and polishing system
4. CMP system
5. Die-matrix expander

LITHOGRAPHY

1 SPIN-COATER WITH INTEGRATED HOT PLATE

> Solar-Semi OC ST22

Use: Photoresists spin coating



Spin speed	≥ 7000 rpm
Cover	Close, middle or open (with some speed limitations)
Wafer Chuck	diam. 100 mm max and small pieces (only vacuum fixation)
Recipes	Selection and edition with touch screen display
Hot Plate	250 °C max, diam. 152 mm max • Vacuum contact baking

2 SEMI-AUTOMATIC METROLOGY PLATFORM

> Süss Microtec DSM8 GEN2

Use: Top & bottom / Top & top / Alignment control

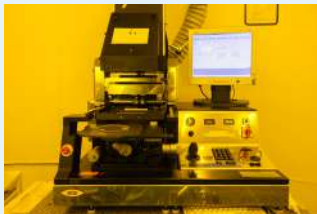


Substrate size	4" & 6" circular wafers
Substrate thickness	from 200 µm to 1000 µm
Front to back measurement accuracy	0.2 µm
Accuracy	Tool induced shift compensation by wafer & pattern rotation
Graphical user interface	Including graphical display of results • ASCII output files (.CSV)

3 UV DOUBLE-SIDE ALIGNMENT SYSTEM

> EVG 620

Use: Top and bottom side alignments / Alignment for bonding

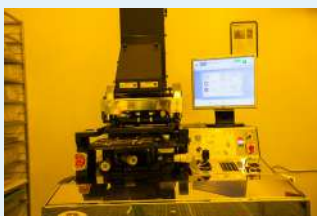


Resolution	Vacuum ≥ 0.8 µm • Hard Contact ≥ 1.5 µm • Soft Contact ≥ 2.0 µm Proximity ≥ 5.0 µm
Mask size	4" and 5"
Alignment stage	Manual precision micrometers
Alignment accuracy	Top side alignment: ± 1.0 µm • Bottom side alignment: ± 1.25 µm
Substrate size	2", 3" and 4" • Thickness: 0.1 to 2.5 mm (more on demand)
Exposure	Broadband (mercury arc lamp: 350 W) • Long pass filter for SU-8 photoresist • Time / Time interval • Sector exposure

4 UV DOUBLE-SIDE ALIGNMENT SYSTEM

> EVG 620

Use: Top and bottom side alignments



Resolution	Vacuum ≥ 0.8 µm • Hard Contact ≥ 1.5 µm • Soft Contact ≥ 2.0 µm Proximity ≥ 5.0 µm
Mask size	4", 5" and 7" • 5" flexible film
Alignment stage	Autofocus and automatic positioning • Manual precision micrometers
Alignment accuracy	Top side alignment: ± 1.0 µm • Bottom side alignment: ± 1.25 µm
Substrate size	2", 3", 4" and 6" and small pieces (≥ 7x7 mm²) Thickness: 0.1 to 1.0 mm (more on demand)
Exposure	Broadband (mercury arc lamp: 500 W) • Long pass filter for SU-8 photoresist • Time / Time interval • Sector exposure

5 AUTOMATIC SPIN-COATER, BAKING AND DEVELOPER

> ACS 200 GEN3

Use: Adherence promotor • Photoresist coating • Photoresist development



System	Cassette to cassette (high throughput fully automated)
Substrate size	3" & 4" circular wafers
Resists	5 dispense lines
Baking	4 hot plates (contact and proximity mode)
Developer	3 developer lines (TMAH, KOH & PGMEA) • Spray and puddle
Recipes	Library of recipes

6 LASER MARKING SYSTEM

> Traçamatrix

Use: Wafer & device marking • Transparent & opaque



Laser	Nd:Yb, 1064 nm • Beam size: 100 µm • Adjustable: laser frequency and power, writing speed
Stage	Write field: up to 110 x 100 mm² • Motorized Z
Resolution	Minimum text height: 300 µm
Features	Red diode to preview the marking area on the surface of the piece

7 OPTICAL MASK GENERATOR

> HEIDELBERG MLA150

Use: Optical masks • Direct exposure • Grayscale lithography

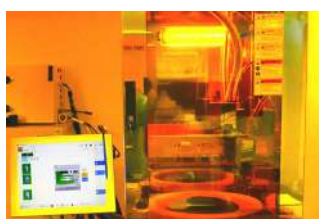


Features	Minimum structure size 0.6 µm • Minimum lines and spaces: 0.8 µm • Files format: GDSII, CIF, DXF, GERBER, BMP • Grayscale: 128 gray levels
Substrates	Size 5 x 5 mm to 8" x 8" / Thickness 0.1 - 12 mm • Mask soda lime 7*7*0,12 Mask Quartz 6*6*0.25 • Mask soda lime 5*5*0.09 • Mask soda lime 4*4*0.09 Wafer 6", 4" and 3"
Chuck	Stage X/Y with vacuum
2 Laser types	Diode, blue, 405 nm, 8W (h-line photoresists) • Diode, UV, 375 nm, 3W (i line photoresists)

8 SPRAY COATER

> Süss Microtec AS 8

Use: Conformal resist coating on substrate with high topology



Resist thickness	Standard process: 5 µm • Other process: several tens of microns
Parameters	Dilution and solvent • Resist flow • Speed of the nozzle • Number of meanders • Chuck temperature • Nitrogen flow • Distance between nozzle and substrate
Nozzle	One dedicated to AZ10XT
Process time	5 minutes (for 5 µm)
Resist dilution	Acetone • MEK
Substrate size	From pieces to 150 mm max

9 SEMI AUTOMATIC CLEANING SYSTEM

> Solar-Semi QS W300

Use: Mask & wafer cleaner



Chuck by clamp	Wafer 3", 4" and 6" • Mask 4", 5" and 7"
Cleaning	Deionised water (30 to 180 bars) • Heated solvent (80 °C max) • Piranha
Back side rinse	

INTEGRATION / PACKAGING

1 WAFER ALIGNER-BONDER 6"

> AML AWB-04

Use: Flexible automatic multi-process bonding system (Direct, Anodic, Eutectic, Thermo-Compression, Adhesive)



Features	In-situ wafer IR/VIS alignment, in-situ plasma surface activation • Surface treatment (plasma, vapors) & UV exposure • Alignment accuracy $\pm 1.5 \mu\text{m}$ (bond type, wafers) • No flag wafer clamping
Chamber	Vacuum min $1\text{E}-6$ mbar • Pressure control mode • 3 process gases: N_2 , O_2 , Ar / Vapour: DI water, formic acid
Substrat	Wafers: 3", 4" and 6" / chips: $10 \times 10 \text{ mm}^2$, $26 \times 10 \text{ mm}^2$, $26 \times 20 \text{ mm}^2$ • Min. thickness of top wafer: 0.2 mm • Max. thickness of wafer stack: 30 mm
Voltage	Max. bonding voltage/current: 2.5 kV / 40 mA • Constant voltage or constant current operation
Heating	Source: Halogen lamps, max. rate $\sim 1.6^\circ\text{C/s}$ • Top/Bottom temperature: max. 560°C , 1°C step
Contact Force	Hydraulic load cell 0-40kN, resolution $\pm 5 \text{ N}$ • Top Tungsten Platen: max. 40 kN • Top Graphite Platen: max. 1 kN (anodic bond)
Cooling	Natural or forced by N_2 flow ($\leq 200^\circ\text{C}$)

2 MEGASONIC WAFER CLEANER & WAFER BONDING INSPECTION SYSTEMS

> CL200 & IR200

Use: Final rinsing of wafers before bonding (*reduction of particles*)



Features	Dedicated for removing particles from wafer surface by megasonic DI-water jet • Drying the wafers by IR heating and spinning • Vibratory motor and tilt applied to align wafers • Pre-bonding of wafers
Wafers	Size of round wafers: 2", 3", 4", 5" and 6" • Size of square substrates: 4x4", 5x5" • Via-holes not allowed (vacuum chucks)
Chucks	Vacuum chucks
Spin speed	max. 4000 rpm
Inspection IR System	Infra-Red inspection system for bonded Si stack • IR Camera, manually adjustable Optical Zoom • Field of view: diam. 75 mm max

3 MULTI-WAFER BONDER 4"

> AML 402P

Use: Special bonding process (*Anodic at controlled atmosphere*)

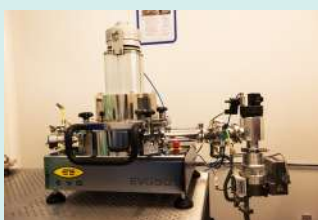


Features	Wafer-level bonding (NO FLAGS , clean processes only) • Big separation between wafers (up to 10 mm) • In-situ wafer alignment: Visible/IR ($\pm 5 / 20 \mu\text{m}$) • Control of atmosphere with inert gas (He, Ne)
Chamber	Vacuum down to $1\text{E}-6$ mbar
Wafers	Size of 3" and 4" (Si, SOI, Glass, LiNbO_3 , Quartz) • Max. thickness of wafer stack: $8 \text{ mm} \pm 0.5 \text{ mm}$ • Min. thickness of top wafer: 0.4 mm
Heating	Top: Halogen lamps (max. 560°C) • Bottom: Resistance heater (max. 560°C) • Fast or controlled heating
Voltage	Max. bonding voltage/current: 2.5 kV / 40 mA • Constant voltage or constant current operation
Contact Force	Top Graphite Tool: max. 500 N (anodic bonding) • Top Molybdenum Tool: max. 2.5 kN ($1\text{E}-5$ mbar)
Cooling	Natural or controlled cooling

4 MULTI-WAFER BONDER 4"

> EVG 501

Use: Standard bonding process (*Anodic, Eutectic, Thermo-Compression, Adhesive & Direct*)



Features	Wafer-level bonding • Separation set by 3 FLAGS (thickness 50 µm or 200 µm) • Alignment of wafers possible in EVG601 (±5 µm)
Gas	Vacuum down to 1E-4 mbar (turbo pump) • Purge gas: N ₂ / Process gases: N ₂
Wafers	Size of 3" and 4" • Silicon, SOI, Glass, LiNbO ₃ , Quartz • Max. thickness of wafer stack: 6 mm
Heating	Top: Resistance heater (max. 550 °C) • Bottom: Halogen lamps (max. 550 °C)
Voltage	Max. bonding voltage/current: 2 kV / 50 mA
Force	Quartz Tool: max. 2 kN (anodic bonding) • Titanium Tool: max. 4 kN
Cooling	Natural or ramp cooling

5 PLASMA SURFACE ACTIVATION SYSTEM

> Nanoprep NP12

Use: Surface activation for low-temperature bonding applications



Features	Activation in cold plasma (low temperature, ambient conditions), based on dielectric barrier discharge • Very fast process (<1 min)
Plasma	Oxygen, nitrogen, argon • Power: max. 500 W (typ. 200 W for Si wafer) • Programmable number of passage
Wafers	Silicon, Glass, Quartz, LiNbO ₃ ... • Wafers with metallic layers NOT ALLOWED • Size range: 10 mm up to diam. 300 mm • Thickness: typical 0.5 mm, 1.0 mm
Chuck	Vacuum fixation of substrate

6 AUTOMATIC FLIP-CHIP BONDER

> Süss Microtec FC250

Use: Die to substrate bonding and interconnecting



Features	Automatic pick & place of die • In-situ die-to-substrate alignment • Bonding of components with excellent process control (heating/cooling rate, compression force, time)
Operations Modes	Bonding – Interconnecting, Hot embossing, Dispensing
Technical specifications	Size of die: 0.2-10 mm, height max. 2 mm • Size of substrate: 0.5-200 mm • Heating: 20 °C up to 500 °C (die) & 450 °C (substrate) • Force: 0.3-500 N

7 MECHANICAL MICRO BOND TESTER

> Nordson DAGE 4000 Plus

Use: Testing of: Electrical interconnects • Bonding quality



Features	Mechanical testing of micro-components in both PULL & SHEAR modes • Automatic surface detection for SHEAR • Vacuum/mechanical holder
Cartridges	P100g for Wire Pull Destructive test • S250g for Ball Shear Destructive test • S5Kg for Die Shear Destructive test • S200Kg for Die Stud Pull Destructive test
X-Y stages	High force, high precision motorized stage • Working surface: 280x280 mm ² • Travel range: max. 160 mm
Optics	Microscope Leica S9D, magnification up to 69.3x • Trinocular camera
Substrate	3", 4" and 6" wafers • Non-standard: 5-70 mm ²

8

PICK AND PLACE DIE BONDER

> TPT HB-70

Use: Die bonding, Assembly of micro- components



Features	Die adhesive bonding, assembly of micro-components • Epoxy stamping, epoxy pneumatic dispensing • Manual or semi-automatic modes
Die Tool	Pick Up vacuum tools available: Metal Tip: 100 µm, Hole 50 µm • Plastic Tips: 500 & 1016 µm, Hole 200 & 508 µm • Force range: 1-100 cN • Motorized and Programmable Z-axis (25 mm)
Die Chuck	Large heated stage (100x100 mm ²) • Mechanical/Vacuum substrate fixation • Height range: 70-90 mm • Heating option: ambient to 250 °C • Rotatable table with alignment ± 10 µm • Option: Mechanical stage for miniature substrates
Optics	HDMI Camera 11x Optical and 125x Digital Zoom
Epoxy	Stamping capillary (dot < 150 µm, ceramic tip) • Stamping tool (cross, dot ~1 mm, metal tip)

9

SEMI-AUTOMATIC WIRE BONDER

> TPT HB-16

Use: Wire bonding of electronic components



Features	Ball, edge, bump & ribbon bonding. Stud bump fabrication
Bonding Tool	Au wire (25 & 19 µm) or Al wire (25 µm) • Ultrasonic Power: 0 – 10 W (63.3 kHz) • Bond Time: 0 – 10 s / Bond Force: 5 - 150 cNm • Motorized and Programmable Z-axis (17 mm), Y-axis (10 mm) • Electronic Ball Size Control (typical diam. 75 µm) • Programmable Loop Profile
Chuck	Heated stage (diam. 90 mm) • Mechanical/Vacuum substrate fixation • Height range: 70-90 mm • Heating: ambient to 250 °C
Optics	Optical Microscope 20x Optical Zoom

WET CHEMISTRY

1 Ni ELECTROPLATING SYSTEM

> Yamamoto Electroplating Station

Use: Hard mask for etching Items in nickel • Vias filling



Type of plating	Semi-bright Nickel
Substrates	Wafer 3, 4 and 6 inches
Stress	About 90 MPa
Speed of growth	1,5A/dm ² = 18 µm/h
Roughness	Around 20 nm

2 HYDROFLUORIC ACID BENCH

Use: SiO₂ and Ti etching



Solutions	BHF 1:7 • HF 48%
Etch Speed	SiO ₂ by BHF: 57 nm/min at 20 °C • BF33 by HF 48%: 4.2 µm/min

3D LASER MICROFABRICATION

1 CO₂ LASER 3D MICROMACHINING

> Coherent CombiLine Adv. WT

Use: Precise 3D machining of material



Features	Focused CO ₂ laser beam (~240µm in diameter) with optical alignment • Main application: surface polishing of glass microstructures • Possible applications: marking, cutting, scribing, ablation
Laser	Coherent PowerLine C30 (lambda=10.6µm, pulsed 1-25kHz)
Optics	f-theta lens
Scanning	Galvo, field size 90x90 mm ² • Programmable X-Y axis (150 mm travel) • Programmable Z-axis (300 mm travel range, 0.1 mm accuracy)
Vision system (alignment)	Field of view: ~12x9 mm ²
Materials (standard)	Fused Silica, Borofloat 33

2 HIGH RESOLUTION 3D PRINTER

> Nanoscribe Photonic Pro. GT+

Use: 3D laser µ-printing • 2D & 2.5D lithography



Scanning	Piezo & Galvo modes
Writing	Dip-in Laser Lithography & Oil Immersion modes
Printing specs	Min 3D lateral feature size: 200 nm • Max object height: 8 mm • Build volume: 100x100x8 mm ³ • Minimum surface roughness Ra ≤ 20 nm • Scan speed ≤ 100 mm/s
Wafers	Fused silica (high resolution) • Silicon substrates (large features) • Soda lime with ITO (mesoscale applications)
Photoresists	IP-Dip2, IP-S, IP-Q, IP-PDMS, IP-n162, IP-L, GP-Silica
Optics	20X (2D), 10X, 25X & 63X (3D)
Files	3D CAD (.stl) or GWL scripting

3 3D LASER MICROFABRICATION SYSTEM

> FEMTOprint f100 aHEAD Enhanced

Use: 3D micromachining of transparent materials & local index modifications



Features	Fabrication of highly accurate 2.5D / 3D geometries by femtosecond • laser assisted wet etching method (FLAE) • Sealing, welding, selective ablation, micro-cracks generation • Modification of refractive index • Alignment to marks with ± 1-2 µm precision
Laser Source	Power: >5 W, λ=1030 nm • Controllable pulse duration & repetition rate
Writing head	Objective lens: 10x, 20x, 50x
Materials	Standard types of glass: Fused silica, Borofloat 33
Performances	Max. precision: ± 1 µm (2.5D), ± 2 µm (3D) / Aspect ratio >1:500
Substrate	2», 3» and 4» wafers • Small samples (10x10 mm ² , 20x20 mm ² , 26x10 mm ² , 26x20 mm ²)

4 AUTOMATED CRITICAL POINT DRYER

> TOUSIMIS AUTOSAMDRI-931

Use: Drying delicate samples for 3D structures, SEM & Biological applications



Features	Automated, reproducible and controlled process • Slow fill control for the most delicate sample types • Internal particulate filtration down to 0.08 µm • Fast Adiabatic chamber cooling (less than 60 s)
Method	Preserves the surface structure of a specimen which could otherwise be damaged due to surface tension when changing the liquid to gaseous state
Chamber	1.25" chamber size
Holders	HF compatible holder for 2 chips (25*25*0.7 mm) • 1" Large Capacity holder
Software	"Statis Software" for challenging sample types
Gas	LCO ₂ tank with syphon (Dip) tube • Purity ≥ 99.998% ("Bone dry")

THIN FILM TECHNOLOGY

1 RF MAGNETRON SPUTTERING SYSTEM

> Plassys MP 450S

Use: Metal, Oxide & Nitride deposition



Features

RF reactive sputter deposition of metallic targets to deposit: Oxides (Al_2O_3 , ZnO , SiO_2) or nitride (AlN , TiN) • 4" and 6" targets • Plasma RF cleaning/activation of the substrates • Heating substrate until 600 °C

Wafers

One 4" or 3" wafer per run (small samples as well)

2 DC MAGNETRON SPUTTERING SYSTEM

> Alliance Concept DP650

Use: Metal deposition



Features

DC sputtering of 8" & 6" metallic targets: Au 6" target, Cr, Cu, Al, W, Ti, 8" Al target • Plasma RF cleaning/activation of the substrates

Wafers

6" substrates (max height: 1 cm) on 6 diff. positions during the same run

3 DC MAGNETRON SPUTTERING SYSTEM

> Plassys MP 500

Use: Metal deposition



Features

DC sputtering of 4" metallic targets: Au, Cr, Cu, Ag, Mo, Ta, Pt, Ti, W and Ni reinforced magnetron • 6" Al target • Plasma RF cleaning/activation of the substrates

Wafers

One 4" wafer or smaller samples per run (max height: 4 cm)

4 DC MAGNETRON SPUTTERING SYSTEM

> Plassys MP 700S

Use: Metal deposition



Features

DC sputtering of 4" metallic targets: Au, Cr, Ni reinforced magnetron - 6" Al and Ti target - 3" tilted Cu target • Plasma RF cleaning/activation of the substrates • Heating substrate until 600 °C • Enhanced thickness uniformity with the tilted target

Wafers

One 4" wafer or smaller samples per run (max height: 4 cm)

5 PLASMA ENHANCED ATOMIC LAYER DEPOSITION

> Veeco Fiji G200

Use: Highly conformal and uniform oxide and platinum depositions



Features

Thermal (max. 500 °C) and plasma ALD • Ultra-thin layers (typically from 1 nm to 100 nm, depending on the material).

Wafers

One 8" or 6" wafer or Two 4" wafer per run or smaller samples (max height: 1cm)

Materials

Al_2O_3 , TiO_2 , SiO_2 , ZnO , HfO_2 , ZrO_2 , Pt.

6 ELECTRON-BEAM EVAPORATOR

> Plassys MEB 600

Use: Metal & Oxide deposition for lift-off processes



Features	Electron beam evaporation of metals or oxide compounds (Al, AlCu, Au, Cr, Ni, Ag, Pt, Au, Ti, Ta, SiO ₂ , Al ₂ O ₃ , TiO ₂) • End-Hall ion source for surface activation & enhanced layer density
Wafers	5 wafers of 4", 7 wafers of 3" or smaller samples, 3 wafers of 4" or smaller samples with the double planetary substrate holder

7 ICPECVD

> Sentech SI 500D

Use: Oxide & Si₃N₄ deposition • Good conformal deposition



Features	Low temperature chemical vapor deposition of silica & silicon nitride by means of ICP (Inductive Coupled Plasma) • He back-cooling & RF Ar plasma to: activate the surface – polarize the wafer
Wafers	4", 3" substrates or smaller samples

8 ELECTRON-BEAM EVAPORATOR

> Alliance Concept EVA 450

Use: Metal deposition for lift-off processes



Features	Electron beam evaporation of metals (Au, Cr, Ti, Al)
Wafers	3 wafers of 6", 5 wafers of 4" or 7 wafers of 3" or smaller samples

9 OXIDATION AND ANNEALING FURNACE

> AET

Use: Thermal oxidation & diffusion



Features	3 different furnaces: one for wet or dry oxidation – one for titanium diffusion in LiNbO ₃ • one for annealing under N ₂ or air up to 900°C
Wafers	batch up to 25 wafers (3", 4" and 6")

10 RAPID THERMAL PROCESSING

> Annealsys AS-Premium RTP

Use: Densification & Crystallization • Contact annealing



Features	Densification or crystallization of deposited thin films • Rapid thermal oxidation or nitriding • The RTP processes can be performed in: atmospheric pressure – under vacuum (~10-3 mbar)
Wafers	6" wafer or 4" and little samples in a susceptor (Tmax = 1250°C, Ramp ≤ 20°C/s) No metal in contact with SiC (Peek tweezers)

DRY ETCHING

1 VAPOR HF

> SPTS uEtch

Use: Etched materials: Thermal oxide, TEOS, SOI bonded oxide



Features	DRY vapor phase process • All size of substrates up to 200 mm wafer • Stiction free
Gas	HF, N ₂ and EtOH
Mask materials	Si, Al ₂ O ₃ , SiC, Al, Au, Ni, Cr

2 STRIPPING TOOL

> Tepla GIGABatch360M

Use: PR stripping • Surface activation



Features	Resist stripping • Quartz holders for 25 wafers from 100 mm to 150 mm & Aluminium shuttles (from pieces to 150 mm wafers)
Microwave source	100 to 1000W
Gas	O ₂ , CF ₄ , Ar
End point detection	Intensity

3 RIE-CCP SYSTEM

> CORIAL 200-R

Use: Nano-metric & sub-μ etching on variety of materials



Features	CCP source: 600 W • Clamping chuck: Mecanic
Gas	SF ₆ , C ₂ F ₆ , O ₂ , CHF ₃ , Ar
Mask	PR, SiO ₂ , Metallic masks are allowed
Materials	Dielectrics, SC, piezo-electric ...
Wafers	4", samples can be glued on 3" or 4" Glass carrier wafer
End point detection	EPD Interferometry HORIBA Jobin-Yvon (wavelength 673,7 nm, spot size 20 μm)

4 STRIPPING TOOL

> Muegge R3T

Use: Thick photoresist remover (SU8), descum and surface Activation



Features	Pure chemical etching • Remote plasma microwave source 1 kW • Process temperature: 20 to 70 °C • Only very slight attack to Si and Si compound
Gas	O ₂ , N ₂ and CF ₄
Mask	No attack to metals (Ni, Au, Cu ...)
Materials	Mainly resist remover
Wafers	Substrate size up to 240x240 mm

5 ASHER & SURFACE TREATMENT SYSTEM

> Nanoplas DSB 6000

Use: PR stripping • Surface treatment, preparation, functionalization



Features	ICP source: 600 W • Clamping chuck: No • Temperature Process for both chamber & substrate: 60 to 180 °C
Gas	O ₂ , Ar, SF ₆ , CF ₄
Mask	PR, SiO ₂ , Metallic masks are allowed
Wafers	4", samples can be glued on 4" Glass carrier wafer
End point detection	OES system can be used

6 MULTI-MATERIAL DRIE-ICP SYSTEM 4"

> STS APS

Use: Dielectric, isolated & piezo-electric materials etching



Features	ICP power source: 3 KW • Bias power source: 1.5 KW • Process temperature: -20 to 40 °C • Clamping chuck: Mechanical
Gas	SF ₆ , C ₄ F ₈ , O ₂ , Ar, CF ₄ , He
Mask	PR, SiO ₂ , Metallic masks are allowed
Wafers	4", samples can be glued on 4" carrier wafer
End point detection	OES system can be used

7 Si DRIE-ICP SYSTEM 6"

> SPTS Rapier Omega C2L

Use: Si deep, sub-micronic & isotropic etching • Vias etching



Features	ICP power source: 5.5 KW • Bias power source: 1.5 KW • Dual source • Process temperature: 0 to 40 °C • Clamping chuck: Electrostatic
Gas	SF ₆ , C ₄ F ₈ , O ₂ , Ar, N ₂ , He
Mask	PR, SiO ₂
Wafers	6", samples can be glued on 4" carrier wafer
End point detection	CLARITAS OES system integrated

8 Si DRIE-ICP SYSTEM 4"

> SPTS Rapier

Use: Si deep, sub-micronic & isotropic etching • Vias etching



Features	ICP power source: 5.5 KW • Bias power source: 1.5 KW • Dual source • Process temperature: 0 to 40 °C • Clamping chuck: Electrostatic
Gas	SF ₆ , C ₄ F ₈ , O ₂ , Ar, N ₂ , He
Mask	PR, SiO ₂
Wafers	4", samples can be glued on 4" carrier wafer
End point detection	CLARITAS OES systems integrated

9 ICP-RIE ETCH SYSTEM

> Corial 210IL

Use: Nano-metric & submicronic etching on variety of materials • Metals: Al, Cr, Ni, Ti... • III-V materials: GaAs...



Features	ICP Source : 1000W • Bias power : 600W • Clamping chuck: Mechanic • Quartz shuttles (compatible 75, 100, 150 mm wafers)
Gas	BCl ₃ , Cl ₂ , C ₂ H ₄ , SF ₆ , CHF ₃ , O ₂ , N ₂ , Ar
Mask	PR, SiO ₂ , Metallic masks are allowed
Wafers	3,4 & 6 inch wafers, samples can be glued on 3" or 4" carrier wafer
End point detection	EPD Interferometry HORIBA Jobin-Yvon, LEM G50

PROCESS CHARACTERIZATION

1 THIN LAYER MEASUREMENT SYSTEM

> Filmetrics F50-EXR

Use: Automated film thickness measurement Index mapping



Models	Spectral reflectance & Fast Fourier Transform
Thickness	From 20 nm to 250 μm
Wave-length range	$380 < \lambda < 1700 \text{ nm}$
Wafer chuck	Motorized rotation stage (diam. 100 mm max) • Vacuum substrate fixation
Mapping	Custom map patterns (polar, rectangular, linear...)
Acquisition speed	2 pts/s
Spot size	1.5 mm
Filter	High-Pass Filter ($\lambda > 550 \text{ nm}$)

2 SPECTROSCOPIC ELLIPSOMETER

> Accurion ParkSystems EP4nanofilm

Use: Thin film thickness • Optical constants • Imaging



Measurement capabilities	Thin film thickness: from 0.1 nm to 5 μm • Single layer or multiple layer thin-films • Lateral resolution: 1 μm • Automated imaging and mapping
Holder	max 10 x 10 cm^2 , automatic height and tilt adjustment
Materials	Transparent dielectric, semi-conductors and metals
Optics	Spectral range: UV to NIR: $190 < \lambda < 1700 \text{ nm}$ • Angle of incidence: $39 < \text{AOI} < 90^\circ$ • Objectives: 5x, 10x, 20x and 7x for UV range

3 FIZEAU INTERFEROMETER

> ZYGO Verifire GPI XP/D

Use: Measurement of surface profile and planarity



Measurement capabilities	Z Resolution: $< 0.1 \text{ nm}$ • XY resolution: 100 μm (100 mm field) – 15 μm (15 mm field) • Z measurement range: $> 50 \mu\text{m}$ • Smooth profile with step $< 300 \text{ nm}$
Sample	Large stage suitable for diam. $\leq 100 \text{ mm}$ • Thickness range: 0 to 100 mm • Reflective materials: glass, silicon, metal...
Optics	Fizeau phase shifting interferometer • He-Ne laser ($\lambda = 633 \text{ nm}$) • Camera 1000 x 1000 pixels • Motorized zoom x1 to x6 (not indexed) • Motorized focus (not automatic)

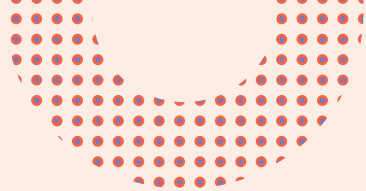
4 2D CONTACT PROFILOMETER

> BrukerDEKTAK XT

Use: Step and roughness • 3D mapping • Stress measurement



Stylus	Diamond tip 12.5 μm
Force	Adjustment 0.03 to 15 mg
Vertical range	1 mm
Minimum step measurable	few nm
Stages	3 Motorized axes • X and Y: 150 mm / θ : continuous 360°
Wafer Chuck	2", 3", 4", 6" & 8" wafers
Scan Length range	50 μm to 200 mm with scan stitching capability
Sample thickness	50 mm max



5 WAFER SURFACE MEASUREMENT

> CyberTechnologies Vantage 2

Use: Surface measurement • Thickness measurement • Optical profilometry



Features	Max size: 200 mm / 40 mm thickness • Max measurement range: 10 mm • X & Y resolution: 50 nm • SCAN CT software - Various filters and measurements
Optics	Infrared interferometer (IT1000 @1310 μm) • Confocal white light sensor (CHR1000 : 1000 μm range)
Holding	Pins (no vacuum)
Materials	Si, Glass, Quartz, LiNbO_3 , LiTaO_3 , Sapphire

6 CONTACT ANGLE METROLOGY

> GBX MCAT

Use: Dynamic contact angle • Liquid surface tension • Wetting hysteresis



Measurement capabilities	Precision: $\pm 0.1^\circ$ on reference droplet - $\pm 2^\circ$ on standard droplet • Angle measurement range: 0 - 180° • Surface tension range: 0,5 - 1000 mN/m • Dynamic measurement: 50 images/s • Borosilicate glass or plastic syringe with Teflon tip • Liquids: DI water (others possible)
Sample stage	Large stage suitable for diam. 100 mm • Thickness range: 0-60 mm • Z-table with fine adjustment X screw
Optics	USB Camera / Optical x10 Zoom / Backside LED illumination

7 SEMI AUTOMATIC RF PROBE STATION

> SIGNATONE

Use: Automated measurement • Electrical RF (100kHz to 20GHz)



Features	Temperature: From -20 °C to 150 °C • Chuck RF: Motorized X,Y,q (f = 200 mm max) with vacuum fixation • Mapping: Custom map: site & sub-site • Acquisition speed: 50 mm/s
-----------------	--

8 CR/CARBON COATER

> LEICA EM ACE600

Use: Coating for SEM/FIB observations & EDS analysis



Features	Cr & Carbon deposition • Rotating stage • Tilted targets
Samples	No wafers allowed, only small chips

9 X-RAY PHOTOELECTRON SPECTROMETRY

> ThermoScientific Nexsa G2

Use: Quantitative atomic characterization of a surface (1-10 nm depth)



Features	Al K α 1486.6 eV anode • Flood gun for charge compensation • Ion gun for depth profile • Acquisition in UHV
Spot Size	10 - 400 μm
Sample max size	60 x 60 mm



10 THIN FILM STRESS MEASUREMENT SYSTEM

> FSM 500 TC

Use: Stress measurement • Thermal expansion coef. • Wafer bow height



Features	Measurement of the wafer curvature before and after film deposition • Stress range: 1 MPa to 4 GPa • Wafer sizes: 200 mm or smaller • Laser: Dual wavelength (780 nm, 650 nm) diodes • Repeatability: 1.5 % (1 σ) of average
Scan & Mapping	Scan range: Up to 170 mm • Scan line: Single scan line at any wafer orientation • Mapping: Multi scan line mapping by manually rotating wafers • Max of 6 line mapping with 30° between each line
Heating	Maximal temperature: 450 °C • Heating and cooling ramps: max 6 °C/min

11 MANUAL DC PROBE STATION

> Cascade Microtech MPS150

Use: Manual probing • DC parametric test



Features	I-V & C-V coaxial chuck with +/- 3 μ m planarity and 360° rotation • Single chip and wafer 150 mm max. (device biasing and vacuum switch) • X/Y movement <5 μ m resolution and independent axis locks • 4 DPP210-M-S DC magnetic positioners with coaxial probe arms • Tungsten tips probe PTT-120-25 • Trinocular stereo zoom microscope 15x to 100x
-----------------	---

12 ENVIRONNEMENTAL SEM & EDS SYSTEMS

> ThermoFisher Apreo S

Use: High resolution observations • 3D reconstruction • Chemical analyses (EDS)

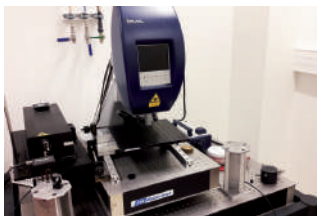


Features	Schottky Field Emission Gun • Landing voltage: 20 V to 30 kV • Current: 1 pA to 400 nA • High vacuum (10 ⁻⁴ Pa) and low vacuum (<500 Pa) modes • IR Camera / NavCam
Detectors	Everhart-Thornley SE detector • Trinity Detection System (T1/T2/T3) for SE and BSE (resolution <1 nm) • Retractable BSE detectors (CBS for high-vac. and GAD for low-vac.) • Low-vacuum SE detector (resolution <2 nm) • EDS SDD 30 mm ² (qualitative and quantitative analysis, mapping) • Element detection from Be • CL detector for cathodoluminescence
Stage	Eucentric stage: 5 axes • X/Y: 110 mm / 110 mm, tilt: -15 to 90° • 6" wafer compatible

13 MEMS ANALYSER

> Polytec MSA-500

Use: MEMS/MOEMS dynamical analysis



Out of plane vibration LDV	VD-09: wide bandwidth Velocity Decoder (0 - 2.5 MHz), max. velocity $\pm$ 10 m/s, typical resolution 0.02 - 0.7 μ m/s/ $\sqrt{\text{Hz}}$ • VD-06: high res. & precision digital Velocity Decoder (0 - 350 kHz), max. velocity $\pm$ 0.5 m/s, typical resolution 0.01 - 0.06 μ m/s/ $\sqrt{\text{Hz}}$
LDV (Laser Doppler Vibrometry)	DD-300: high freq. analog Displacement Decoder (-3 dB: 0.03 - 24 MHz) • Amplitude range limit: $\pm$ 75 nm, noise limited resolution < 0.05 pm/ $\sqrt{\text{Hz}}$
In plane motion SVM (Stroboscopic Video Microscopy)	Frequency range: 1 Hz - 1 MHz • 1.4 Mpixel (1392 x 1040) progressive scan camera • 100 ns time resolution • Limited to repetitive motion and nanometer resolution
3D topography WLI (White Light Interferometry)	Z direction scan range: 250 μ m / Z resolution <1 nm • Lateral resolution <1 μ m (magnification dependent) • Mirau x10 objective

NANOTECHNOLOGY

1 ELECTRON BEAM LITHOGRAPHY SYSTEM

> Raith Voyager

Use: Electronic lithography • Lift-Off Process • Mask for Etching



Filament	Schottky TFE
Current	Up to 40 nA
Voltage	50 kV
Stage	150 mm x 150 mm
Holders	Chips, 4" & 6" wafers
Detectors	SE & BSE
Generator	50 MHz / 20 bit
Field size	500 µm
Resolution	Min feature size: 10 nm
Stitching	30 nm
Overlay	25 nm
File	csf & gds

2 FOCUSED ION BEAM SYSTEM

> Thermo Fisher Scientific Helios 5 UC

Use: Ion Beam Lithography • Cross section • SEM observation • 3D reconstruction



SEM	Source : UC+ Schottky Field Emitter • Acceleration Voltage : 350 V – 30 kV • Beam Current : 1 pA – 100 nA • Resolution @ 1 kV to 15 kV : 0,7 nm
FIB	Source : Ga LMIS • Acceleration Voltage : 500 V to 30 kV • Beam Current : 1 pA – 100 nA • Resolution @ 30 kV : 2,5 nm
Stage	XY : 150 mm x 150 mm, piezo driven • Z : 10 mm • Rotation : 360° endless • Tilt : -10 to 60°
Detectors	For SE and BSE and also for transmission configuration • ETD, TLD, MD, ICD, DBS, STEM, ICE • IR-CCD and NavCam
Gas Injection system	MultiChem Gas Delivery System with motorized gas needle alignment • Pt deposition • W deposition • C deposition • XeF2 enhanced milling
Nanomanipulators	EasyLift EX linked to AutoTEM for automatic TEM lamella preparation • Kleindiek MM3A with RoTip and Micro Gripper System
Patterning	Control of the beam for milling, enhanced milling and deposition • Integrated system for basic shapes • Raith Elphy Multibeam for advanced tasks
Other capabilities	Plasma Cleaner • Charge Neutralizer • Auto Slice & View

3 FOCUSED ION BEAM SYSTEM

> Raith Velion

Use: Ion Beam Lithography • Large Area Lithography • Ion Implantation



SEM	Source : Schottky Field Emitter • Acceleration Voltage : 20 kV • Resolution : 5 nm
FIB	Source : LMAIS AuGeSi • Wien Filter ExB • Acceleration Voltage : 35 kV • Beam current : 5 pA – 1 nA • Resolution @ 35 kV : 10 nm
Stage	XY : 100 mm x 100 mm • DC motors + piezos for fine positioning • Laser interferometer : resolution 1 nm • Rotation & Tilt : available only for small samples (< 1 cm²)
Detectors	ETD • IR-CCD
Patterning	Speed : 50 MHz • Resolution : 20 bit • Dynamic beam control • Stitching accuracy : 50 nm • Overlay accuracy : 50 nm • Traxx and Periodixx • Files : GDSII

DICING/POLISHING

1 HIGH PRECISION DICING SAW 8"

> DISCO DAD 3361

Use: Separation & Structuration of chips • Circle cut process



Features	Substrate & Wafers can be processed • Max size: diam.12" / 4.3 mm thick • Axes precision: 1 µm (X, Y & Z) / 1.0" (θ) • Speed feed: 0.1 to 10 mm/s • Water cooling
Holding	UV tape on porous vacuum chuck
Processed materials	Si, Glass, Quartz, LiNbO ₃ , LiTaO ₃ , PZT, Si ₃ N ₄ , Langasite, Langatate, Sapphire

2 HIGH PRECISION DICING SAW 8"

> DISCO DAD 3350

Use: Separation & Structuration of chips • Circle cut process



Features	Substrate & Wafers can be processed • Max size: diam. 8" / 4.3 mm thick • Axes precision: 1 µm (X, Y & Z) / 1.0" (θ) • Speed feed: 0.1 to 10 mm/s • Water cooling
Holding	UV tape on porous vacuum chuck
Processed materials	Si, Glass, Quartz, LiNbO ₃ , LiTaO ₃ , PZT, Si ₃ N ₄ , Langasite, Langatate, Sapphire

3 PRECISION LAPPING & POLISHING SYSTEM

> Logitech PM6

Use: Optical polishing • Material thinning



Features	Substrate & Wafers can be processed • Max size: diam. 4" / 10 mm thickness • Thickness precision: 1 µm • Speed: 1 to 100 rpm • Automatic flatness control & fix • Pressure of work adjusted with loads • Plate size: diam. 300 mm
Holding	UV tape on vacuum chuck
Processed materials	Si, Glass, Quartz, LiNbO ₃ , LiTaO ₃ , PZT, Si ₃ N ₄ , Langasite, Langatate, Stainless steel

4 CMP SYSTEM

> Alpsitec E460

Use: Wafer optical polishing • Hard materials process



Features	2" to 6" Wafers can be processed • Process program (10 steps) • Max thickness: 10 mm • Speed: 1 to 120 rpm • Hydraulic pressure of work • Plate size: diam. 465 mm
Holding	Vacuum chuck • Ring (+ back pressure)
Processed materials	Si, Glass, Quartz, LiNbO ₃ , LiTaO ₃ , PZT, Si ₃ N ₄ , Langasite, Langatate, Stainless steel

5 DIE-MATRIX EXPANDER

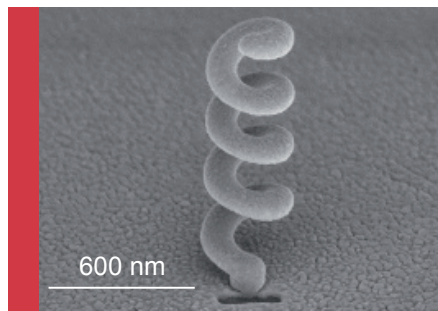
> Ultron UH132

Use: Dicing tape expander

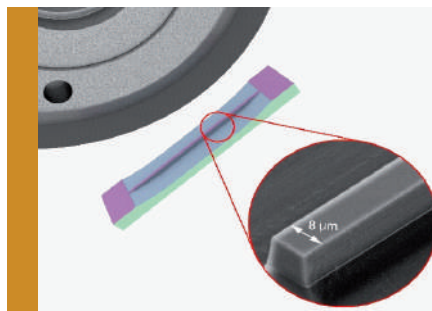


Features	Wafers and devices up to 8"
Holding	Rings & vacuum
Option	Possibilities of thermal process

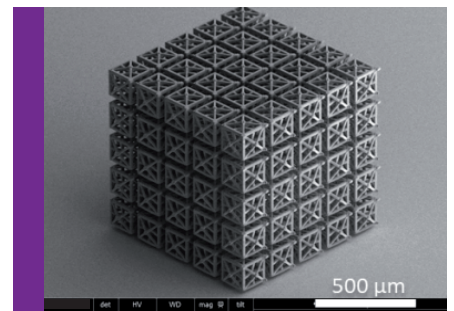
A FEW ACHIEVEMENTS



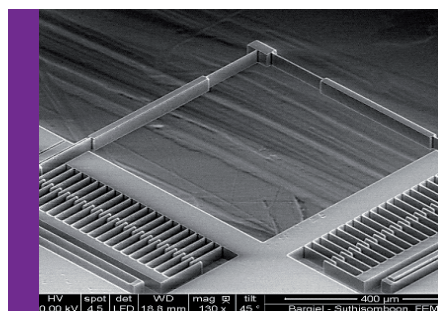
3D deposit
- FIB deposition -



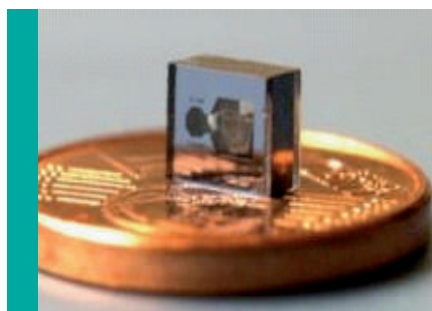
Precision dice & polish LiNbO₃ ridge
- Dicing -



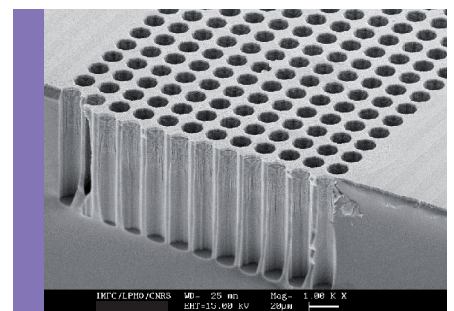
3D mechanical metamaterials
- High resolution 3D printing -



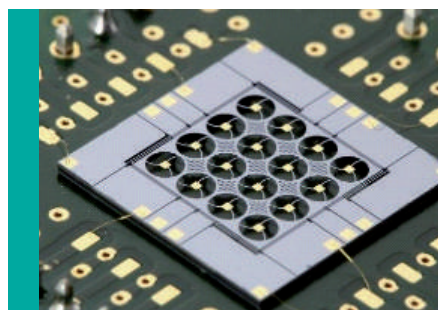
All-in-glass actuated micro-platform
- 3D laser micro-machining -



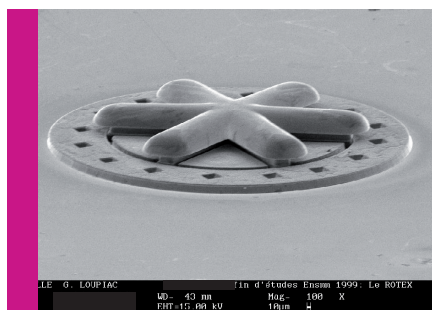
Cesium vapor microcell
for MEMS atomic clock
- Multi-wafer Bonding -



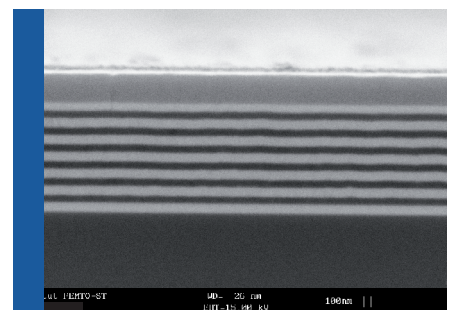
Phononic crystals
- Silicon DRIE etching -



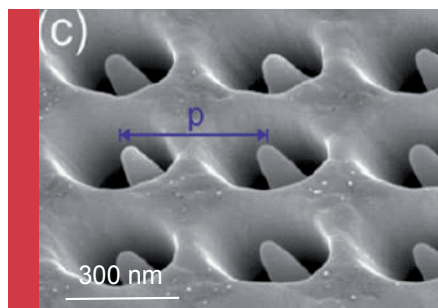
Vertical electrostatic
comb drive actuator
- Wire bonding -



LIGA UV Ni micromotor
- Electroplating -



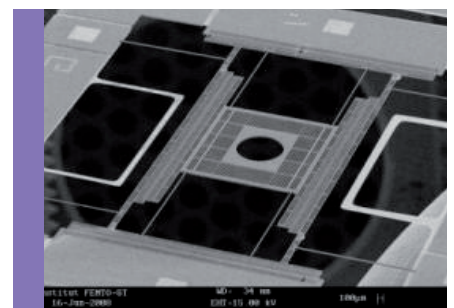
Multi-layer acoustic wave mirror
- Evaporation -



Milling with angle
- FIB milling -



Thinning and release of glass microlenses
- Thinning / Polishing -



Electrostatic X-Y microactuator
- Silicon DRIE etching -



INDUSTRIAL LINE

This industrial production line is managed by SOITEC Besançon. Its activity is dedicated to the fabrication of micro and nano-acoustic waves devices (SAW, BAW) for RF filters and resonators. In that context, the company develops new competencies in the field of MEMS, particularly exploiting SOITEC POI (Piezoelectric-On-Insulator) wafers obtained by Smart-Cut™ techniques and combining single crystal piezoelectric thin films and silicon.

The main characteristic of this project consists in the exploitation of this pilot line, halfway between research and industry. Unprecedented initiative in France, this technology platform provides high yield processes for industry-oriented scientific investigations and unique opportunities for combining front-end research results and market-oriented developments.

The pilot line covers 200 sqm in ISO 5 conditions. The main equipments operated here are a high resolution lithography body9 i-line stepper, automatic coating and development tracks, a sputtering cluster (AlN, Mo), a high accuracy evaporation machine (Al, Ti, Pt, Au), a ferroelectric poling bench, an O₂-plasma cleaner, several characterization instruments (CD SEM equipments, profilometers, tip-probing station, microscopes) and chemical benches for wafer surface processing and cleaning.

CONTACT
frecnsys@soitec.com

Sylvain BALLANDRAS
Filter design & Manufacturing director
+33 (0)3 81 25 53 63

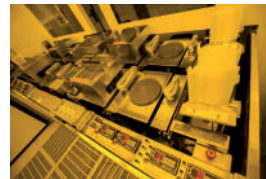
Emilie COURJON
Production manager
+33 (0)3 81 25 53 54

soitec



> SVG 88 series

Use: Automatic coating & development tracks



Substrate size	4" & 6" circular wafers
-----------------------	-------------------------

> Balzers BAK760

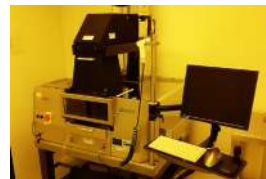
Use: Evaporation



Substrate size	2", 3", 4" & 6" circular wafers
Materials	Ti, Cr, Al, AlCu, Au, Pt

> Süss Microtec MA6-GEN4

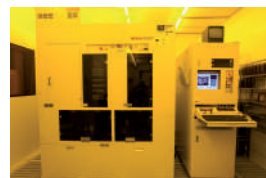
Use: DUV Aligner (*Contact photolithography machine*)



Substrate size	4" & 6" circular wafers
Resolution	<0.8 µm

> Nikon NSR2005i9C

Use: Stepper (*High resolution lithography machine*)



Substrate size	4" circular wafers
Resolution	350 nm

> Trikon Sigma 200

Use: Cathode sputtering



Substrate size	4" circular wafers
Materials	AlN, Ti, AlCu, Mo

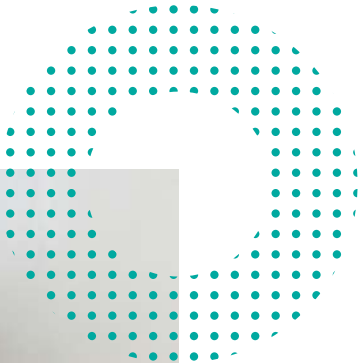
> Hitachi S9220, S8840

Use: CD SEM (*Critical dimension measurement system*)



Substrate size	4" & 6" circular wafers
-----------------------	-------------------------

MIMENTO TEAM





**FEMTO-ST Institute
Main Building**

15B avenue des Montboucons
25000 Besançon

Contact

+33 (0)3 63 08 24 00

www.femto-st.fr



MIMENTO Technology Center

TEMIS-Innovation - Maison des Microtechniques
18 rue Alain Savary
25000 Besançon

Contact

mimento@femto-st.fr

Thomas BARON

+33 (0)3 81 40 28 96

Jean-Claude JEANNOT

+33 (0)3 63 08 24 78

MIMENTO website

platforms.femto-st.fr/centrale-technologie-mimento