LAAS - Plateforme de Micro et Nano Technologies

FIT 2024 : 1er forum scientifique sur l'instrumentation en physico-chimie à Toulouse : 17 et 18 juin 2024

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LAAS-CNRS: Key Figures

Made and understand complex systems

CNRS Research Lab: UPR 8001

581 People (~200 C&EC, ~140 ITA, ~240 phd strudent/postDoc)
115 hosted (Partners, Renatech, …) **250 intership**
50 PhD defenses/year

Buildings
21 000 m²

Budget
17 M€/year (operational budget)

Funding sources
50% National, 20% Europe, 20% Industry, 5% Region …

Contracts/collaborative projects
400 active contrats

21 European projects, 4 ERC
13 PEPR, 3 Equipex, 8 Défis-Clef, …

5 joint Labs with industry
(ROB4FAM-AIRBUS, EPICENTRE-RIBER, OPALE-ESSILOR, LICUR-CEA, DYNAMOGRADE-TOWARD)

1 industrial chair (OneStock, INPT, CNRS)

10 CIFRE/year in average

11 Startups created since 2010, 2 ongoing

Multiple international collaborations

Scientific areas – Departments - Applications

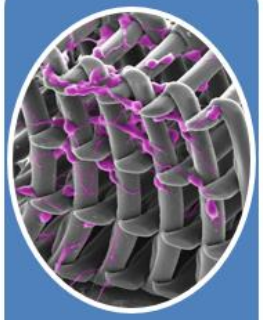
COMPUTER SCIENCE	AUTOMATIC CONTROL	ROBOTICS	MICRO & NANO SYSTEMS

Trustworthy computer systems and networks (RISC)

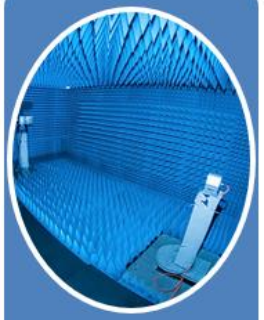
Decision & Optimisation (DO)

Robotics (ROB)

Energy Management (GE)



Micro Nano Bio Technologies (MNBT)



Microwave and Photonic Systems (HOPES)

Health & Environment

Smart Industry

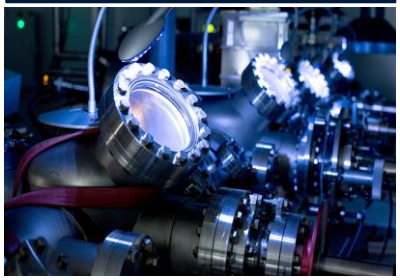
Energy

Space

Transportation & Mobility

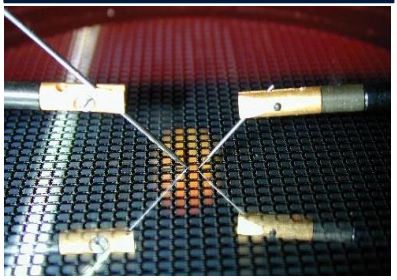
Shared Experimental Platforms

White Room



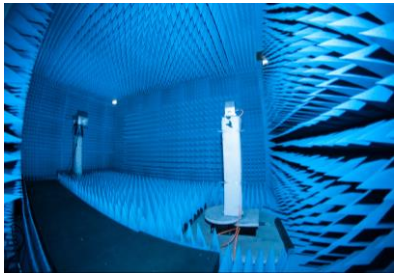
- 40 M€+ equipment, 1600 m^2
- 30 technical support personnel,
- 200 users, 160 proj./yr

Electrical Characterisation



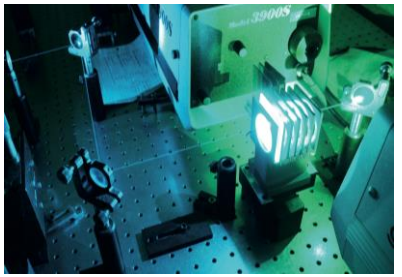
- On wafer measurements: I-V, Z(f), C(V), mapping…
- ESD measurements: TLP, VFTLP, HBM…

Microwave Characterisation



- On wafer characterisation parameters S, spectrum, Noise measurement
- IoT chracterization
- 5G Platform

Optics



- Materials characterization
- Passive and active characterization of photonic devices

Biology & chemistry

- Cell cultures
- Fluorescent microscopy
- DNA, RNA, protein quantification

Multifab Fablab

Open platform for 3D, multi-scale, & multi-materials printing

Robotics

- >15 robots
- 3 humanoids, 5 indoor robots, 3 outdoor robots, drones

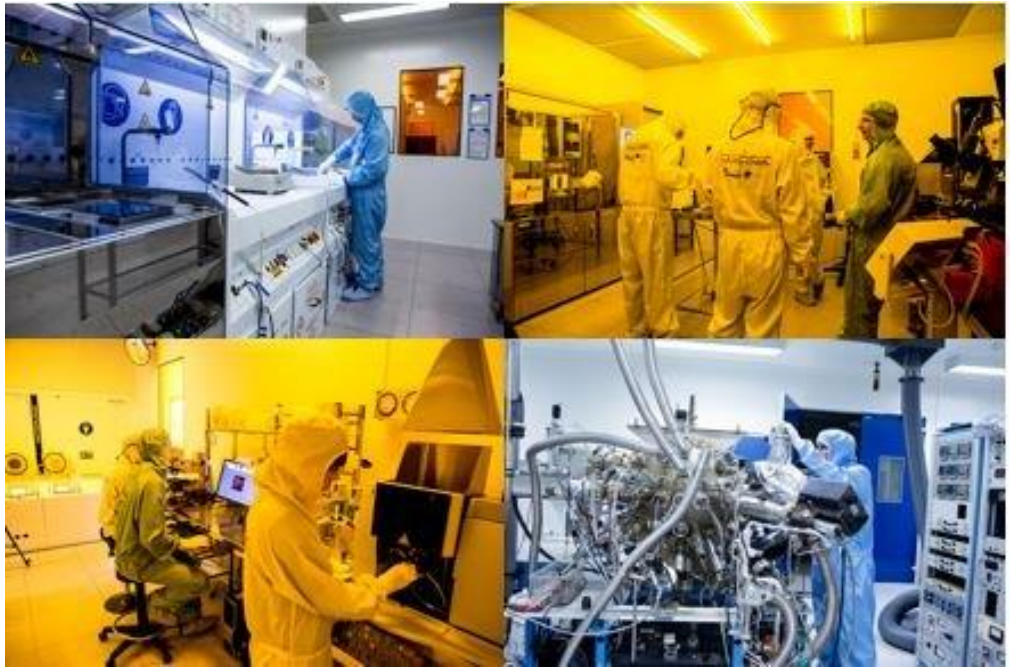
Space

- Experimentation of embedded systems for space
- nanosatellites

Energy management

- Instrumented experimental building (1700 m^2): 100 kWp photovoltaïcs

Micro and nanofabrication plateform



> https://www.renatech.org/

> Since 2003

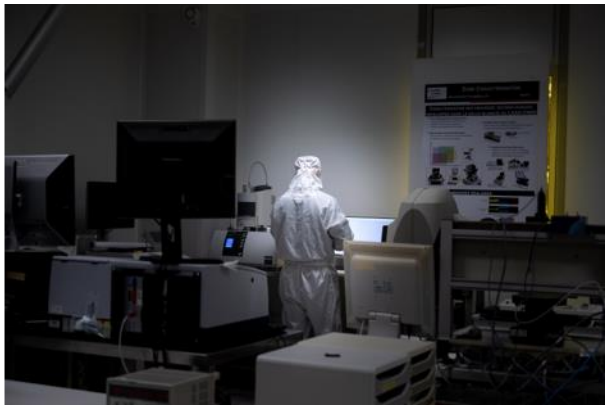
7300 m²
of clean rooms

140
clean room
engineers
and technicians

130 M€
of EQUIPEMENT

RENATECH

5 FACILITIES

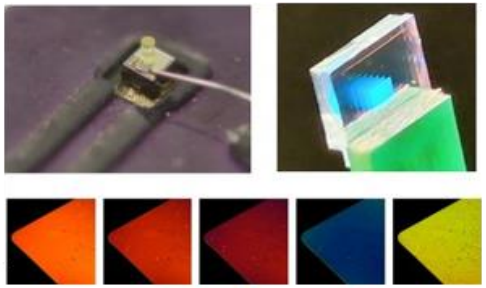


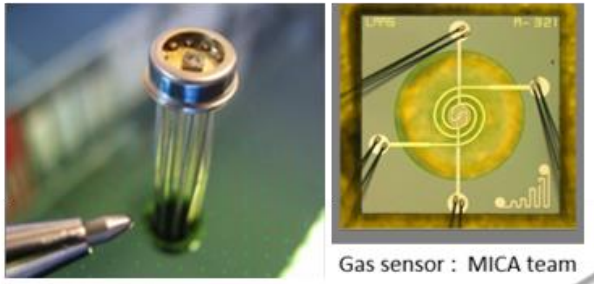
Micro and nanofabrication plateform

- **2500 m² (1500 m² clean room)**
  - Clean room expansion (2025-2026) for
    - nanolithography : 200 m^2
    - industrial valorization : + 200 m^2
- **30 members (Engineers, High level technicians)**
- **200+ Users**
- **160+ Projects / year (average 2014-2023)**
  - 80 internal
  - 80 exogenous
- **40 M€ + equipment**
  - 220+ tools
  - https://lims.laas.fr/WebForms/Equipment/EquipmentList.aspx
- **Budget ≈ 2,5M€ / an**
  - Operational average: 1,5 M€/an
  - Investments (2014/2020) ≈ 1 M€/an

Micro and nano Systems

Laser and OLED: MPN team

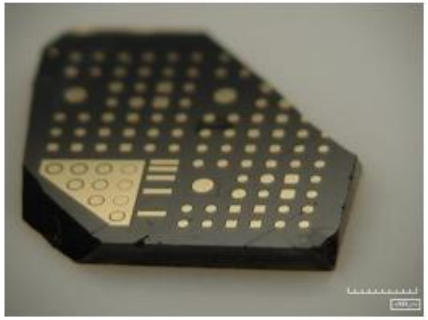




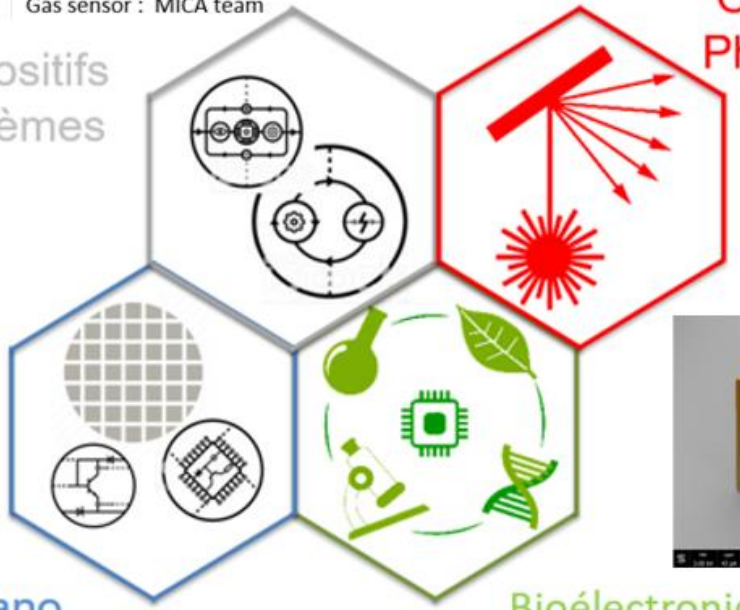
Gas sensor : MICA team

Optique & Photonique

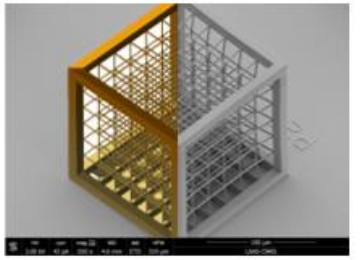
Micro nano dispositifs micro nano systèmes

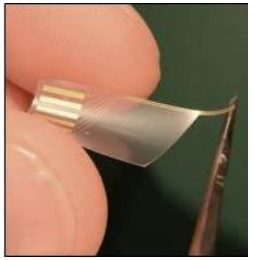


Diodes on diamond: ISGE team



3D for Cells: ELIA team



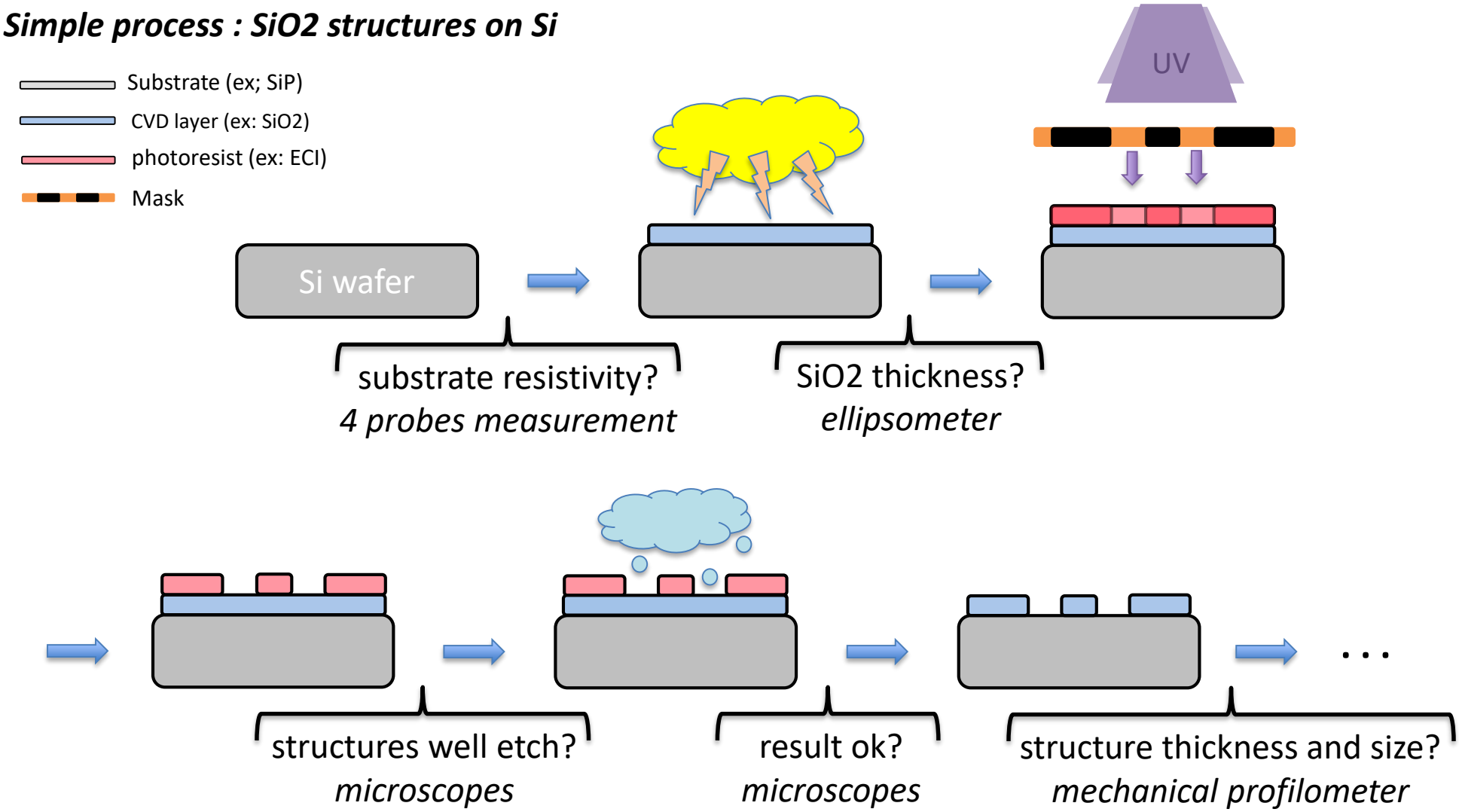


Micro nano électronique

Bioélectronique, biosystèmes, biophysique

Importance of characterization

Simple process : SiO2 structures on Si



Our characterization Area (in clean room)

2 people

Dimensional

- 2 optical microscope
- 2 mechanical profilometer
- 2 optical profilometer
- 2 SEM (3 soon)
- 1 dual-beam (SEM+FIB)
- 2 Ellipsometer
- 1 AFM
- *DRX*

Chemical

- FTIR
- X rays analisys EDX *& DRX*
- *AVS, CVS, Titration & polarographie*

Functional

- **Electrical** (probe tester, resistivimeter, AFM)
- **Optical** (Ellipsometer, UV-Vis spectrometer)
- **Surface energy** (contact angle)
- **Thermal** (TGA & DSC)

https://lims.laas.fr/WebForms/Equipment/EquipmentList.aspx

Dimensional characterization

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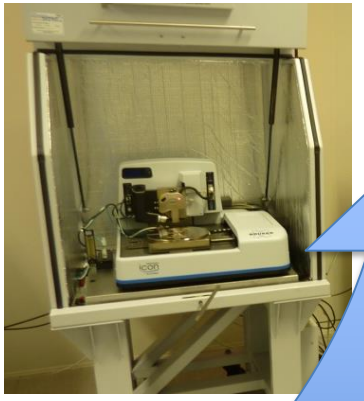
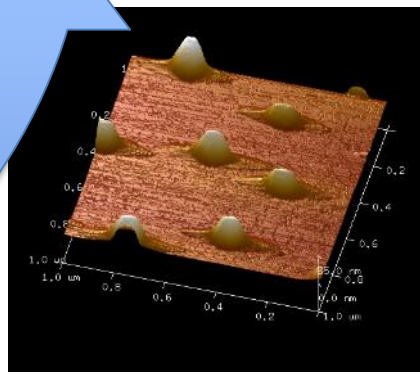
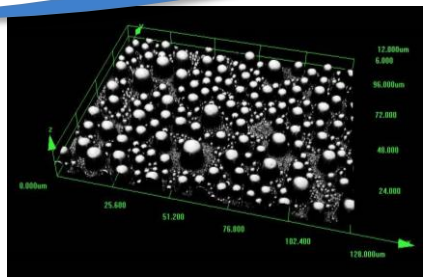
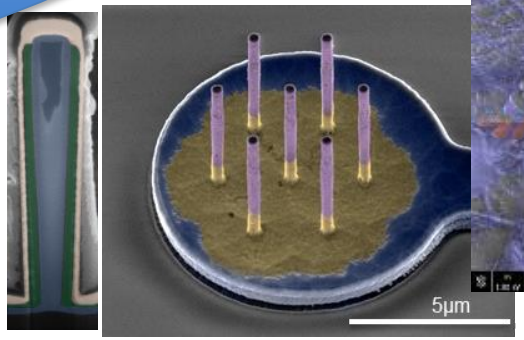


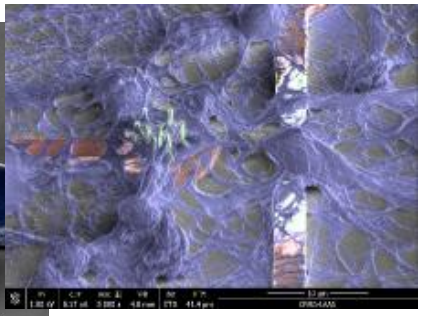


GaAs dash

RF system

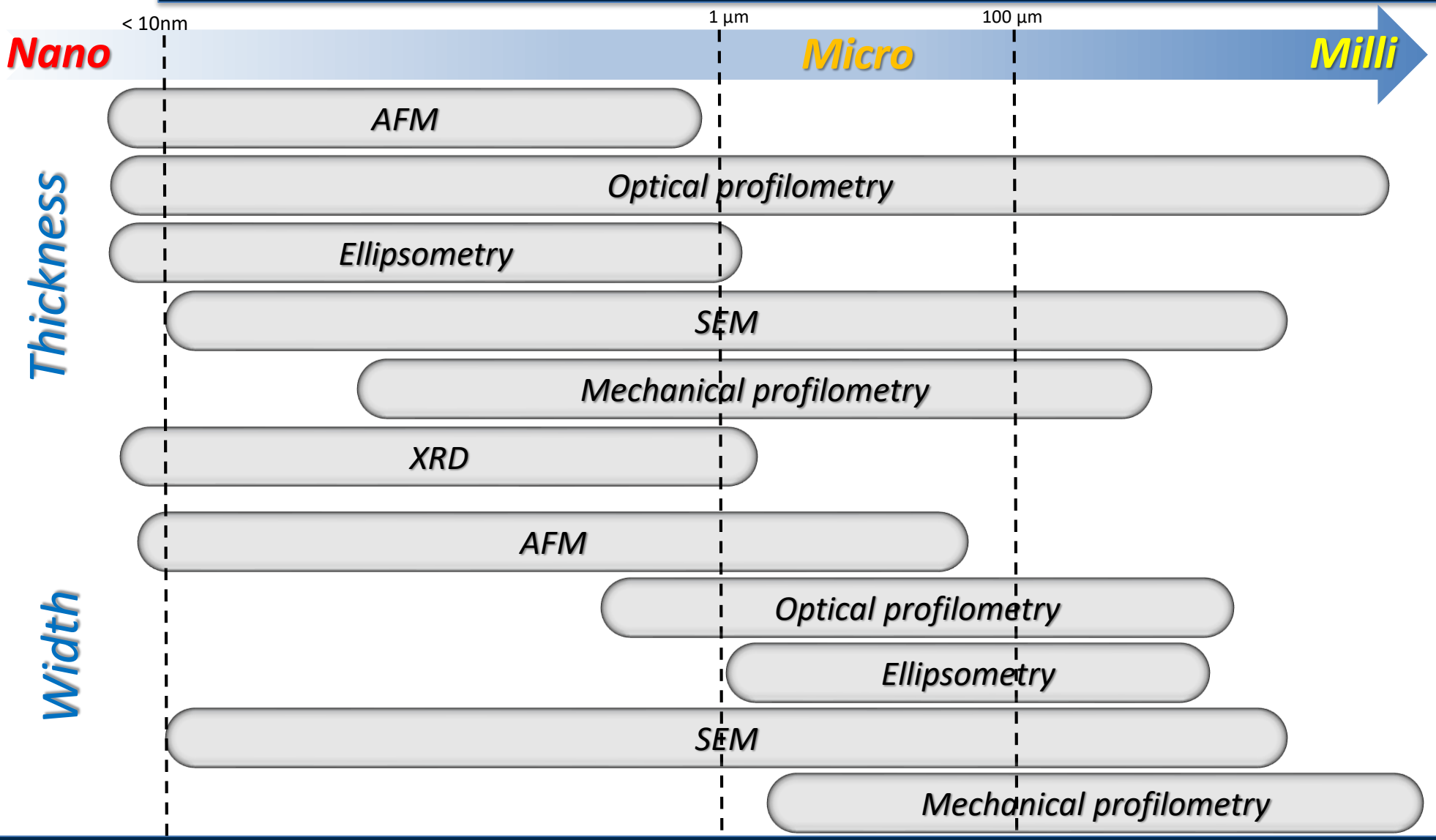






Nanowire for neuronal activity

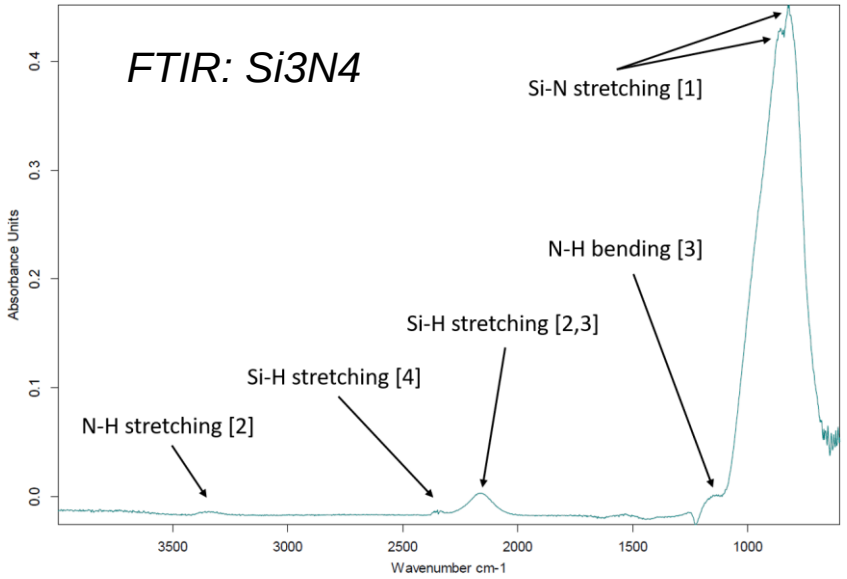
Scale of dimensions

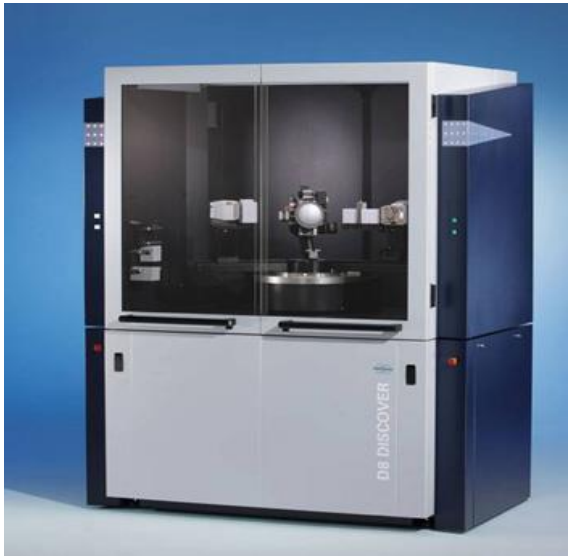


Chemical characterization

Chemical

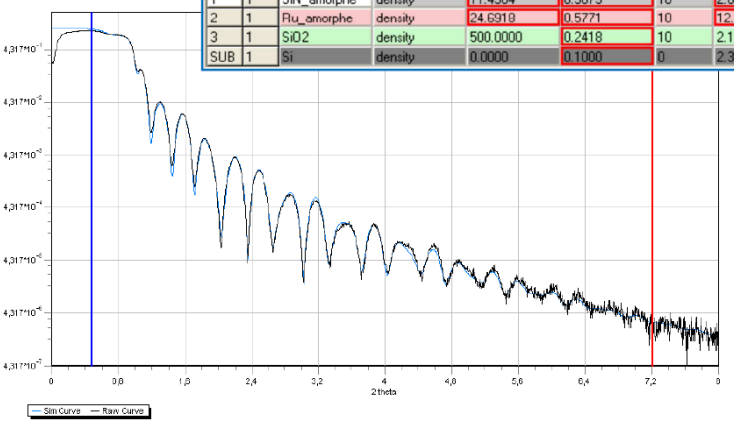
- FTIR
- X rays analisys EDX & DRX
- *AVS, CVS, Titration & polarographie*

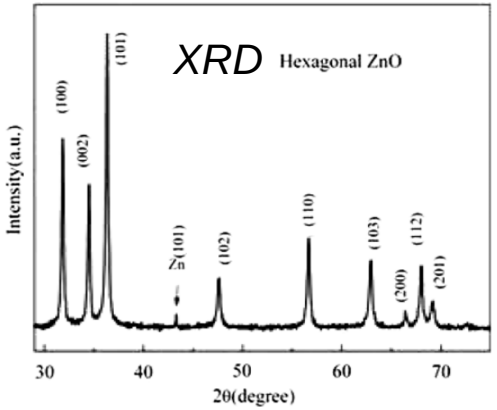




XRR

N	R	Material	Cell input	Thickness	Roughness	Grading	Density T
1	1	SiN_amorphe	density	11.4504	0.5079	10	2.60000
2	1	Ru_amorphe	density	24.6919	0.5771	10	12.33240
3	1	SiO2	density	500.0000	0.2418	10	2.10000
SUB	1	Si	density	0.0000	0.1000	0	2.32910



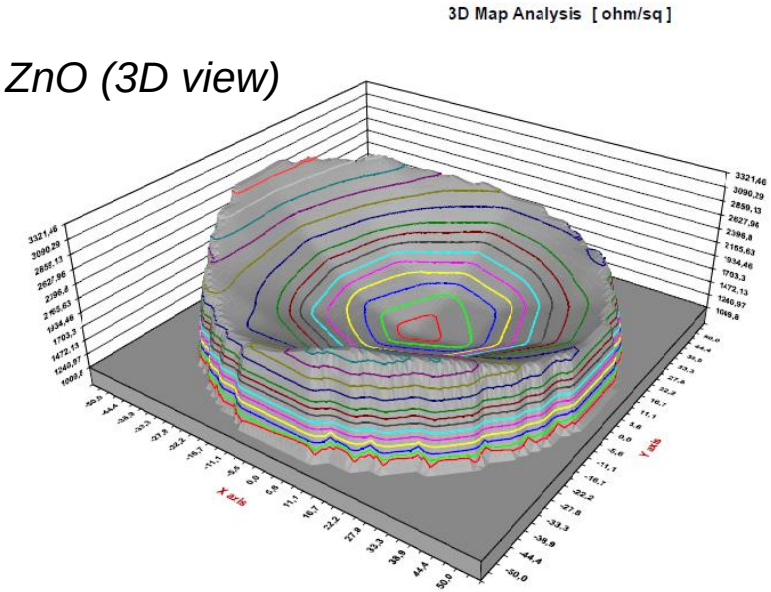


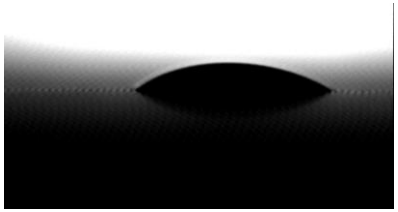
Functional characterization

Functional

- **Electrical** (probe tester, resistivimeter, AFM)
- **Optical** (Ellipsometer, UV-Vis spectrometer)
- **Surface energy** (contact angle)
- **Thermic** (TGA & DSC)

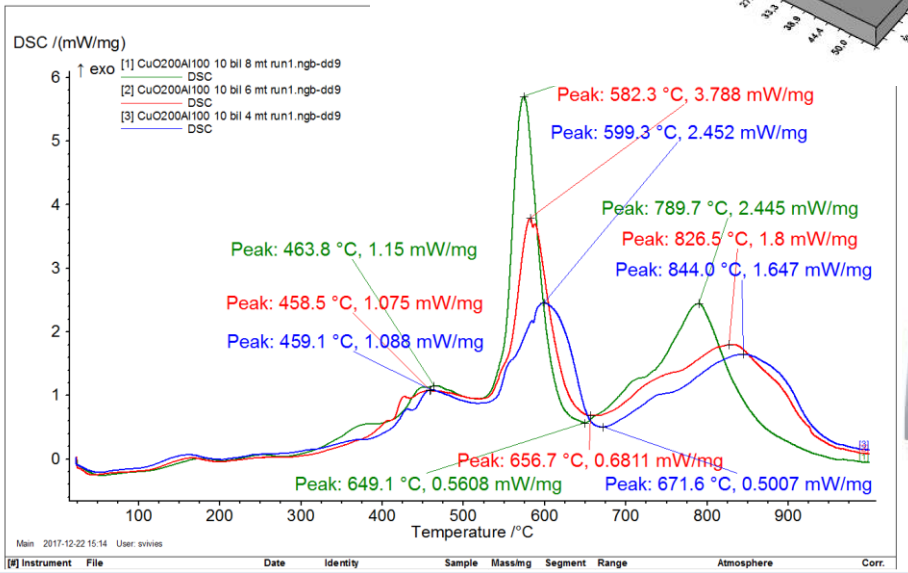
Mapping of ZnO (3D view)





Hydrophilic

Hydrophobic

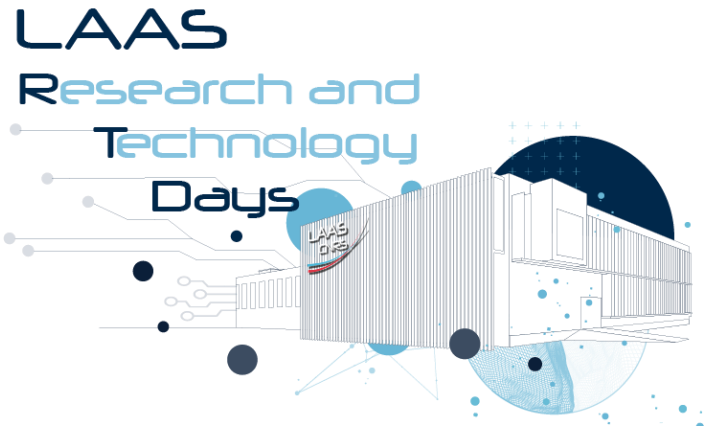


AlCuO2 with different vaccum condition for deposit

Welcome to LAAS

- Scientific and technical collaboration
- Prototyping
- Service
- Equipment / staff hosting
- Training
- Expertising and consulting

renatech@laas.fr



9 juillet 2024

https://www.laas.fr/

Thank you for your attention

Understanding the technique to understand the results: ***Critic mind*** *and* ***reasoned use***