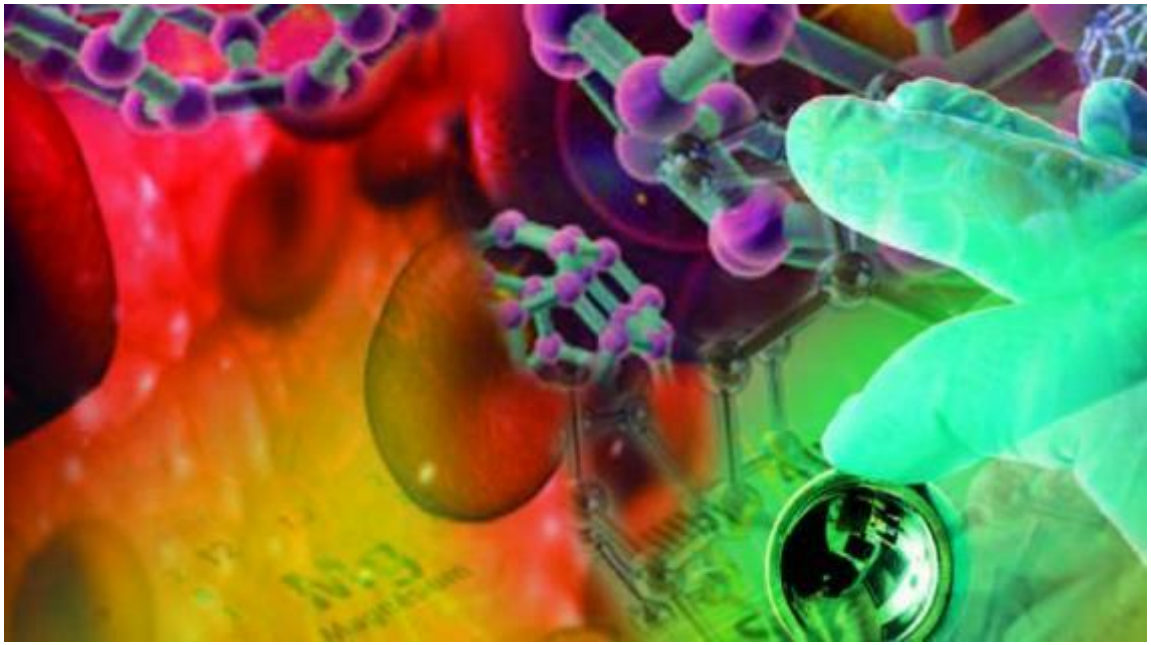
ScanMAT

Synthesis, **C**haracterization and **An**alysis of the **MAT**ter

Université de Rennes

UAR 2025

cnrs



Contact
scanmat@univ-rennes.fr

GDR NAME, 10 november 2023

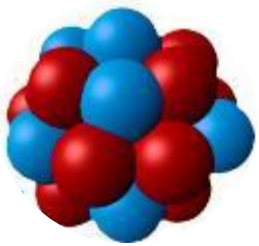
https://scanmat.univ-rennes.fr/

Introduction

ScanMAT brings together 11 platforms in the materials and chemical sector

From molecules for therapeutic purposes, **from ingredients for agri-food to smart materials**, ScanMAT supports **research and development projects** to :

- solve your synthesis and production problems
- characterize, model and develop new materials



100 collaborative, industrial and academic research projects/year

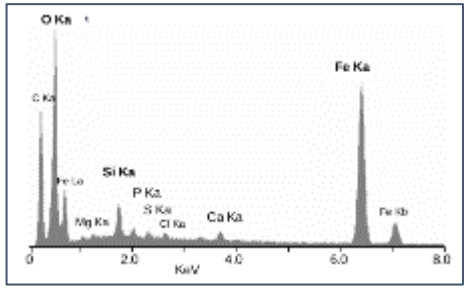
80 publications and 2 patents involving ScanMAT/year

11 dedicated staff associated with 40 collaborators from the ISCR and IPR institutes

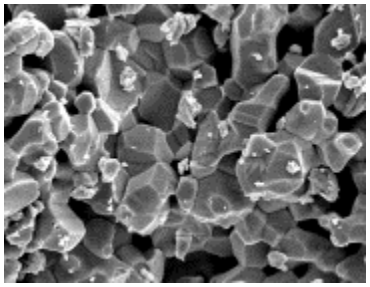
12 million € of investment for the equipment park

2 research institutes involved (700 people): Institute of Chemical Sciences of Rennes (ISCR) & Institute of Physics of Rennes (IPR)

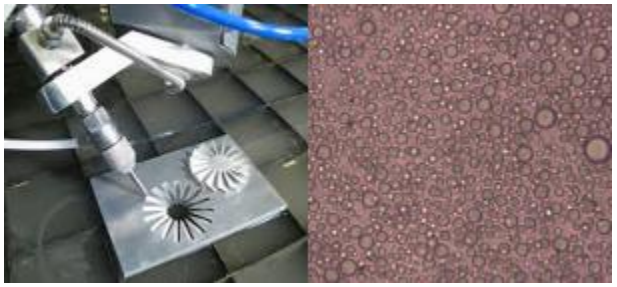
Facilities & expertise – service offering



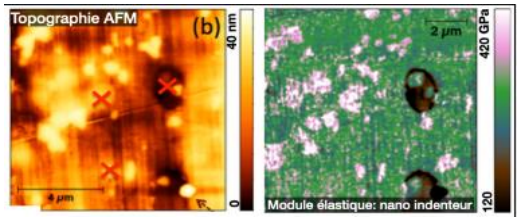
Composition analyses



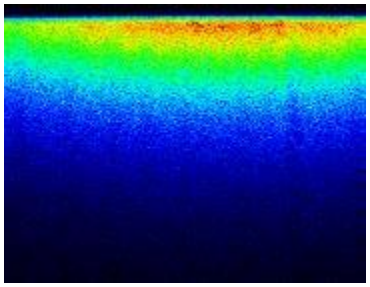
Structural and microstructural analyses



Cutting and shaping



Surface characterization and mechaninal behaviour



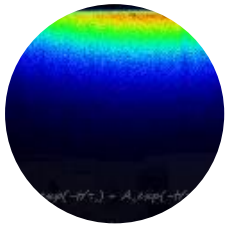
Optical and spectroscopic properties analyses

Chemical synthesis, purification and extraction of molecules

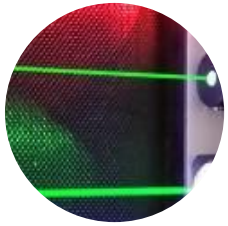
SCAN MAT

Mass spectrometry, liquid NMR molecules & polymers, elemental analysis CHNS, ICP

1 & 2-photon excitation absorption and emission spectrophotometry, static and dynamic measurements



Raman and IR spectrometry: confocal and FTIR Raman imager (microscope, ATR, R&T), portable FT-NIR (probe, diffuse reflection, transmission)



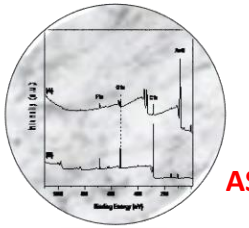
SEM materials, biology, health, EDS, EBSD

CRMPO

CAPHTER

SIR

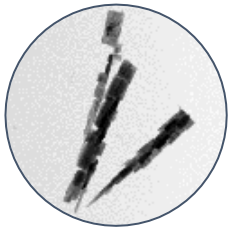
XPS, UPS photoemission spectroscopy



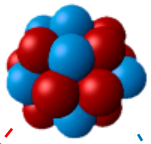
CMEBA

ASPHERYX

THEMIS



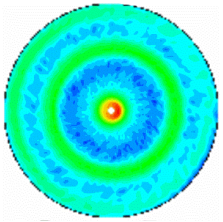
MET, EDS, EELS, EFTEM, electron diffraction; materials, biology



Microwave synthesis, purification, extraction, galenic engineering

S2Wave

OSIRIX



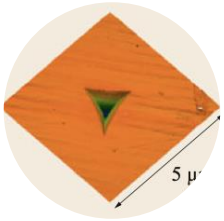
High-resolution and texture X-ray diffraction

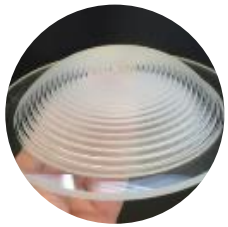
NanoMeca

Dec3D

2CBioMIF

Fluid interfaces, films/foams/emulsions/gels, AFM biological objects, solid surfaces, rheology





Water jet cutting

AFM, Nanoindentation: topography, elasticity, hardness, adhesion - Bulk/thin layer

https://scanmat.univ-rennes1.fr/

CMEBA
Centre de Microscopie à Balayage et microAnalyse

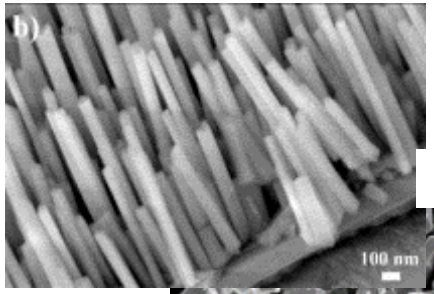
Learn more about the products

Objectives :

Observe to characterize the objects and their evolution: according to the synthesis process, reactivity, stability in time, morphology, etc...

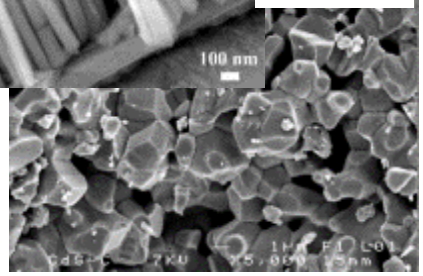
Adapted observation and preparation methods

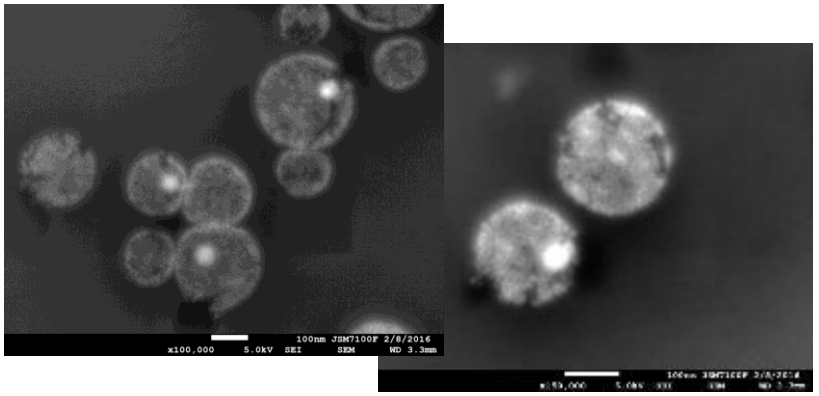
High resolution scanning electron microscopy



Oxides thin films

Ceramics

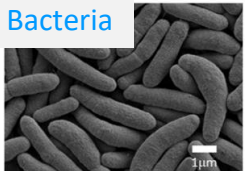




Hybrid nanocapsule QD/polymer (hybridosome®, patent 12/2015) ISCR-CORINT

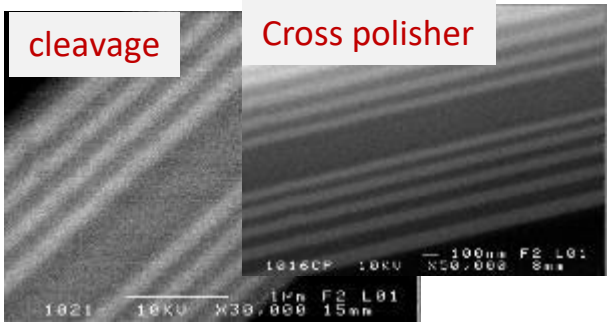
Biological samples : Drying by critical point method

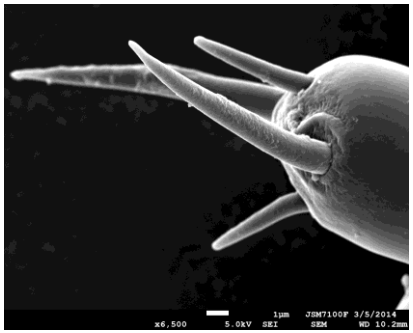
Bacteria

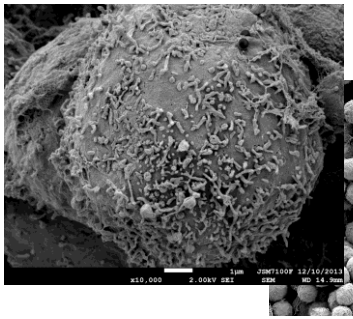


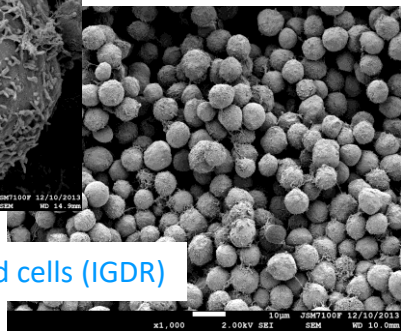
cleavage

Cross polisher









Glass thin films

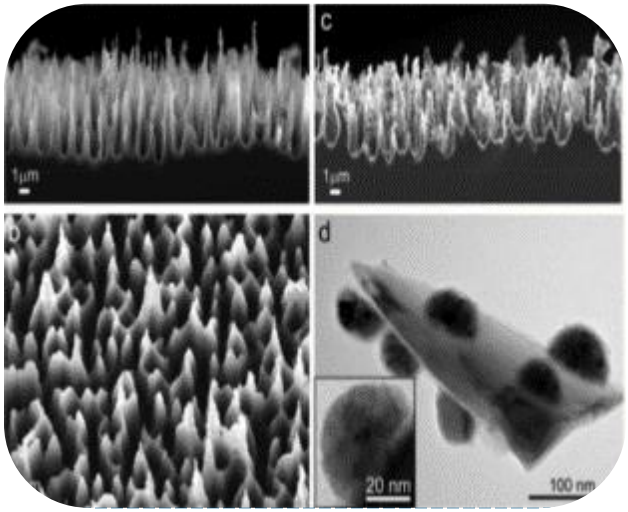
Insects of rapeseed (IGEPP, INRA)

Cancerous blood cells (IGDR)

« Photo-anodes »

Objectives :

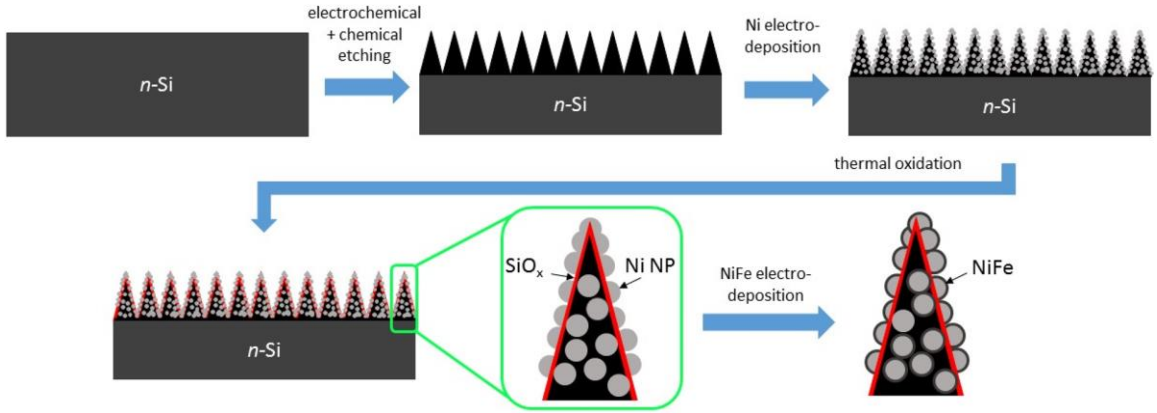
Characterization of photoanodes by Scanning Electron Microscopy (SEM)



Results :

In this project, it was possible to highlight the **important structural and chemical parameters of these structured electrodes** developed for the oxidation of water under solar illumination.

This reaction is very important for the conversion of solar energy into hydrogen, a clean energy carrier.

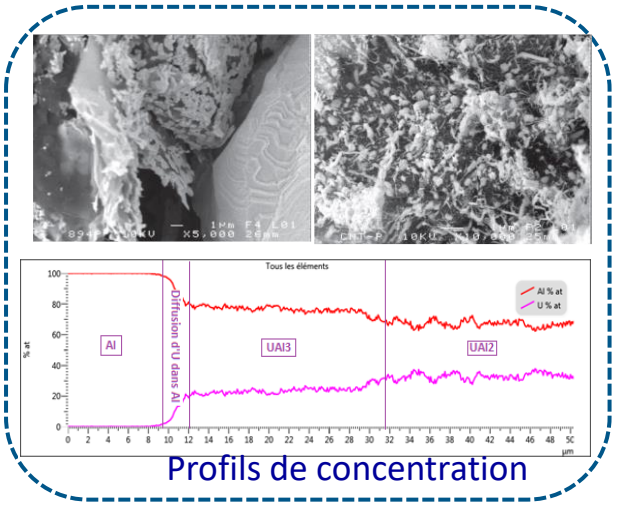


Black Silicon Photoanodes Entirely Prepared with Abundant Materials by Low-Cost Wet Methods ; K. Oh, L. Joanny, F. Gouttefangeas, B. Fabre, V. Dorcet, B. Lassalle-Kaiser, A. Vacher, C. Mériadec, S. Ababou-Girard and G. Loget, *ACS Appl. Energy Mater.*, 2019, 2 (2), pp 1006–1010

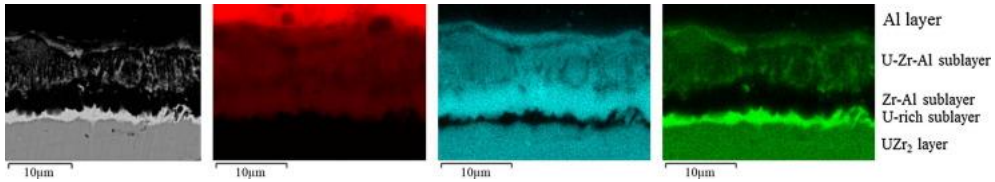
Study of phase diagrams in uranium-based systems

Objectives:

Combine observation, compositional analysis and structural data to study phases and interfaces SEM, TEM, EDS and electron diffraction.

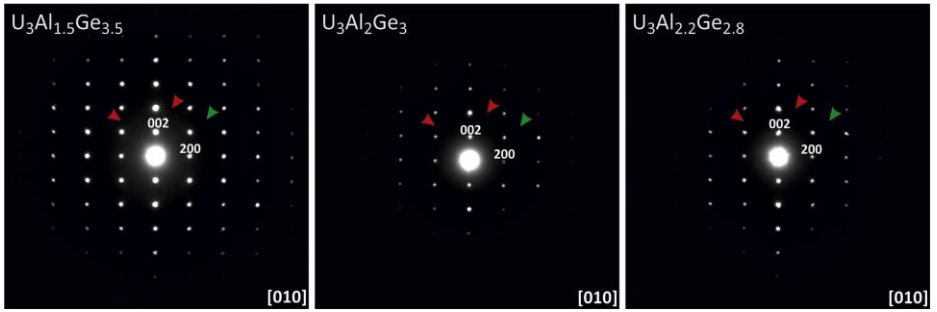


EDS mapping



*Characterization of **uranium carbide** target materials to produce neutron-rich radioactive beams ; S. Tusseau-Nenez et al., Nucl. Inst. and Meth. (2016), 19*

*Investigation of the phase relations in the **U-Al-Ge** ternary system: Influence of the Al/Ge substitution on the properties of the intermediatephases; C. Moussa et al., J Nucl Mat (2015), 193*



«EBSD mapping on Titanium»

Objectives :

To carry out Electron BackScattering Diffraction (EBSD) mapping in order to observe the orientations of grains but also their distribution in the material.

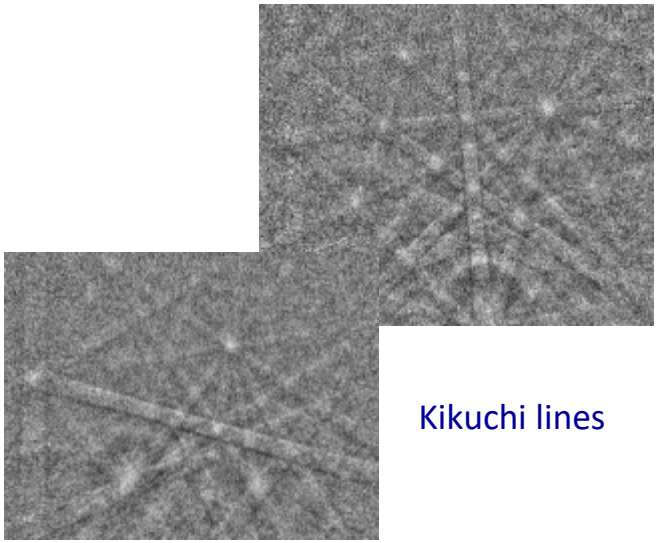
Results :

In this project, we perform an EBSD mapping of the sample.

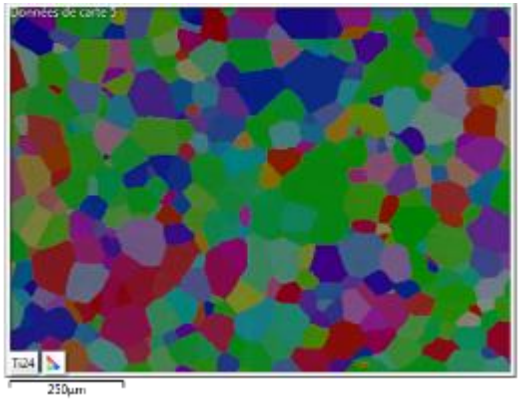
Thus we obtain the **grain boundaries**, the **grain sizes**, their **deformations** and their **distributions** in the material.

Diffraction by the material is required with observation of Kikuchi lines as on the pictures below.

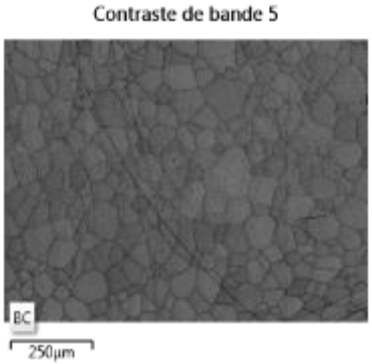
Then follow the operations to obtain the desired information.

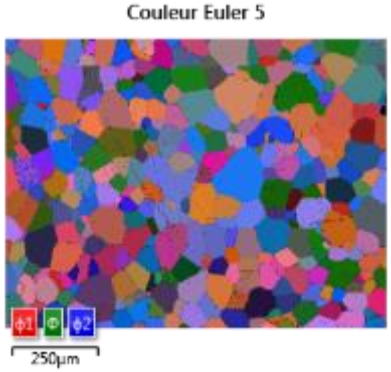


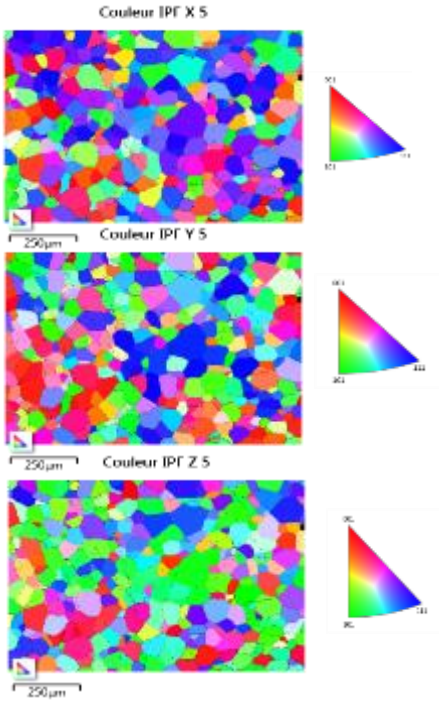
Kikuchi lines



EBSD mapping

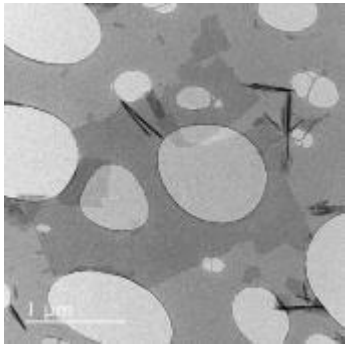




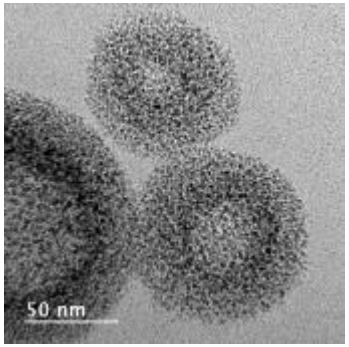


Nano-objects characterization

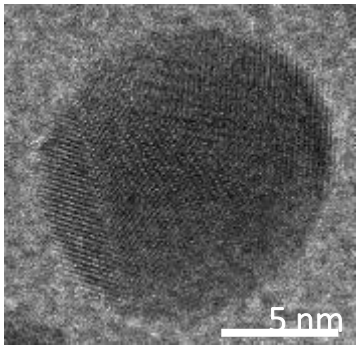
Nanosheets



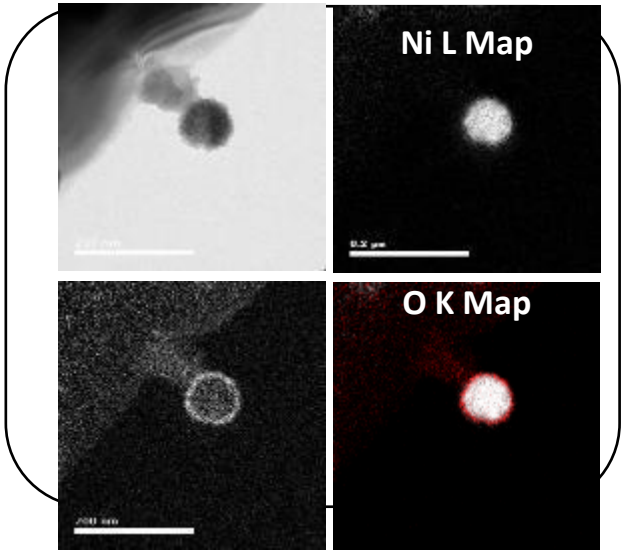
Gold nanoparticles capsules



Gold nanoparticles

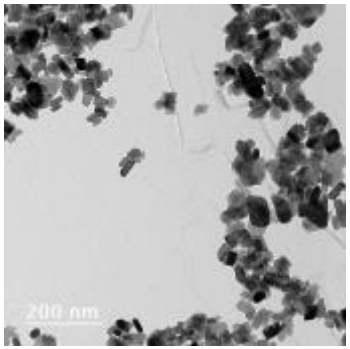


Ni nanoparticles

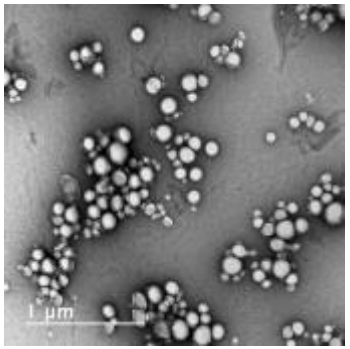


Elementary mapping

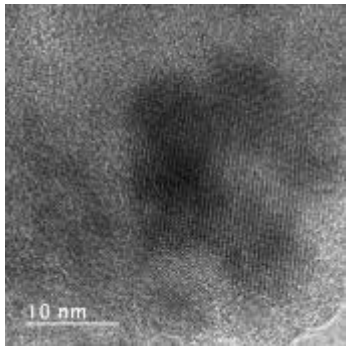
$ZnWO_4$



Polymer nanoparticles



Fe nanoparticles in environmement



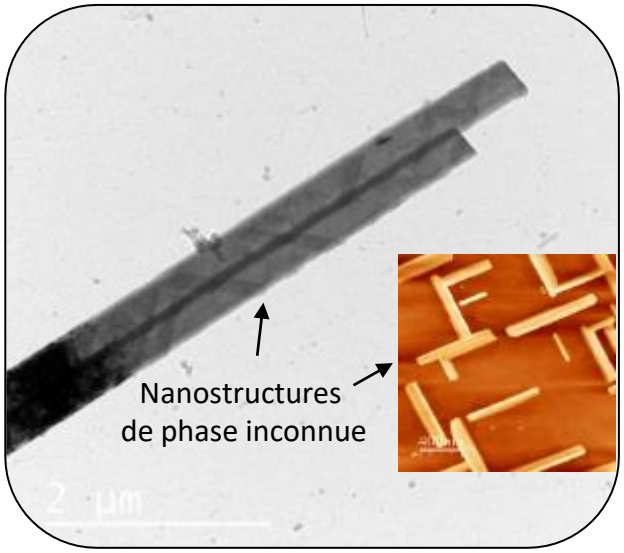
F. Baudouin, V. Demange, S. Ollivier, L. Rault, A.S. Brito, A.S. Maia, F. Gouttefangeas, V. Bouquet, S. Députier, B. Bérini, A. Fouchet, M. Guilloux-Viry Thin Solid Films. **693** (2020) 137682

N. Brandhonneur, T. Hatahet, M. Amela-Cortes, Y. Molard, S. Cordier, G. Dollo. Eur. J. Pharm. Biopharm. **125** (2018) 95

Unkown phase identification and characterization of vanadates

Objectives :

Identify the unknown material obtained as nanostructures on CaVO3 film using high resolution imaging, electron diffraction, EDS analysis, EELS analysis and filtered imaging.



Results :

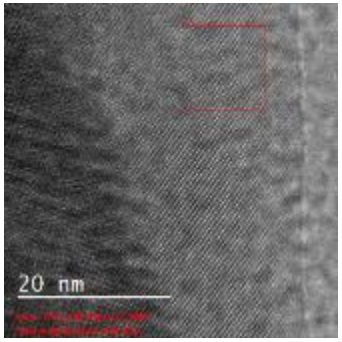
The identified material is the phase $Ca_3(VO_4)_2$ with the valency V^{5+}.

This phase shows epitaxial growth on the underlying film, which is of different valency (V^{4+}).

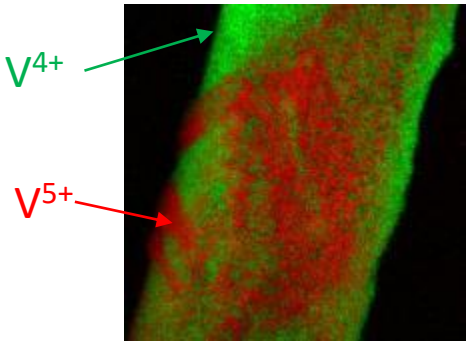
The epitaxial relationships were determined

The presence of ferroelectric domains was shown in the $SrVO_3$ film

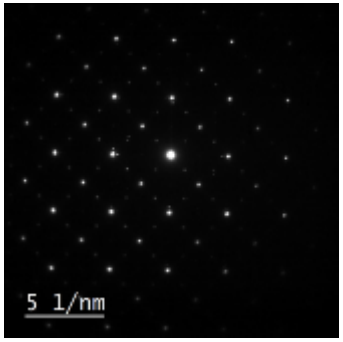
High Resolution Image



Chemical states mapping



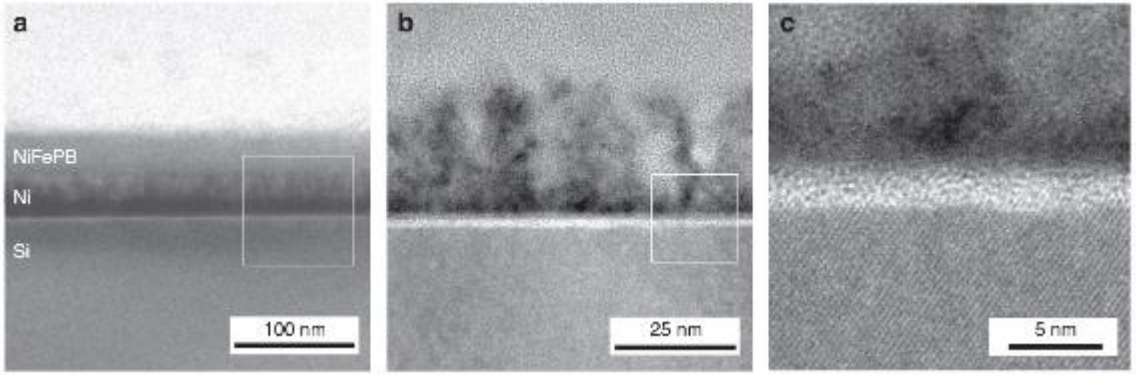
Electron diffraction patterns

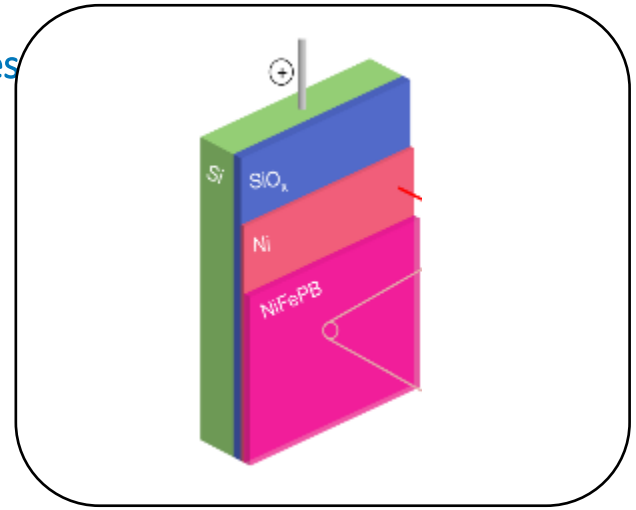


V. Demange, B. Bérini, B. Gautier, E. Popova, Y. Dumont, A. Fouchet
ACS Appl. Nano Mater. **3** (2020) 6684-6692
Highly Transparent and Conductive Indium-Free Vanadates Crystallized at Reduced Temperature on Glass Using a 2D Transparent Nanosheet Seed Layer, A. Boileau, et al., Adv. Funct. Mater., (2021), 210847

Thin film / substrate interface characterization

Metal – insulator – semiconductor (MIS) photoanodes heterostructures

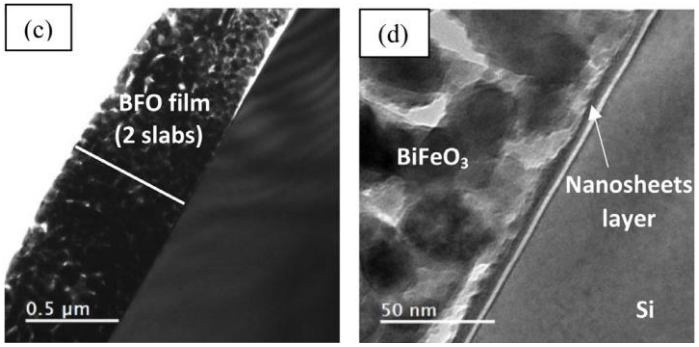




Cross-section TEM images on NiFePB/Ni/SiO_x/Si

G. Loget, C. Mériadec, V. Dorcet, B. Fabre, A. Vacher, S. Fryars, S. Ababou-Girard
Nature Communications **10** (2019) 3522

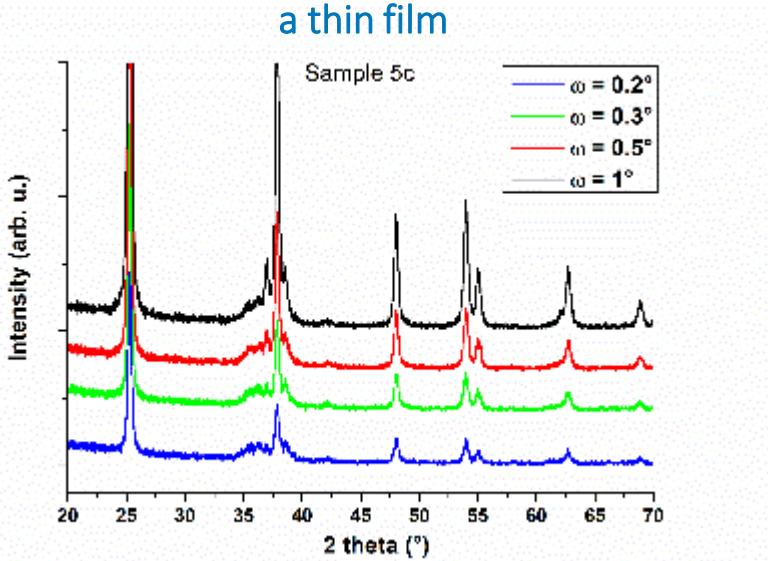
Cross-section of a $BiFeO_3$ film on Si



V. Bouquet, F. Baudouin, V. Demange, S. Députier, S. Ollivier, L. Rault, A. Fouchet, M. Guilloux-Viry
Thin Solid Films **693** (2020) 137687

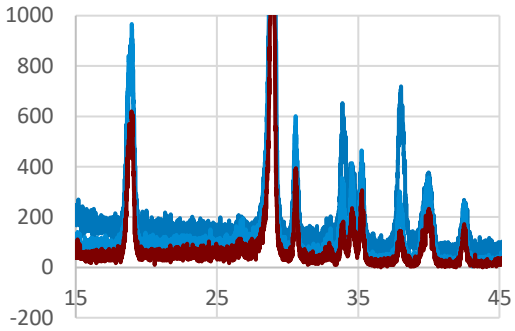
Thin films characterization by X-Ray diffraction

Observation of nanoparticles in a thin film



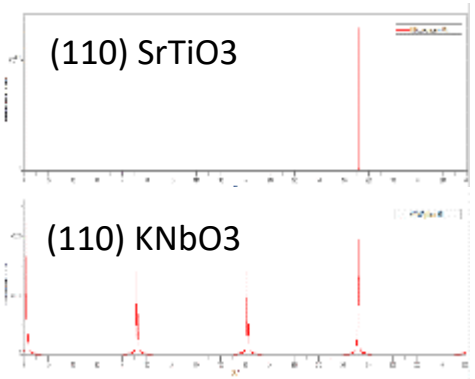
TiO_2 films coated with Cu_2O nanoparticles

Identification of a phase in a thin films of 40 nm thinckness

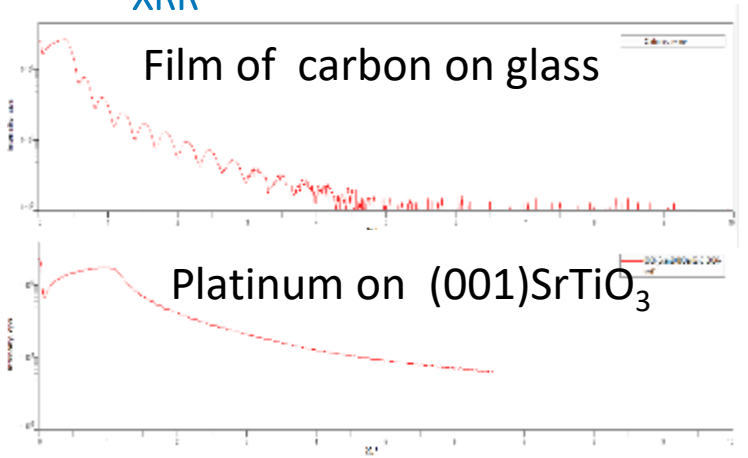


$BiVO_4$ film on SnO_2

Epitaxial relationships of a $KNbO_3$ thin film on $SrTiO_3$



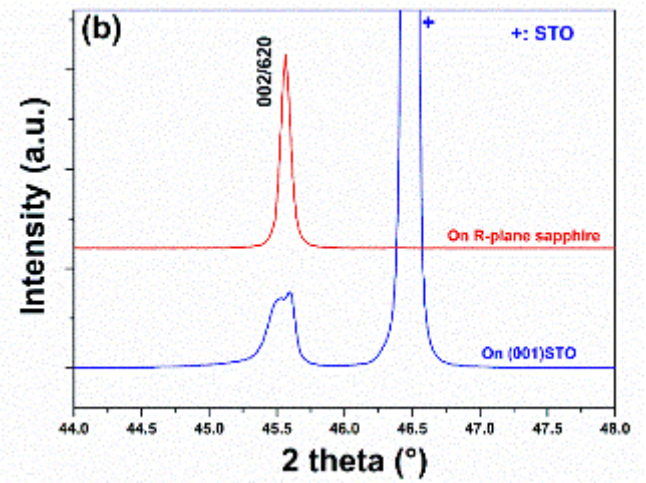
XRR

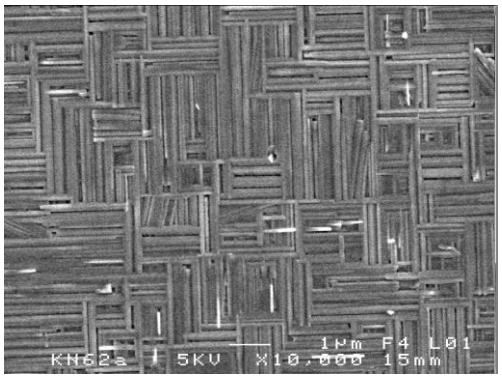


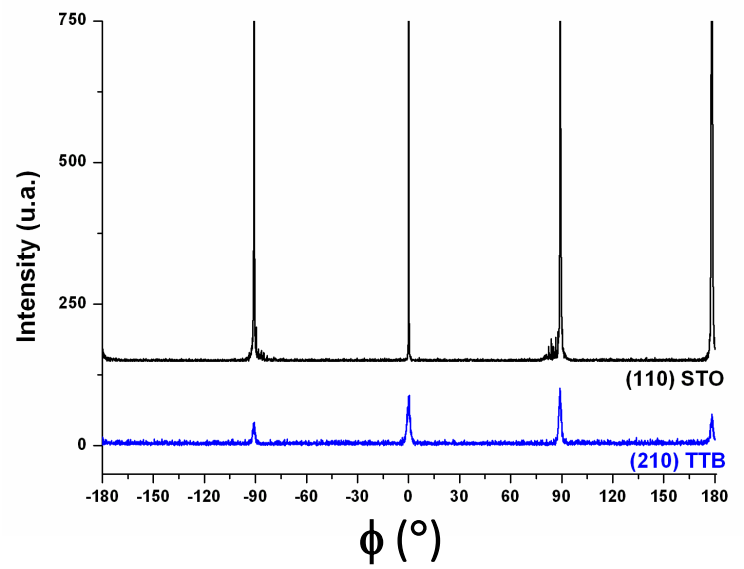
Thickness, density and roughness determination

J. Yu, H. Saada, R. Abdallah, G. Loget, N. Sojic. *Angew. Chem. Int. Ed*. (2020)

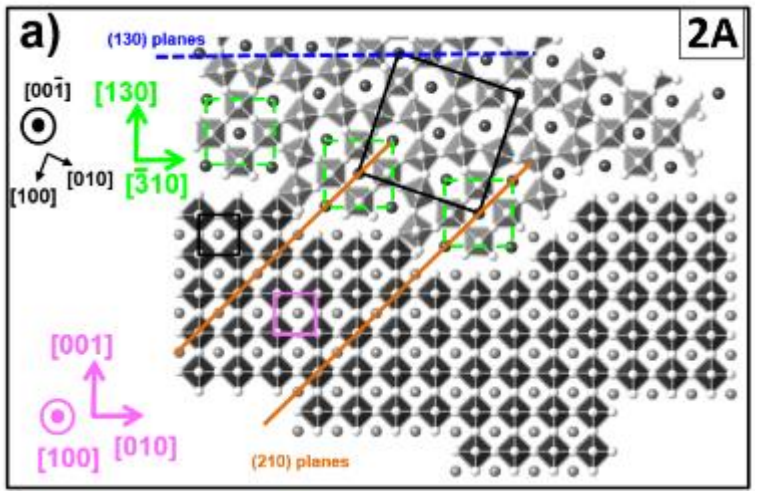
Complex oxides films epitaxy







Compréhension des mécanismes d'épitaxie



V. Demange, Q. Simon, F. Gouttefangeas, L. Joanny, M. Guilloux-Viry. *Cryst. Growth & Design* 20 (2020) 2356-2366

Raman spectrometry on oxides and oxy-nitrides thin films

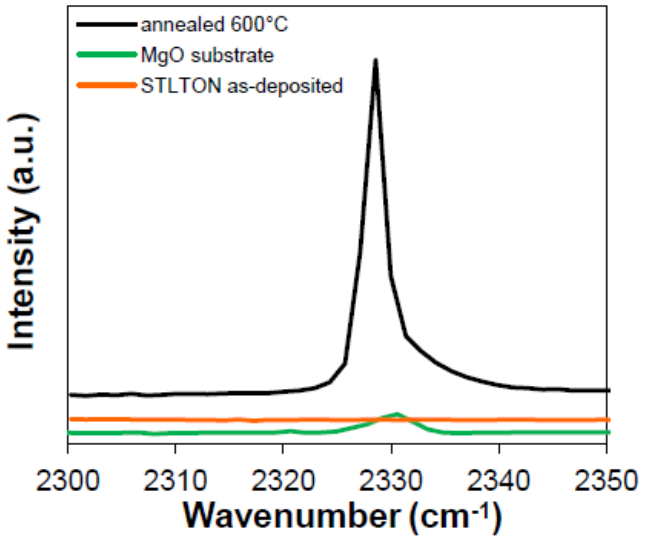
Detection of the N-N band on thin films

Objectives :

Characterize the behavior of thin films of oxides and oxynitrides during thermal treatments.
Detect the N-N band near 2328 cm-1 characteristic of the retention of NN pairs

Results :

The annealing at 600°C of thin oxide and oxynitride layers leads to a partial oxidation of the oxynitride layers with a phenomenon of retention of molecular nitrogen within the material



L. Le Gendre, C. Le Paven, M. Haydoura, R. Benzerga, F. Marlec, A. Sharaiha, F. Cheviré, F. Tessier,
A. Moréac , (Sr2Ta2O7)100-x(La2Ti2O7)x based oxide perovskite films with x = 1.65, Journal of the European Ceramic Society, Elsevier, 40, 6293-6300, 2020
1 Univ Rennes, CNRS, IETR UMR 6164, 35042 Rennes, France
2 Univ Rennes, CNRS, ISCR UMR 6226, 35042 Rennes, France
3 Univ. Rennes, CNRS, IPR UMR 6251, 35042 Rennes, France

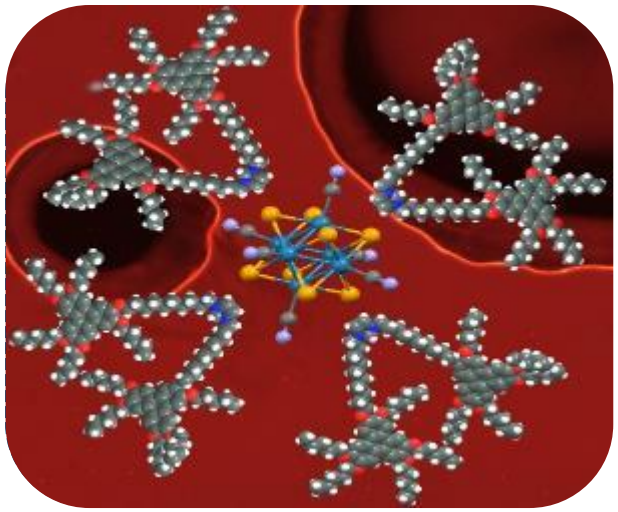
Understanding the interactions between emissive materials

Objectives :

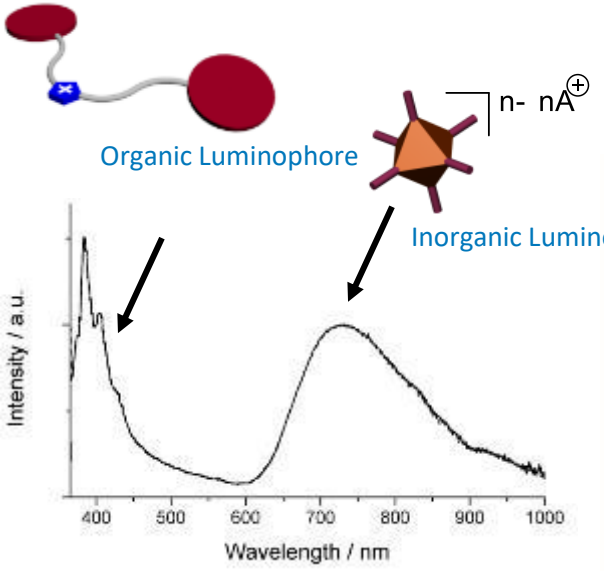
Measure the individual and collective emission properties (quantum yields, excited state lifetimes) of different luminophores in solution, in the solid state (powder and film) and in the liquid crystal state to characterize their interactions.

Results :

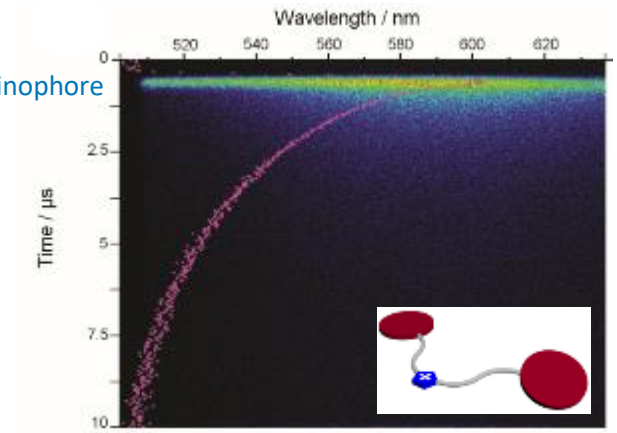
Evidence of energy transfer in the solid and liquid crystal state between an organic and an inorganic phosphor.



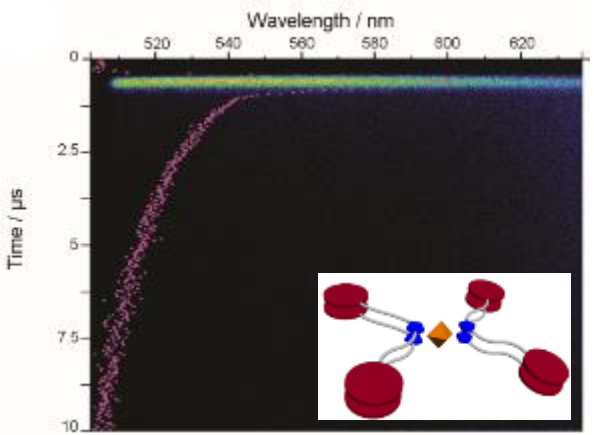
Dalton Trans., 2018, **47**, 10884-10896



Emission spectrum of the mixture of luminophores



Ligand $\tau = 1.35\mu s$



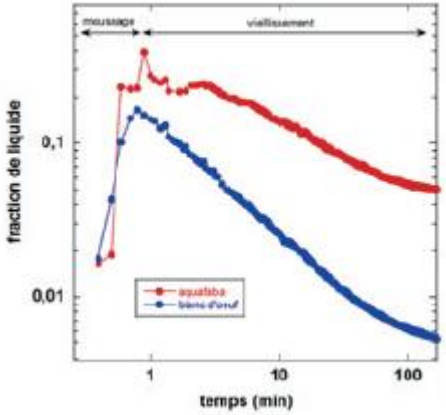
Complexe $\tau = 0.09\ \mu s$

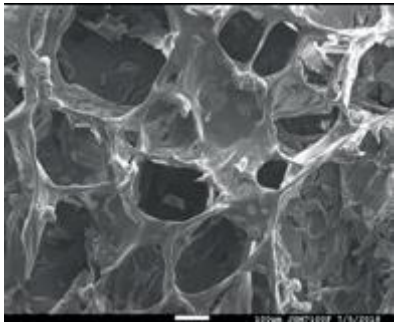
Aquafaba: What to expect?
Foaming properties of Aquafaba

Characterization of the foam:

- Small bubble size, covering a wider range of initial moisture.
- Remarkable stability, 4 times more stable than egg white.
- Chemical characterization: complex mixture of macromolecules (sugar) and lower molecular weight molecules (peptides)
- Synergy: very efficient foam formation, then stabilization over long periods of time.

→ Foaming column to characterize the expansion of aquafaba samples and the stability of the foams produced



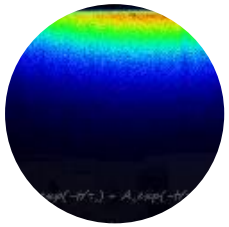


Aquafaba : chickpea cooking juice
Study from the molecular scale to the foam

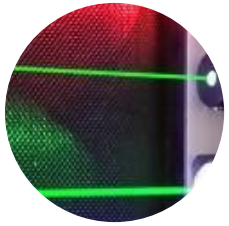
Published in IAA La revue des Industries Agro Alimentaires (Technical and Industrial news)
Muriel Escadeillas, Fabienne Gauffre, Francis Gouttefangeas, Philippe Jéhan, Loïc Joanny, Laurène Jourdy, Nicolas Le Yondre, Alain Moréac, Ludovic Paquin, Véronique Vié, Eric Gicquel, Gilles Paboeuf, Arnaud Saint-Jalmes

Mass spectrometry, liquid NMR molecules & polymers, elemental analysis CHNS, ICP

1 & 2-photon excitation absorption and emission spectrophotometry, static and dynamic measurements



Raman and IR spectrometry: confocal and FTIR Raman imager (microscope, ATR, R&T), portable FT-NIR (probe, diffuse reflection, transmission)



SEM materials, biology, health, EDS, EBSD

CRMPO

CAPHTER

SIR

CMEBA

ASPHERYX

THEMIS

S2Wave

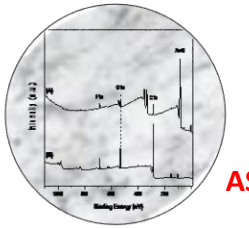
NanoMeca

Dec3D

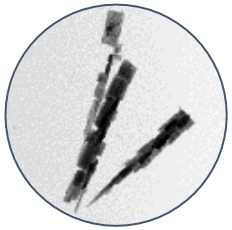
2CBioMIF

OSIRIX

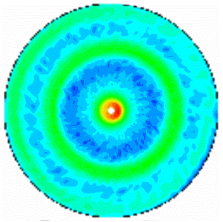
XPS, UPS photoemission spectroscopy



MET, EDS, EELS, EFTEM, electron diffraction; materials, biology

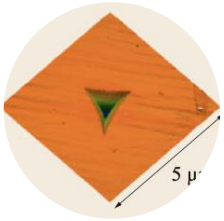


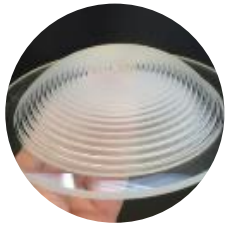
Microwave synthesis, purification, extraction, galenic engineering



High-resolution and texture X-ray diffraction

Fluid interfaces, films/foams/emulsions/gels, AFM biological objects, solid surfaces, rheology





Water jet cutting

AFM, Nanoindentation: topography, elasticity, hardness, adhesion - Bulk/thin layer

https://scanmat.univ-rennes1.fr/

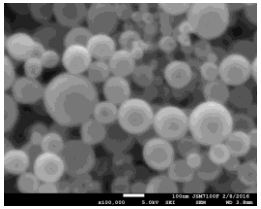
Scanning Electron Microscopy and MicroAnalysis

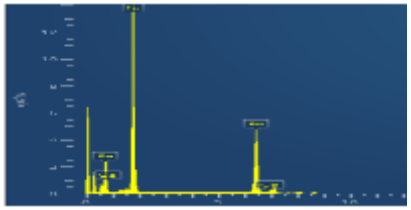
CMEBA
Centre de Microscopie à Balayage et microAnalyse

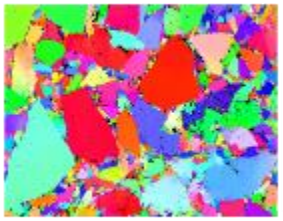
SERVICE OFFERING:

- Observation by scanning electron microscopy
- Composition analysis by EDXS (x-ray energy dispersive spectroscopy): local, zone, profile modes, mapping
- Microstructural analysis by EBSD (Electron BackScattering Diffraction): orientation mapping
- Sample preparation: cross section polisher, critical point drying, metallizer

- Theoretical and practical training







EQUIPMENTS :

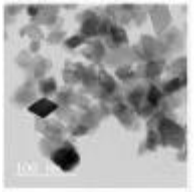
2 scanning electron microscopes equipped with analysis :

- JEOL JSM 7100 F : EDS EBSD Oxford
Field Effect Gun – High Resolution
- JEOL IT 300 LA adjustable pressure: EDXS JEOL
W filament, large chamber (sample of maximum diameter 200 mm and 80 mm height)

CONTACT :

cmeba@univ-rennes.fr

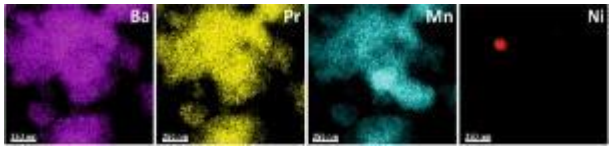
Electron Transmission Microscopy



SERVICE OFFERING:

- Conventional bright/dark field imaging, STEM-BF, STEM-HAADF
- High resolution imaging
- Electron diffraction in zone axis with reciprocal lattice reconstruction
- Tomography electron diffraction coupled with the electron precession technique for the determination of crystal structure
- 3D reconstruction of objects: bright field tomography and STEM-HAADF
- Energy filtered imaging (EFTEM)
- Chemical analysis (EDXS or EELS) in TEM and STEM modes: local, line or mapping
- Characterization of crystal defects
- Preparation of thin samples

- Practical and theoretical training



EQUIPMENTS :

- JEOL 2100 (tip of LaB_6, 80-200 KV) and associated equipements
- Scanning module STEM (Scanning Transmission Electron Microscopy)
- BF/HAADF (Bright Field/ High Angle Annular Dark Field) detectors
- EDXS SDD Oxford 80 mm^2 probe
- GIF Gatan Electron Energy Loss Spectroscopy
- Electron precession module Nanomegas Digistar
- Cameras
- ion polishing system Gatan PIPS II (sample thinning)

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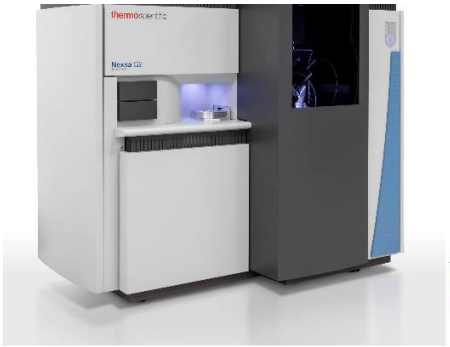
SURFACE & INTERFACE ANALYSIS USING XPS-UPS SPECTROSCOPY

SERVICE OFFERING : Surface analysis (1 to 10-15 nm deep) of solid materials

•nanomaterials, powder, fiber, thin film, solid materialsmineral, organic), insulator, semiconductor, conductor
•Samples of a few cm^2 and small thickness (few mm)
•Qualitative and semi-quantitative analysis with 0.1% atomic sensitivity
•Determination of chemical and redox stateConcentration profile (ion abrasion by monoatomic Ar ion or cluster)
•Chemical mapping imagingEnergy levels of molecular orbitals (UPS analysis)



- RX Source: Al Ka
- UV Source : He (I) and He (II)
- Micro-focus du spot RX
- Compensation of charge effects : Combined ion and electron guns
- Dual mode for "abrasion" Ar Monoatomic and Cluster Ar
- Imaging « snapmap »

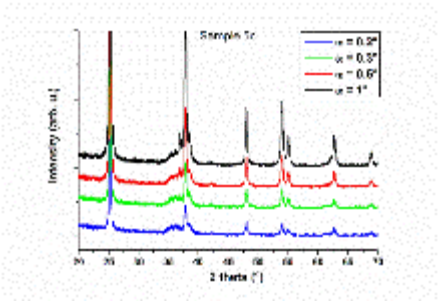
Specimen holders: conventional, powder, fiber and angle-variable

CONTACT : corinne.lagrost@univ-rennes.fr
christophe.calers@univ-rennes.fr

High resolution and texture X-Ray diffraction

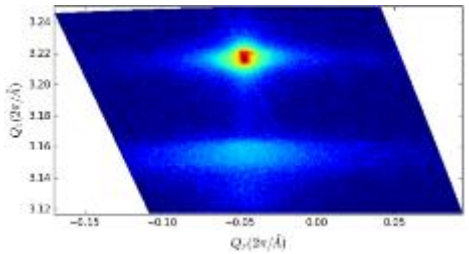
SERVICE OFFERING:

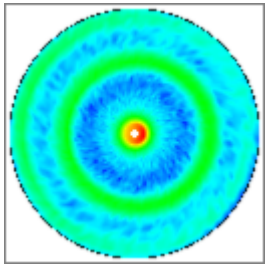
- Identify the crystallized phases in a sample: thin films (from 20 nm thickness), powder, ceramic and measure the lattice parameters
- Determine the texture, the orientation (pole figure)
- Determine the epitaxial relationships between a thin film and a substrate
- Residual stress state of a thin film
- Thickness and density measurement by X-ray reflectometry



EQUIPMENTS :

- Smartlab Rigaku 5 axes diffractometer
- Multi-configurations : θ-2θ, rocking-curves, φ-scans, grazing incidence, pole figure, Reciprocal Space Mapping (RSM), X-ray reflectometry (XRR), in plane mode, GI-SAXS, GI-WAXS
- Data processing and visualization





CONTACT : Dr Valérie DEMANGE
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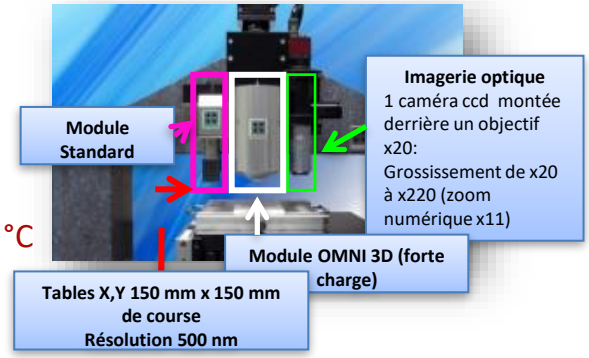
valerie.demange@univ-rennes1.fr

Surface topography and mechanical behavior

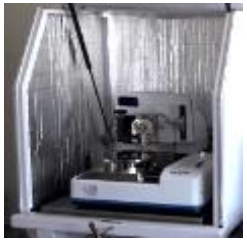
SERVICE OFFERING :

- Characterization of surface topography at the micrometer and sub-micrometer scale
- Mechanical behavior of materials or structures by mechanics of contact
- Measurements of hardness, reduced modulus ($Er=E/1-\nu^2$), friction, complex modulus, tangent δ

EQUIPMENTS :



Nanotribo-indentor TI 950, Bruker (Hysitron)
nano – dynamic mechanical analysis DMA III de 0 à 300 Hz, RT - 800 °C
xSol 800 Indentation instrumented 0-10 N, RT - 800 °C
Continuous measurement of stiffness (CSM)
Acoustic emission modulus
SPM imaging, topography, elastic modulus mapping (µN)
2 indentation-stripping heads in parallel: Nano 0 - 10 mN and micro 0 - 10 N.



Atomic Force Microscope ICON-PT
Various Modes : piezoresponse and force spectroscopy, electro chemistry, magnetic (MFM), electrostatic (EFM)…
Fast tapping, Peak force QNM, Fast force volume contact resonance,
Liquid Cell
thermo acoustic chamber

CONTACT :

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Infrared and Raman spectrometry

SERVICE OFFERING:

- Characterization of the vibrational signature of materials and molecules by Infrared and Raman spectrometry: identify a species/substance (through its bonds) and its concentration (intensity of the bands in the recorded vibrational spectrum) in a mixture or a heterogeneous material
- Follow-up of chemical reaction mechanisms, reaction product, phase transition
- Contribution to the understanding of the crystalline and amorphous structure of materials
- Evaluation of the state of mechanical stress by Raman imaging
- Study at macro and microscopic scale, imaging mode (Raman mapping) and deported,
- Control of the sample environment: study of samples in various forms (solid, liquid, gas, thin films), under mechanical stress, high pressure, temperature

- Theoretical and practical training in vibrational spectrometry.

EQUIPMENTS :

- 2 **Raman spectrometers LabRAM HR-800** et **LabRAM HR-Evolution**, Horiba Scientific lasers : 785 nm, 633 nm, 532 nm, 405 nm (pUV)
  imager, deported measuring head, multi-well (12X8), polarization kit, coupled confocal microscope for 2D (3D) imaging, spatial resolution of the order of µm2 (qq µm3 in 3D), confocal macrospot, duoscan (laser scanning)
- 1 **FT-NIR (UV-proche IR) Perkin-Elmer spectrometer**
  absorption, diffuse reflection, fiber probe for remote analysis - on-site handling possible (portable)

Possibility of privileged access to FTIR spectrometers (Medium IR) - ATR, fluidic, transmission, reflection modes

Spectral data processing: Grams software - spectral data analysis, pre-processing and analysis of data sets (dedicated user workstation)

CONTACT :

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Dr Alain MOREAC (technical manager)
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Characterization of fluid interfaces

2CBioMIF
Comportement et Caractérisation des BioMolécules aux Interfaces Fluides

SERVICE OFFERING:

Study of: biomolecules, molecules, macromolecules, polymers with amphiphilic character, interfacial films, foams, emulsions, membrane models

Multi-scale (mm to nm) characterization of fluid interfaces by physical measurements:

- detection and quantification of adsorption/desorption of surface active molecules *(surfactants)*
- measurement of the quantity of matter at the interface
- phase diagram of amphiphilic molecules (synthetic lipids, proteins, biopolymers,...)
- study of membranotropic activity of synthetic or natural molecules (antimicrobial, enzymes,...)

Characterization of **emulsions**

- droplet size, stability (time, temperature,...)

Characterization of **foams**

- bubble size, stability, expansion,...

Observation at the mesoscopic scale... (**AFM**)

- biological molecules/surfactant interfacial films
- morphological modifications of bacteria under the effect of exogenous molecules / physical treatment

EQUIPMENTS :

- Ellipsometer coupled to a surface pressure sensor
- drop/bubble tensiometer
- Interfacial rheometer *(bicone)*
- Atomic force microscope (AFM)
- Turbiscan
- Nanoparticle Tracking Analysis (NTA)

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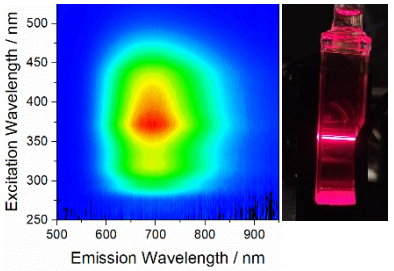
veronique.vie@univ-rennes.fr

CAPHER — CArtography and PHotoluminescence in Resolved Time

SERVICE OFFERING :

- Measurement of absorption, emission, excitation spectra, emission vs. excitation mapping (250-1100nm), 2-photon absorption emission, second harmonic generation
- Measurement of absolute luminescence quantum yields between 365 nm and 1100 nm
- Measurement of fluorescence and phosphorescence lifetime for powder, film and solution samples in a wide range of wavelengths: 350 nm-1700 nm.



EQUIPMENTS :

Pulsed excitation:
picosecond laser diodes (10 KHz à 100 MHz) at 375 nm and 405 nm, LED diode at 340 nm
tunable femtosecond laser system(140 fs, 80 MHz, 230 nm - 540 nm and 680 nm –1080 nm)

steady state detection:
C9920-03 (Hamamatsu) with Xenon lamp 150W, integrating sphere and detector PMA-12 (350 nm – 1100 nm)
Duetta Horiba Jobin-Yvon (excitation: 250-600nm; detection: 250-1100 nm);
Ocean Optics QEPro (300-1100nm).

Time-resolved detection:
Streak camera C10910-25 (Hamamatsu) in the range 350 nm -950 nm, time resolution: 100 ps to 300 µs.
Photomultiplier PMTH10330-75 (Hamamatsu) in the range 950 nm -1700 nm.

Cryostat Optistat DN2 (Oxford Instrument) between -200°C and 450°C

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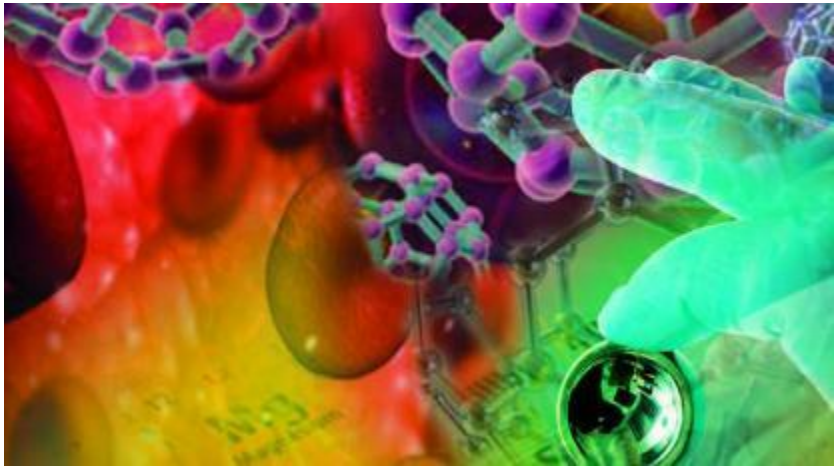

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https://scanmat.univ-rennes.fr/

Lab-Tour

Infrared and Raman spectrometry

SERVICE OFFERING:

- Characterization of the vibrational signature of materials and molecules by Infrared and Raman spectrometry: identify a species/substance (through its bonds) and its concentration (intensity of the bands in the recorded vibrational spectrum) in a mixture or a heterogeneous material
- Follow-up of chemical reaction mechanisms, reaction product, phase transition
- Contribution to the understanding of the crystalline and amorphous structure of materials
- Evaluation of the state of mechanical stress by Raman imaging
- Study at macro and microscopic scale, imaging mode (Raman mapping) and deported,
- Control of the sample environment: study of samples in various forms (solid, liquid, gas, thin films), under mechanical stress, high pressure, temperature

- Theoretical and practical training in vibrational spectrometry.

EQUIPMENTS :

- **2 Raman spectrometers LabRAM HR-800 et LabRAM HR-Evolution**, Horiba Scientific lasers : 785 nm, 633 nm, 532 nm, 405 nm (pUV)
  imager, deported measuring head, multi-well (12X8), polarization kit, coupled confocal microscope for 2D (3D) imaging, spatial resolution of the order of µm2 (qq µm3 in 3D), confocal macrospot, duoscan (laser scanning)
- **1 FT-NIR (UV-proche IR) Perkin-Elmer spectrometer**
  absorption, diffuse reflection, fiber probe for remote analysis - on-site handling possible (portable)

Possibility of privileged access to FTIR spectrometers (Medium IR) - ATR, fluidic, transmission, reflection modes

Spectral data processing: Grams software - spectral data analysis, pre-processing and analysis of data sets (dedicated user workstation)

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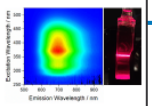
CAPHER CArtography and PHotoluminescence in Resolved Time

SERVICE OFFERING :

- Measurement of absorption, emission, excitation spectra, emission vs. excitation mapping (250-1100nm), 2-photon absorption emission, second harmonic generation
- Measurement of absolute luminescence quantum yields between 365 nm and 1100 nm
- Measurement of fluorescence and phosphorescence lifetime for powder, film and solution samples in a wide range of wavelengths: 350 nm-1700 nm.



EQUIPMENTS :

Pulsed excitation:
picosecond laser diodes (10 KHz à 100 MHz) at 375 nm and 405 nm, LED diode at 340 nm
tunable femtosecond laser system(140 fs, 80 MHz, 230 nm - 540 nm and 680 nm –1080 nm)

steady state detection:
C9920-03 (Hamamatsu) with Xenon lamp 150W, integrating sphere and detector PMA-12 (350 nm – 1100 nm)
Duetta Horiba Jobin-Yvon (excitation: 250-600nm; detection: 250-1100 nm);
Ocean Optics QEPro (300-1100nm).

Time-resolved detection:
Streak camera C10910-25 (Hamamatsu) in the range 350 nm -950 nm, time resolution: 100 ps to 300 µs.
Photomultiplier PMTH10330-75 (Hamamatsu) in the range 950 nm -1700 nm.

Cryostat Optistat DN2 (Oxford Instrument) between -200°C and 450°C

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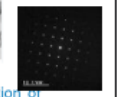
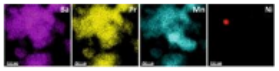
THEMIS Electron Transmission Microscopy



SERVICE OFFERING:

- Conventional bright/dark field imaging, STEM-BF, STEM-HAADF
- High resolution imaging
- Electron diffraction in zone axis with reciprocal lattice reconstruction
- Tomography electron diffraction coupled with the electron precession technique for the determination of crystal structure
- 3D reconstruction of objects: bright field tomography and STEM-HAADF
- Energy filtered imaging (EFTEM)
- Chemical analysis (EDXS or EELS) in TEM and STEM modes: local, line or mapping
- Characterization of crystal defects
- Preparation of thin samples

- Practical and theoretical training



EQUIPMENTS :

- JEOL 2100 (tip of LaB_6, 80-200 KV) and associated equipements
- Scanning module STEM (Scanning Transmission Electron Microscopy)
- BF/HAADF (Bright Field/ High Angle Annular Dark Field) detectors
- EDXS SDD Oxford 80 mm^2 probe
- GIF Gatan Electron Energy Loss Spectroscopy
- Electron precession module Nanomegas Digistar
- Cameras
- ion polishing system Gatan PIPS II (sample thinning)

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SURFACE & INTERFACE ANALYSIS USING XPS-UPS SPECTROSCOPY

SERVICE OFFERING : Surface analysis (1 to 10-15 nm deep) of solid

•nanomaterials, powder, fiber, thin film, solid materialsmineral, orga
conductor
•Samples of a few cm^2 and small thickness (few mm)
•Qualitative and semi-quantitative analysis with 0.1% atomic sensitiv
•Determination of chemical and redox stateConcentration profile (io
ion or cluster)
•Chemical mapping imagingEnergy levels of molecular orbitals (UPS

- RX Source: Al Ka
- UV Source : He (I) and He (II)
- Micro-focus du spot RX
- Compensation of charge effects :
  Combined ion and electron guns
- Dual mode for "abrasion" Ar Monoatomic and
- Imaging « snapmap »

Specimen holders: conv

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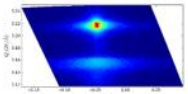
OSIRIX High resolution and texture X-Ray diff

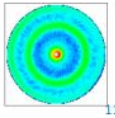
SERVICE OFFERING:

- Identify the crystallized phases in a sample: thin films (from 20 nm th
  and measure the lattice parameters
- Determine the texture, the orientation (pole figure)
- Determine the epitaxial relationships between a thin film and a subst
- Residual stress state of a thin film
- Thickness and density measurement by X-ray reflectometry

EQUIPMENTS :

- Smartlab Rigaku 5 axes diffractometer
- Multi-configurations : θ-2θ, rocking-curves, φ-scans, grazing incidence, pole figure, Reciprocal Space Mapping (RSM), X-ray reflectometry (XRR), in plane mode, GI-SAXS, GI-WAXS
- Data processing and visualization





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