

External Services 2020

CIC nanoGUNE

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CIC nanoGUNE launches an External Services Department with the aim of supporting the fabrication and characterization of nanoscale devices and materials for both academic and industrial users. New external services department will be one of the mechanisms by which technology transfer is implemented.

The aim is to reinforce the connections and fill the gap between research agents and industry in the Basque region, but it is also a tool to bridge with other national and international industry and R&D centers. Diversity will enable fruitful exchanges for ultimate benefit of our region.

In order to get this mission, CIC nanoGUNE opens its 6200m² of facilities equipped with a clean room and several novel labs assuring suitable environments with electromagnetic interference free and ultra-low level of vibration and acoustical noise for nanotechnology development.

The External Services Department is designed to be an open facility. Beside the services carried out by qualified CIC nanoGUNE personnel, most of the equipment is available to a wide range of users, including external academic and industrial researchers.



CIC nanoGUNE

- Private non-profit organization devoted to nanosource research
- Founded in 2006 and promoted by the Basque Government
- Operation started in January 2009
- New dedicated building of 6,200 m² with:
 - state-of-the-art equipment
 - electromagnetic interference free
 - ultra-low level of vibration and acoustical noise



I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical properties characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

Thin film growth services

- Ultra High Vacuum (UHV) magnetron sputtering (UHV ATC series AJA Sputtering System)
- E-beam/thermal evaporation (Oerlikon - UNIVEX 350 / EPVD75 Kurt J. Lesker)
- Table top basic sputtering (Leica / Quorum technologies Q150 T ES)
- Atomic Layer Deposition (ALD Cambridge Nanotech Savannah S100)

Nano-structure fabrication services

- E-beam lithography (Raith - I50-TWO / e-line)
- Focused Ion Beam (FIB) patterning – Focused Electron/Ion Beam Induced Deposition FE(I)BID (Dual beam FIB/SEM FEI Helios Nanolab / Helios 450S)
- Optical lithography (EVG Mask Aligner)

Sample processing services

- Ion milling (4wave)
- Reactive Ion Etching (RIE Oxford Plasmalab 80 Plus)
- Microscopy sample preparation (mechanical polishing, cleavage, ion polishing, target preparation)

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

- X-Ray Reflectivity / Diffractometry (XRR-XRD X'pert PRO by PANalytical)
- Atomic Force Microscopy (AFM 5500 Agilent / Nano observer CSI Instruments)
- Environmental Scanning Electron Microscopy / Scanning Electron Microscopy (SEM/ESEM FEI Quanta 250)
- Transmission Electron Microscopy (TEM FEI Titan)
- Transmission Electron Microscopy (TEM) images simulation and analysis

Magnetic and electrical properties characterization services

- Low temperature characterization Physical Properties Measurements System (PPMS Quantum Design)
- Probe station (Lake Shore Probe Station)

Chemical characterization services

- Raman microscopy (Confocal RAMAN microscope Alpha 300R WiTec)
- Energy-Dispersive X-ray spectroscopy (EDX EDAX's detectors)
- Electron Energy Loss Spectroscopy (EELS)
- Near-field microscopy (s-SNOM) and spectroscopy (nano-FTIR)

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

External
Services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical properties characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform



Introduction

CIC nanoGUNE is equipped with state of art techniques for nano/micro scale sample fabrication, either with systems for high quality thin film growth or for nano and micro scale structure fabrication.

Concerning the thin film fabrication services our facilities gives the possibility to grow films of a wide variety of materials, such as, metals, semiconductors and dielectrics in different type of substrates with precise thicknesses, starting from few atomic layers to micron size thicknesses. The thin films can be deposited in substrates of up to 4" diameter.

The nanostructure fabrication services also offers the possibility to make different shape structures in nano and micro scale. The smallest resolution achievable is around 20 nm by electron beam lithography technique, while using the focused ion beam milling we are able to pattern features with sizes down to 10 nm. Moreover our FIB/SEM dual beam system gives the possibility to deposit nanostructure of a wide variety of materials by focused ion/electron beam induced deposition. Most of these services are carried out in our 300 m² clean room, which is divided in four different areas classified from class 100 to class 10000 assuring the environmental conditions for working at nanoscale.

Sample process services can perform several treatments to the specimen, such as, wet etching, physical milling, plasma cleaning, annealing at high temperatures as well as high quality microscopy sample preparation by means of mechanical polishing, physical milling and others.

The sample fabrication platform can encompass and give solutions to a wide research and industrial activities.

I. Sample fabrication platform

Cleanroom

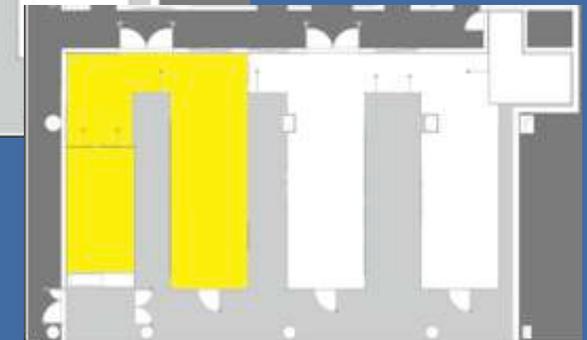
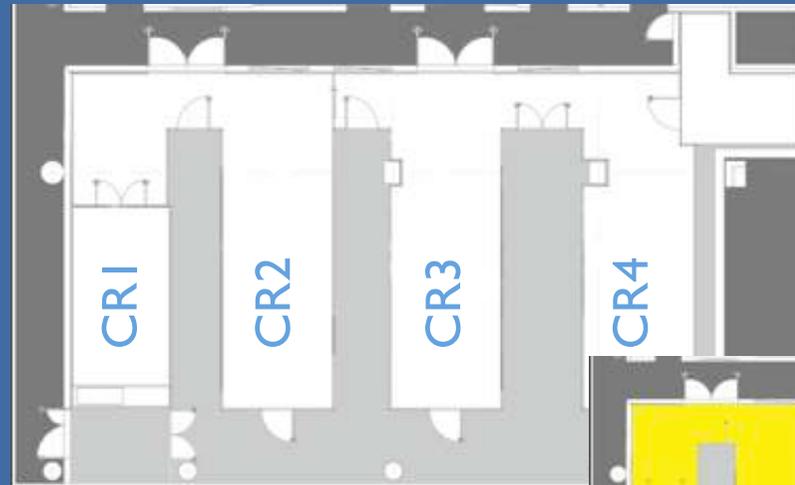
Approximately 300m²

Class: ISO 5 (class 100)
ISO 6 (class 1000)
ISO 7 (class 10000)

Lighting: Yellow light area
White light area

4 areas: CR1 - Electron Beam Lithography Room
CR2 - Photo Bay
CR3 - Etching Bay
CR4 - Deposition and Characterization Bay

Clean room equipment devoted to nanofabrication. All 4'' compatible.



I. Sample fabrication platform

Thin film growth services

I. Sample fabrication platform

Thin film growth services

Ultra High Vacuum (UHV) magnetron sputtering (UHV ATC series AJA Sputtering System)

E-beam/thermal evaporation (Oerlikon - UNIVEX 350 / EPVD75 Kurt J. Lesker)

Table top basic sputtering (Leica / Quorum technologies Q150 T ES)

Atomic Layer Deposition (ALD Cambridge Nanotech Savannah S100)

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical characterization services

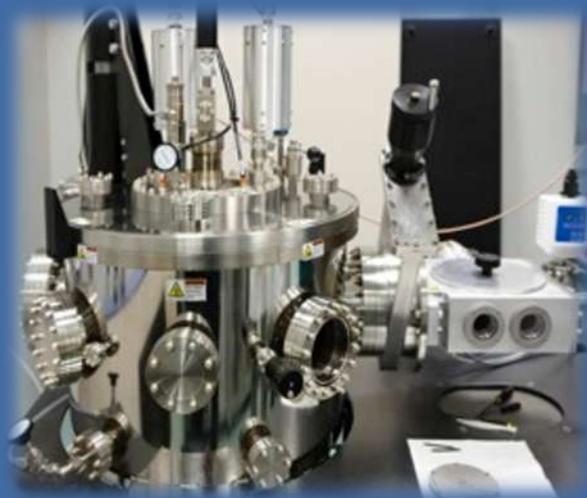
Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

Thin film growth services – UHV magnetron sputtering

ATC series AJA Sputtering System



Equipment

- Confocal 7 magnetron sputtering guns (DC / RF)
- RF bias available
- Base pressure 10^{-8} Torr
- Sample holder: 4" compatible and possibility to heat (up to 850 °C) or cool the sample (liquid nitrogen cooler)
- Reactive gasses: nitrogen and oxygen

Services

- High quality single or multiple layer thin film growth.
- Alloy thin film growth with determine stoichiometry.
- Nitride and oxide growth of thin film by reactive sputtering.
- Deposition or post-deposition treatment (annealing, Ar plasma cleaning of the surface)

I. Sample fabrication platform

Thin film growth services – E-beam / thermal evaporation

Oerlikon - UNIVEX 350 / EPVD75 Kurt J. Lesker



Equipment

- Multi pocket e-beam and thermal evaporation.
- Deposited thickness control by quartz crystal monitor.
- Deposition pressure of 10^{-6} - 10^{-7} mbar.
- Sample holder: 4" compatible and possibility to heat up to 350 °C

Services

- Single or multiple layer thin film growth by e-beam or thermal evaporation.
- Deposition or post-deposition treatment (annealing)

I. Sample fabrication platform

Thin film growth services – Atomic Layer Deposition

Cambridge Nanotech Savannah S100



Equipment

- "*Exposure mode*" for deposition of conformal and uniform films on substrates with ultra high aspect ratios, greater than 2000:1
- "*Continuous mode*" for perfectly dense, uniform and conformal films.
- 4 precursor sources (heated up to 150 °C) and option of using O₃
- Sample holder: 4" compatible and possibility to heat up to 300 °C

Services

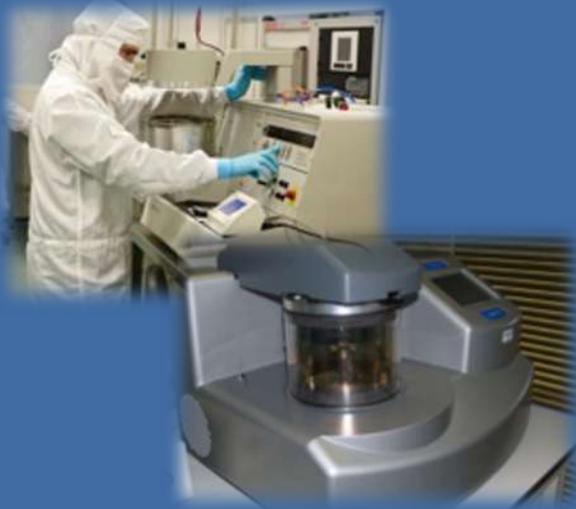
- Deposition of wide variety of materials (Al₂O₃, HfO₂, ZnO, TiO₂ and other oxides, nitrides and metals) on flat substrates (e.g. Si wafer) or high aspect ratio substrates (porous foams, fibers....)

I. Sample fabrication platform

Thin film growth services – Table top basic sputtering

Leica EM MED020 / Quorum technologies Q150T ES

Equipment



- Magnetron sputtering (DC power supply)
- Carbon rod evaporation head insert for carbon coating.
- Glow discharge attachment for surface modification or wetting
- Variable angle 'Rota-cota' rotatory planetary stage (diameter 50 mm)
- Sample holder: 4" compatible

Services

- Thin film growth of metals for basic coatings or contact fabrication.
- Carbon coating of the specimen

I. Sample fabrication platform

Nano-structure fabrication services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

beam FIB/

E-beam lithography (Raith -I50-TWO / e-line)

Focused Ion Beam (FIB) patterning – Focused Electron/Ion Beam Induced Deposition FE(I)BID (Dual SEM FEI Helios Nanolab / Helios 450S)

Optical lithography (EVG Mask Aligner)

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical properties characterization services

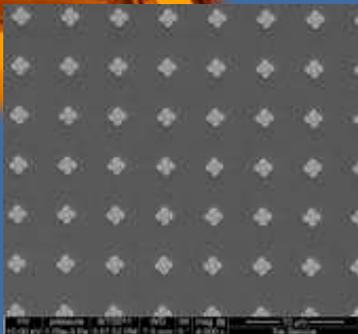
Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

Nano-structure fabrication services - E-beam lithography

Raith - I50-TWO / E-line



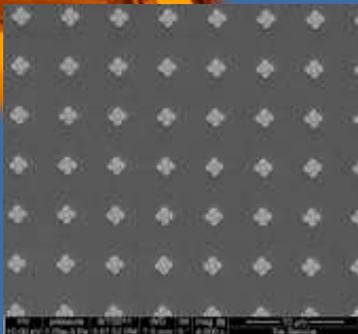
Equipment

- Electron beam column and optics
 - Electron source: Schottky field emitter ZrO/W.
 - Beam energy range: 100 V to 30 kV in 10 V steps.
 - Beam current range: 5 pA – 20 nA.
 - Beam size (Gaussian beam):
 - 2 nm at 20 kV at 3 mm working distance.
 - 4 nm at 1 kV at 3 mm working distance.
- Deflection system with writing field size range: from 0.5 μm up to 2 mm
- Laser interferometer controlled stage (res. 2 nm, repeatability $\ll 50$ nm)
- Aperture: 7 to 120 μm
- 20 MHz high speed pattern generation
- Automated height sensing
- Minimum feature size ≤ 20 nm.
- Possibility to pattern areas of up to 4" wafers

I. Sample fabrication platform

Nano-structure fabrication services - E-beam lithography

Raith - I50-TWO / E-line



Services

- Design fabrication
- Sample preparation for e-beam
- Nanostructure fabrication
 - Minimum feature size ≤ 20 nm.
 - Maximum patterned area 4"
- Resist developing
- Material deposition / milling / etching
- Lift-off process

I. Sample fabrication platform

Nano-structure fabrication services - FIB - FE(I)BID

Dual beam FIB/SEM - FEI Helios Nanolab / FEI Helios 450S



Equipment

- High tension electron column 50 V - 30 kV
- High tension Ga-column 0.5 kV – 30 kV
- Electron column resolution 0.5 nm at 15 kV and 0.8 nm at 1 kV (STEM)
- FIB milling resolution 10 nm at 30 kV
- GIS precursor for FE(I)BID: platinum, silicon oxide, gold, tungsten, cobalt
- Nanomanipulator with microgripper (Kleindiek)
- LN₂ cooling stage (CryoMat)
- EDX silicon drift detectors for elemental analysis (EDAX)
- Detectors: ETD SE, True in-Lens Detector (TLD), STEM II detector, High performance Ion Conversion and Electron (ICE), Concentric Back Scatter (CBS) detector
- iFast software for advanced Dual Beam automation in order to automate the imaging and nanofabrication
- MAPSTM for automatic acquisition of extra large images with high resolution
- AutoSlice&View™ software for 3D imaging by sequential sectioning of the sample

I. Sample fabrication platform

Nano-structure fabrication services - FIB - FE(I)BID

Dual beam FIB/SEM - FEI Helios Nanolab / FEI Helios 450S

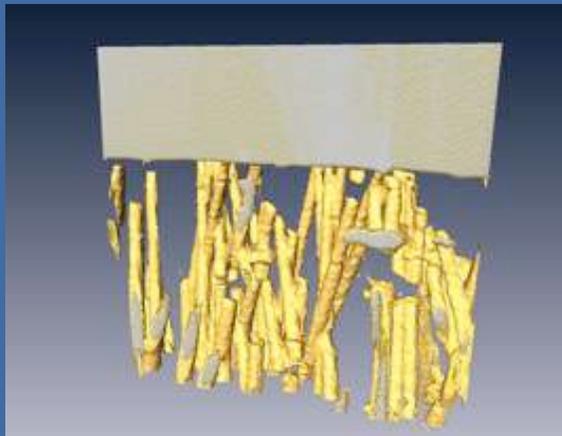


Services

- Surface patterning by FIB with a minimum feature size of 10 nm (processing areas below mm^2)
- Focused electron/ion beam induced deposition (FE(I)BID) of W, Au, Co, Pt and SiO_x .
- Complex structures fabrication (including 3D structure).
- Characterization FIB/SEM:

Automatic 3D imaging

Imaging of large areas



I. Sample fabrication platform

Nano-structure fabrication services – Optical lithography

Mask aligner (EVG)



Equipment

- Possibility of contact and proximity optical lithography process
- Easily minimum size achievable of 5 μm
- Possibility to pattern areas of up to 4" wafers
- Wide range of mask types
- UV lamp (15 mW /cm²)

Services

- Sample preparation
- Nanostructure fabrication: min. feature size 5 μm and max. patterned area 4"
- Resist developing
- Material deposition / milling / etching + lift-off process
- Possibility of mask fabrication

I. Sample fabrication platform

Sample processing services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Ion milling (4wave)

Reactive Ion Etching (RIE Oxford Plasmalab 80 Plus)

Microscopy sample preparation (mechanical polishing, cleavage, ion polishing, target preparation)

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

Sample processing services – Ion milling

4 Wave



Equipment

- Inductively coupled ion source. High output, low-energy Ar plasma source (max. 1.2 kV, max. 600 mA)
- In situ magnetron sputter system (3 guns, DC / RF)
- Base pressure 10^{-8} Torr
- Sample holder: 4" compatible

Services

- Ion processing and sputter deposition of thin films in situ in one chamber without breaking the vacuum conditions

I. Sample fabrication platform

Sample processing services – Reactive Ion Etching

RIE Oxford Plasmalab 80 Plus



Equipment

- Possibility to use different gasses, such as, oxygen (O_2), tetrafluoromethane (CF_4), trifluoromethane (CHF_3) and sulfur hexafluoride (SF_6).
- 5 - 500 mTorr operating pressures.
- Sample holder: 8" compatible

Services

- Reactive etching of wide range of materials (Si, SiO_2 , PMMA, Au, Ti...)

I. Sample fabrication platform

Sample processing services – Microscopy sample preparation

- Mechanical polishing of a broad range of sample surfaces up to 0.5 cm² with final surface roughness of less than 1 nm depending on the material
- Classical TEM bulk samples – prepared by long established dimple grinding and Ar milling methods
- Powder and colloidal samples – dispersion by sonication and nebulization
- Target sample preparation by focused ion beam and/or unique tool for milling, drawing, drilling, polishing and optical microscope imaging without sample removal from the instrument (Leica TXP)
- Others: wire saw, ultrasonic disk cutter, dimple grinder

I. Sample fabrication platform

Others

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical properties characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

I. Sample fabrication platform

Others

- Automatic dicing / cutting saw
- Wet benches
 - Ultra sonic bath
 - Spin coaters max. 8000 rpm (4" substrates)
 - Hot plates max. temp 300 °C (4" substrates)
- Wet etching of samples (e.g. hydrofluoric etching)
- Plasma asher, Ar and O₂ plasma surface treatment for surface cleaning (PICO-electronic diener plasma surface tech.)
- Annealing in specialized oven in vacuum conditions
 - Up to 650 °C / possibility to introduce N₂ gas (unitemp GmbH)
 - Up to 1000 °C / possibility to introduce N₂ and Ar gasses (Fisher Scientific)
- Critical point drying (Emitech K850WM)

II.Characterization platform

External
Services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II.Characterization platform

Structural characterization services

Magnetic and electrical properties characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

II.Characterization platform



Introduction

CIC nanoGUNE posses advanced physical properties characterization platform with state of the art equipment. This characterization platform is divided in three different service units, structural characterization, magnetic and electrical characterization and chemical characterization services.

For structural characterization services we offer a versatile X-ray diffraction/reflection system and atomic force microscopes. Furthermore, CIC nanoGUNE owns last generation electron microscopies, specifically an environmental scanning electron microscope (ESEM, FEI Quanta 250) and a transmission electron microscope (TEM, FEI Titan). These systems are operated by highly qualified personnel which are capable for a complete processing, simulation and visualization of the electron microscopy data.

CIC nanoGUNE also owns a physical properties measurement system for outstanding electrical and magnetic characterization services (Low temp. PPMS, Quantum Design).

CIC nanoGUNE also provides nanoscale chemical characterization services based on s-SNOM, RAMAN, EDX and EELS techniques. Importantly, the available s-SNOM microscopes together with several monochromatic and broadband infrared lasers are operated by highly qualified scientists allowing for state-of-the-art nanoscale optical and chemical characterization.

Moreover, our labs are equipped with other basic characterization systems, such as profillometer, optical microscopes or table top scanning electron microscopes.

II.Characterization platform

Structural char. services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II.Characterization platform

Structural characterization services

X-Ray Reflectivity / Diffractometry (XRR-XRD X'pert PRO by PANalytical)

Atomic Force Microscopy (AFM 5500 Agilent / Nano observer CSI Instruments)

Environmental Scanning Electron Microscopy / Scanning Electron Microscopy (SEM/ESEM FEI Quanta

250)

Transmission Electron Microscopy (TEM FEI Titan)

Transmission Electron Microscopy (TEM) images simulation and analysis

Magnetic and electrical characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

II. Characterization platform

Structural char. services - X-ray reflectivity/diffractometry

X'pert PRO by PANalytical



Equipment

- Possibility for thin film characterization:
 - X-ray reflectivity (XRR)
 - X-ray diffractometry (XRD)
- Possibility for powder characterization:
 - X-ray diffractometry (XRD)
- Very precise and reproducible θ - 2θ goniometer
- High stability 3 kW X-ray generator tube (anode copper)
- Analysis software (ICDD crystallographic reference pattern database)

Services

- Thin film characterization:
 - X-ray reflectivity (XRR): thickness and quality characterization thin films
 - X-ray diffractometry (XRD): Basic and detailed crystallographic characterization
- Powder characterization:
 - X-ray diffractometry (XRD): crystal phase characterization

II.Characterization platform

Structural char. services – High resolution Atomic Force Microscopy

AFM 5500 Agilent



Equipment

- Maximum scan range: 100 μm x 100 μm
- High resolution scanner (max. scan range 10 μm x 10 μm)
 - Lateral resolution with standard tip: 5 nm
- Magnetic force microscope measurements
- Images of biological samples
- Images under liquid solutions
- Heat the sample while imaging up to 250 $^{\circ}\text{C}$

Services

- Characterization of surface topography in flat surfaces or nanostructures
- Imaging of biological samples
- Imaging under liquid solution
- Magnetic domains imaging
- Topographic image at high temperatures

II.Characterization platform

Structural char. services – Atomic Force Microscopy

Nano observer CSI Instruments



Equipment

- Non-destructive characterization of surface topography
- Maximum scan range: 100 μm x 100 μm
- Minimum scan range: 1 μm x 1 μm
- Possibility to perform magnetic force microscope measurement

Services

- Characterization of surface topography in flat surfaces or nanostructures
- Magnetic domains imaging

II.Characterization platform

Structural char. services – SEM/ESEM

ESEM – FEI Quanta 250

Equipment

- High tension 0.5 kV – 30 kV
- Schottky field emitter gun
- Electron beam resolution 2.5 nm at 30 kV (BSE, high vacuum)
- Electron beam resolution 1 nm at 30 kV (SE, high vacuum)
- Working chamber pressure (H₂O or auxiliary gas) 10⁻⁴ Pa – 4000 Pa
- EDX silicon drift detector (EDAX)
- Detectors: ETD SE detector, BS Si detector (BSE), Large Field Gaseous SE detector (LFD), Gaseous SE detector (GSED), Gaseous BS detector (GBSD)
- Peltier stage (-25 °C – +55 °C)
- Nanomanipulator with microinjector (Kleindiek)



II.Characterization platform

Structural char. services – SEM/ESEM

ESEM – FEI Quanta 250

Services

- SEM – morphological surface analysis
- STEM – resolution < 1 nm at 30 kV
- ESEM – non conducting samples without any coating
- Imaging of wet samples and liquid water
- Possibility to inject liquid by manipulators while imaging
- In-situ electrical measurements – 3 probes, probing current 10 nA to 100 mA, probing max. voltage 100 V and probing resistance 7Ω
- Extra large high-resolution surface imaging (up to cm^2 areas with nm resolution)

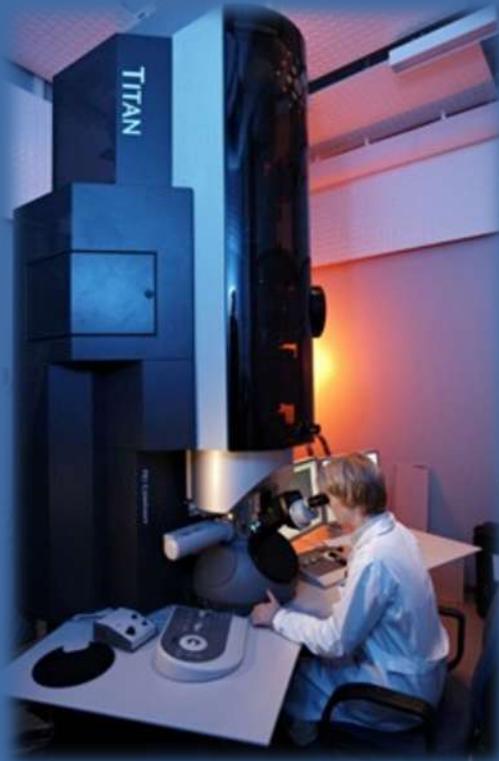


II.Characterization platform

Structural char. services – Transmission Electron Microscopy

TEM FEI Titan

Equipment



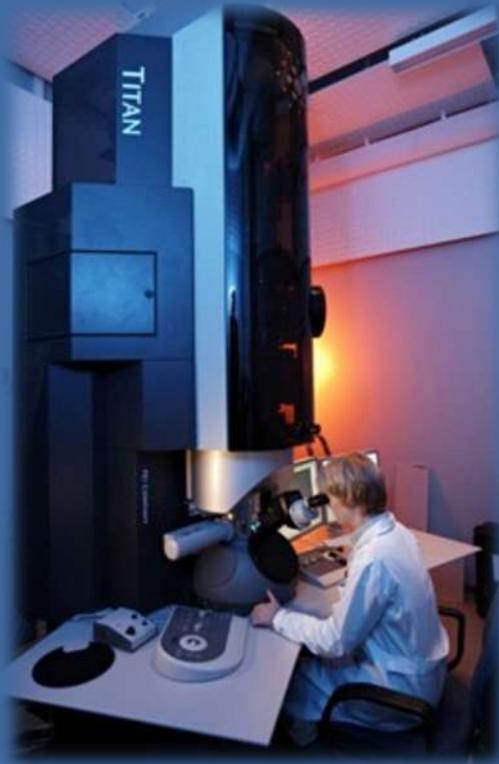
- High tension: 60 kV – 300 kV
- High-brightness XFEG gun
- Point resolution 0.08 nm
- Imaging side Cs corrector
- Detectors: HAADF detector (Fisheye), BF, ADF and HAADF detectors (Gatan)
- Pre- and post- GIF 2 k x 2 k CCD ultrascan cameras (Gatan)
- EDX RTEM (EDAX) detector for x-ray analysis
- Lorentz lens
- Biprism

II.Characterization platform

Structural char. services – Transmission Electron Microscopy

TEM FEI Titan

Services

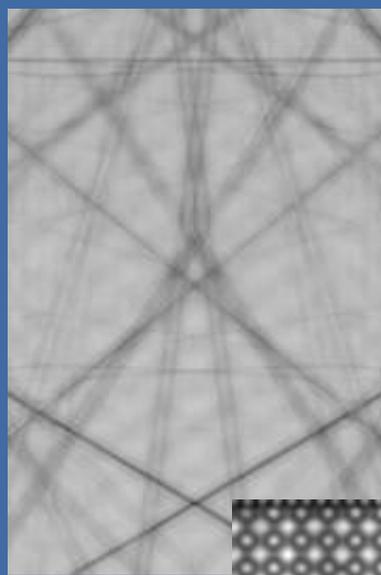


- Conventional and high resolution TEM (HRTEM)
- Low voltage (down to 60kV) HRTEM for beam sensitive materials
- Electron diffraction and convergent beam electron diffraction
- STEM (resolution 0.135nm)
- Low loss and core loss EELS analysis (resolution down to 80 meV)
- Electron holography
- TEM and STEM electron tomography
- In situ heating (up to 1200 °C) and 4 - contact electrical biasing
- Lorentz microscopy

II.Characterization platform

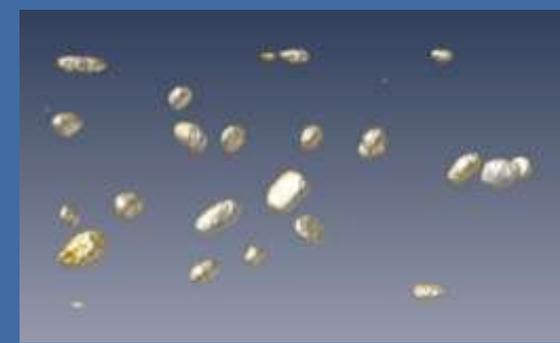
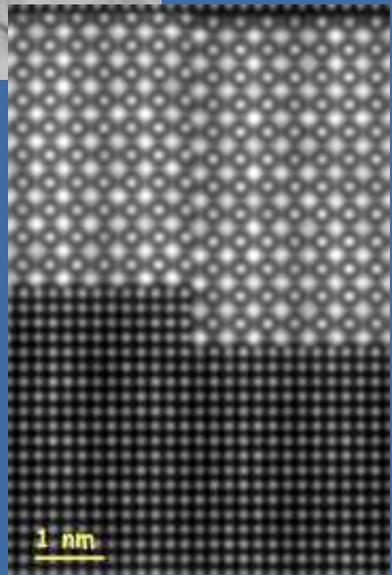
Structural char. services – TEM images simulation and analysis

TEM image simulation and analysis



Services

- 3D data reconstruction and visualization
- Fourier image analysis
- HRTEM image simulation using multislice (up to 10^7 independent atoms, up to 500 x 500 nm unit cell)
- STEM and convergent beam electron diffraction simulation using multislice
- Strain analysis using Geometrical Phase Analysis (GAP) and Convergent Beam Electron Diffraction (CBED)



II. Characterization platform

Magnetic and electrical char. services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II. Characterization platform

Structural characterization services

Magnetic and electrical characterization services

Low temperature characterization Physical Properties Measurements System (PPMS Quantum Design)

Probe station (Lake Shore Probe Station)

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

II. Characterization platform

Magnetic and electrical char. services – Low temp. PPMS

Quantum Design PPMS

Equipment



- Horizontal & vertical sample rotators from 0° to 360°

- Temperature from 2 K – 400 K

- Possibility to apply field up to 9 T

- Vibrating sample magnetometer option

 - RMS Sensitivity: $< 10^{-6}$ emu with 1 sec averaging

 - VSM oven up to 1000 K

- Transport measurements

 - 8 independent interchangeable channels to measure resistivity

 - I (V) and V(I) measurements

II.Characterization platform

Magnetic and electrical char. services – Low temp. PPMS

Quantum Design PPMS

Services



- Transport measurements

Magneto-resistance measurements at different temperatures (2 K - 400 K) applied field up to 9 T

Resistance versus temperature (2 K- 400 K)

I(V) and V(I) curves at different temperatures (2 K - 400 K) applied field up to 9 T

- Magnetic measurements VSM

Magnetic moment versus temperature (2 K- 400 K)

Hysteresis loop measurement at RT

Hysteresis loop measurement at different temperature (2 K - 400 K)

- Magnetic measurements VSM oven option

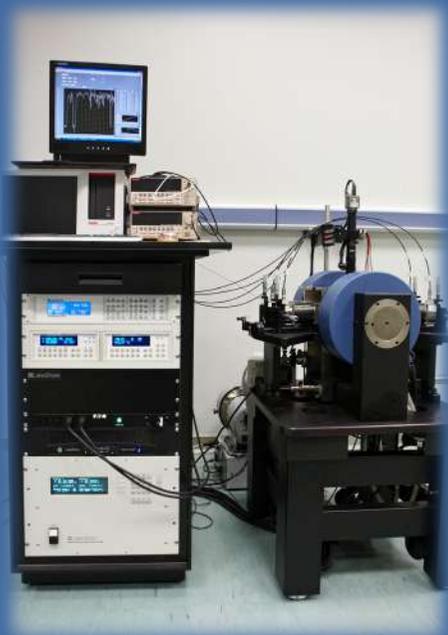
Magnetic moment versus temperature (300 K - 1000 K)

Hysteresis loop measurement at different temperature (300 K - 1000 K)

II.Characterization platform

Magnetic and electrical char. services – Probe Station

Lake Shore Probe Station



Equipment

Electrical and magnetic low temperature and high-field characterization of thin films and nanodevices.

- Four probe measurements
- Variable temperature
- Variable magnetic field

Services

Electrical and magnetic properties measurements of thin films and nanodevices at different applied field and temperatures

II.Characterization platform

Chemical characterization services

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II.Characterization platform

Structural characterization services

Magnetic and electrical characterization services

Chemical characterization services

Raman microscopy (Confocal RAMAN microscope Alpha 300R WiTec)

Energy-Dispersive X-ray spectroscopy (EDAX's detectors)

Electron Energy Loss Spectroscopy (EELS)

Near-field microscopy (s-SNOM) and spectroscopy (nano-FTIR)

Others (profilometry, ellipsometry, optical microscopes...)

II.Characterization platform

Chemical characterization services – RAMAN microscopy

Confocal RAMAN microscope Alpha 300R WiTec



Equipment

- Ability to acquire chemical information non-destructively with a resolution down to the optical diffraction limit.
- Raman spectrum acquisition at selected areas in the sample.
- Possibility to reconstruct 2D chemical images

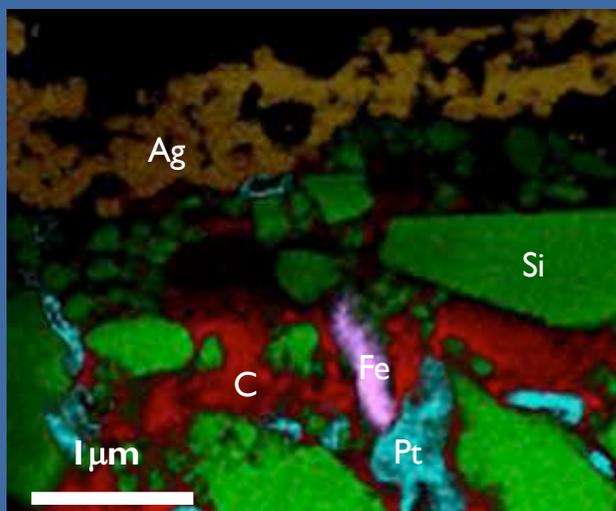
Services

- Raman spectrum acquisition at different areas in the sample
- Chemical image 2D reconstruction

II.Characterization platform

Chemical characterization services – Energy-dispersive X-ray spectroscopy

EDAX's Octacne Silicon Drift / EDAX's Sapphire Si(Li) Detectors



Equipment

CIC nanoGUNE owns four EDX detectors placed in the two FIB/SEM (FEI Helios Nanolab / FEI Helios 450S) systems, in the SEM (FEI Quanta 250) and in the TEM (FEI Titan).

The ones in the two FIB/SEM and SEM are EDAX's Octacne Silicon Drift Detector and the one in the TEM is EDAX's Sapphire Si(Li) Detector (resolution < 1 nm).

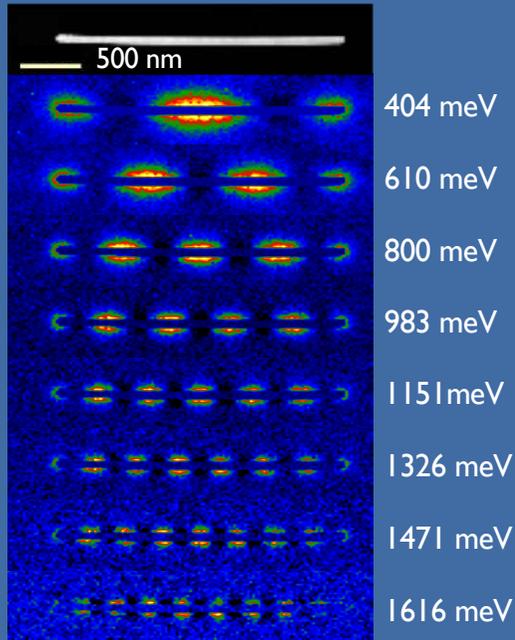
Services

- EDX analysis of a specimen composition
- Elemental maps of the surface and cross section (resolution down to 1 nm)

II.Characterization platform

Chemical characterization services – Electron energy loss spectroscopy

EELS

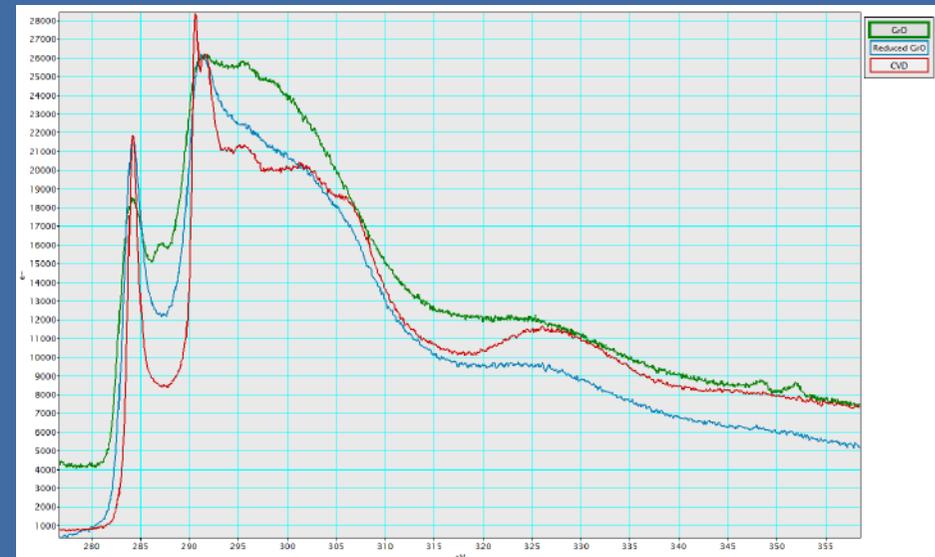


Equipment

- Gatan imaging filter (GIF Quantum)
- Energy resolution 0.2 eV at 300 kV, 80 mV at 60 kV

Services

- EELS characterization of chemical state
- Elemental and chemical mapping
- Low loss plasmon spectroscopy and mapping



II.Characterization platform

Chemical characterization services –Near-field microscopy

NeaSNOM microscope



Equipment

- NeaSNOM microscope
- For spectroscopy: broadband laser, FemtoFiber pro IR (700-2200 cm^{-1} range)
- For imaging: Quantum Cascade lasers (1079-1445 cm^{-1} and 1494-1801 cm^{-1} ranges) and CO2 lasers (890-985 cm^{-1} and 1030-1085 cm^{-1}).
- Ability to acquire monochromatic optical images (i.e. infrared absorption images) and local broadband infrared spectra (i.e. nanoscale FTIR absorption spectra) with 20 nm spatial resolution
- Possibility to record nanoscale hyperspectral infrared images.

Services

- Nanoscale infrared microscopy and nanospectroscopy.
- Applications: conformation analysis of single protein complexes, chemical characterization of polymer blends and rubbers, nanoscale analysis of structural disorder in organic semiconductors, study of single viruses, carrier concentration measurements on nanowires, imaging of compressive/tensile strain, etc.

II.Characterization platform

Others

I. Sample fabrication platform

Thin film growth services

Nano-structure fabrication services

Sample processing services

Others (oven, wet etching, plasma asher, critical point dryer...)

II.Characterization platform

Structural characterization services

Magnetic and electrical characterization services

Chemical characterization services

Others (profilometry, ellipsometry, optical microscopes...)

II.Characterization platform

Others

- Surface profilometry (Veeco Dektak 150 Surface Profiler)
- Spectroscopic ellipsometry (GES5 spectroscopic-ellipsometer SEMILAB)
 - wavelength from 230 to 900nm
 - xy sample stage automatic movement
- Optical microscopes:
 - Leica optical microscope:
 - 100x to 1000x magnification
 - Transmission and reflected light imaging
 - Bright field, dark field polarization contrast and differential interference contrast (DIC) imaging
 - High-definition 5-megapixel camera
 - Advanced image management and analysis software
 - Stereo microscopes with digital camera:
 - High magnification (0.8x – 8x) and high zoom ratio (10x zoom)
 - Total magnification from 4x to 480x
 - High-definition 5-megapixel camera.
 - Fast frame rate of 21 fps (Display mode: 1280 x 960 pixels)
 - 4 Nikon Eclipse LV150A:
 - Located in the clean room
 - 5 plan flour objectives, 5x, 10x, 20x, 50x, 100x
 - Bright field, dark field and differential interference contrast (DIC) imaging



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