Máster en Materiales Avanzados

Nanotecnología y Fotónica

UAM Universidad Autónoma de Madrid

Master in Advanced Materials, Nanotechnology and Photonics

Departamento de FÍSICA APLICADA

Department of Applied Physics

DPTO. DE FÍSICA DE MATERIALES Universidad Autónoma de Madrid

Department of Material Physics

www.uam.es/otros/**matavanz/**

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http://matavanz-uam.000webhostapp.com/

Experimental Master of 1 year (60 ECTS)

Taught in Spanish
Courses 4-5 afternoons/week

For students graduated in

- Physics
- Chemistry
- Material Science
- Advanced Engineering

Structure

1st semester

- Fundamentals
  5 Compulsary Courses (25 ECTS)
- **Nanotechnology Laboratory** **or** **Photonics Laboratory** **(5 ECTS)**

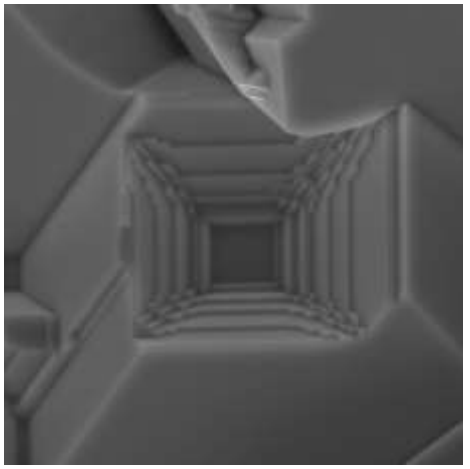
2nd semester

- 3 Elective Courses out of 8 (15 ECTS)
  - **Photonics (3)**
  - **Nanotechnology (5)**
- **Master Thesis** (15 ECTS)

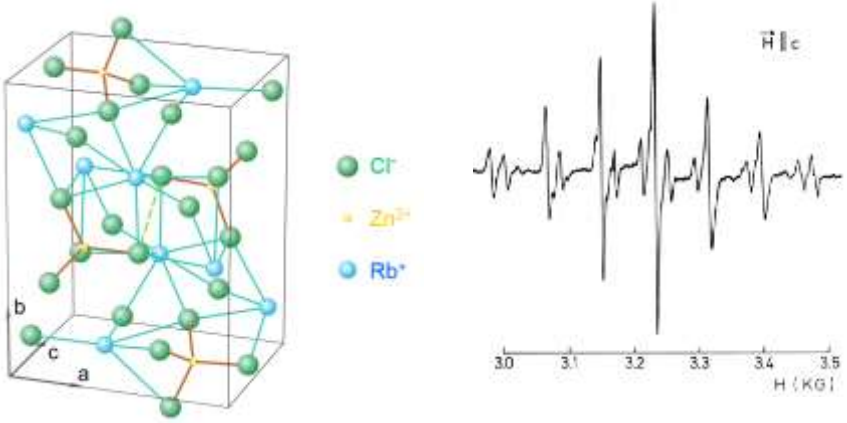
Fundamentals

Techniques for material characterization 1

Spectroscopy with ions, electrons, X-rays and others



In_2Se_3 crystal



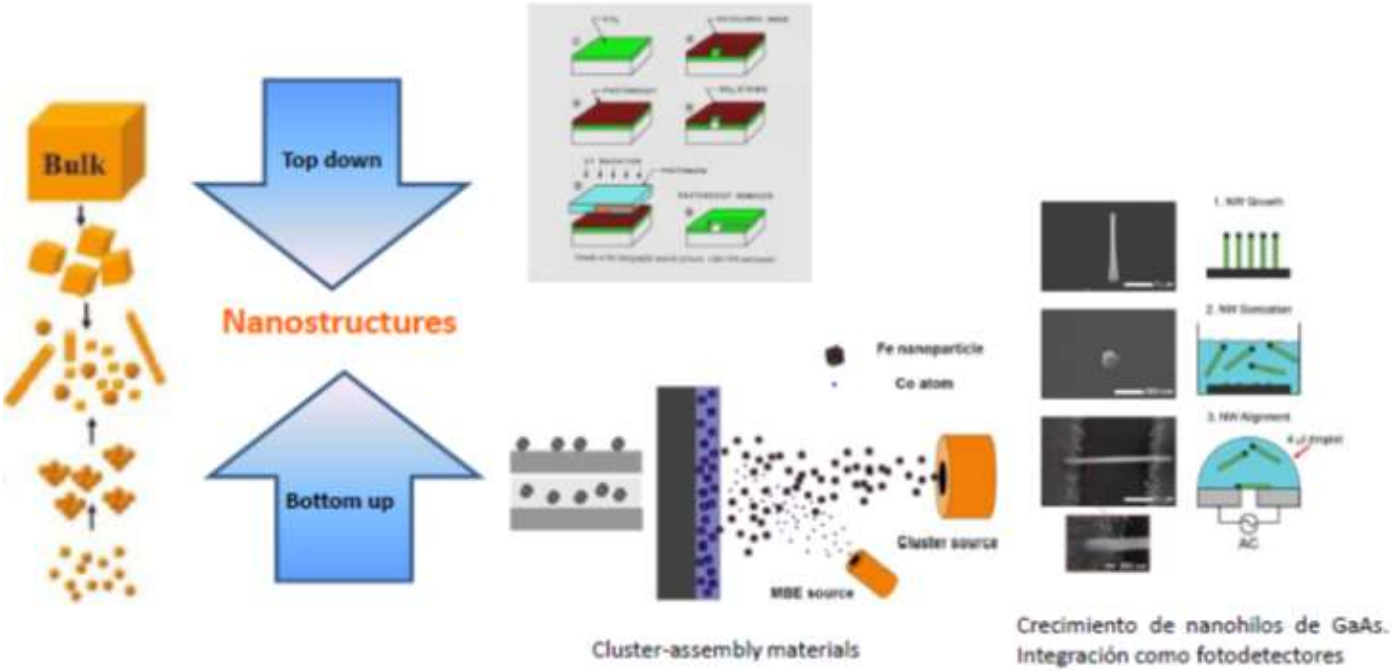
Estructura hiperfina en $Rb_2 Zn Cl_4$

Techniques for material characterization 2

Optical and magnetic spectroscopies

Fundamentals

Synthesis of advanced materials and nanostructures



Physical and chemical synthesis methods

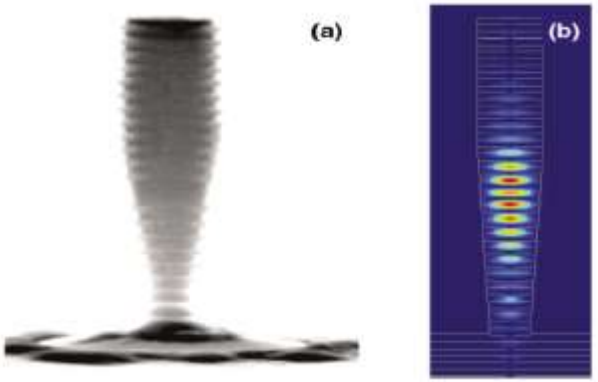
In vapor phase and in solution

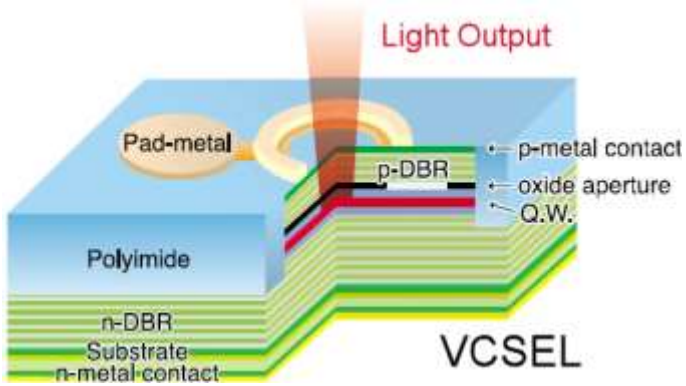
Lithographic techniques to obtain nanostructures, thin films and bulk materials

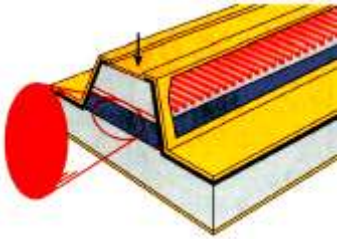
Bottom-up and top-down strategies

Fundamentals

Optoelectronics







Light-matter interaction in semiconductors, quantum confinement, quantum wells, quantum dots, ultrafast processes, single photon emitters

Fundamentals

(25 ECTS)

Nanodevices

Transport in semiconductors, pn junction, FET Transistor, HEMTs, MOSFET, CCD, magnetic nanodevices

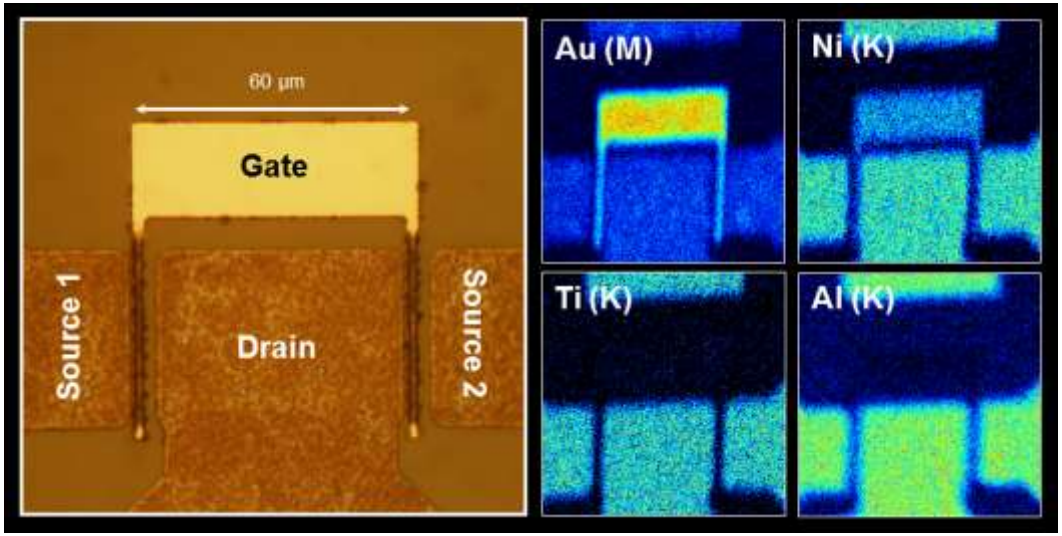
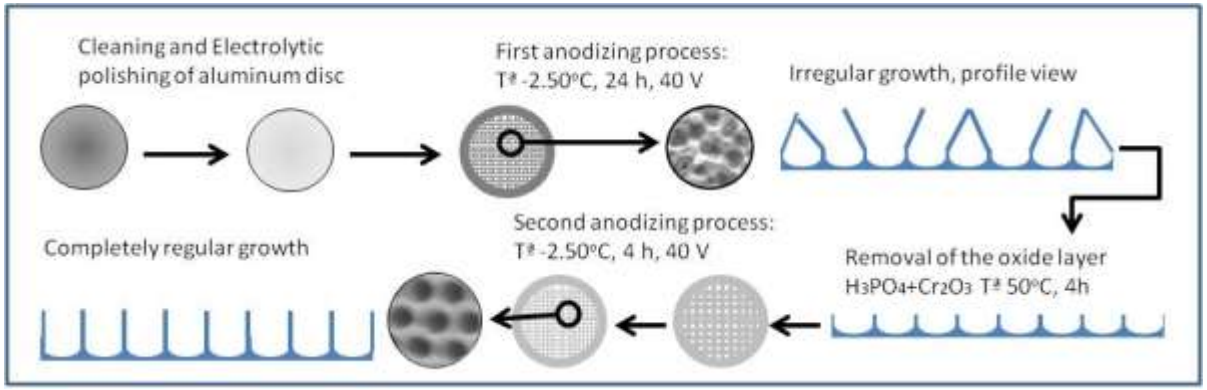


Image of a double-gated nano-transistor and a composition map (X-ray emission)

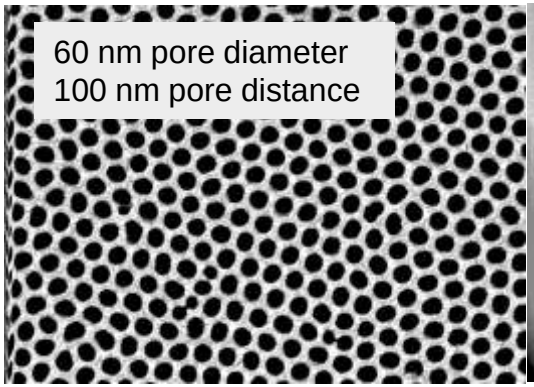
Advanced Materials Laboratory

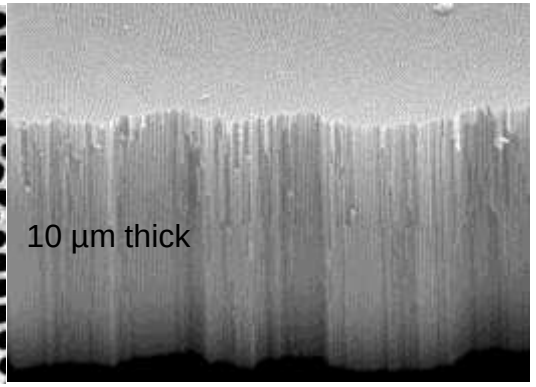
Synthesis of Anodic Alumina Membranes by anodic oxidation process

Electrochemical Method:



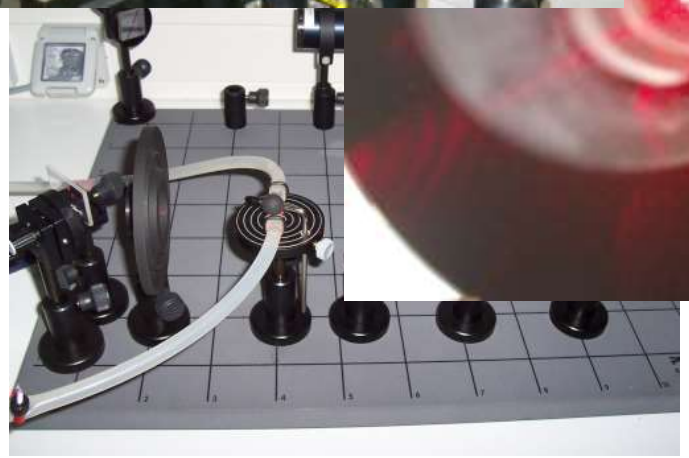
Hexagonal patterned AAO membranes:

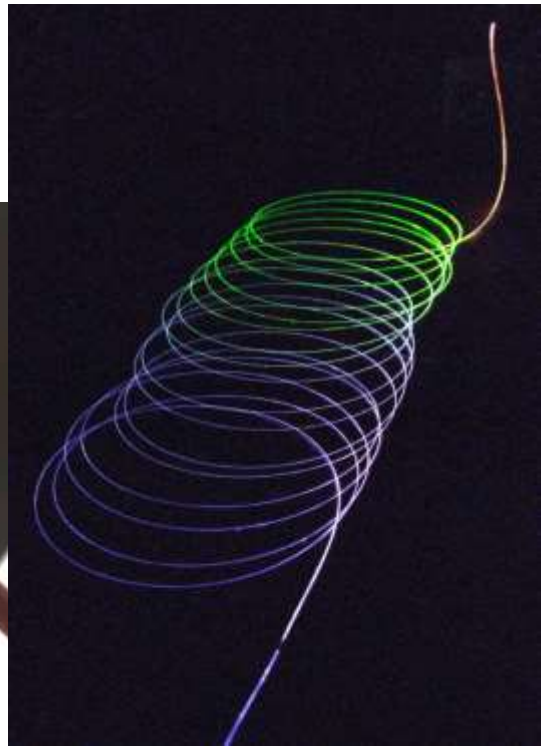




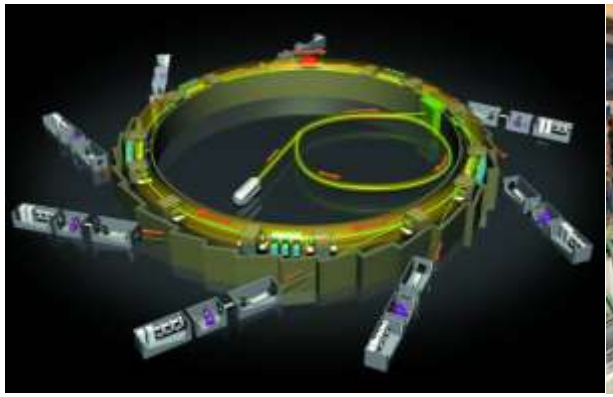
Photonics Laboratory

Experiments with control and manipulation of light

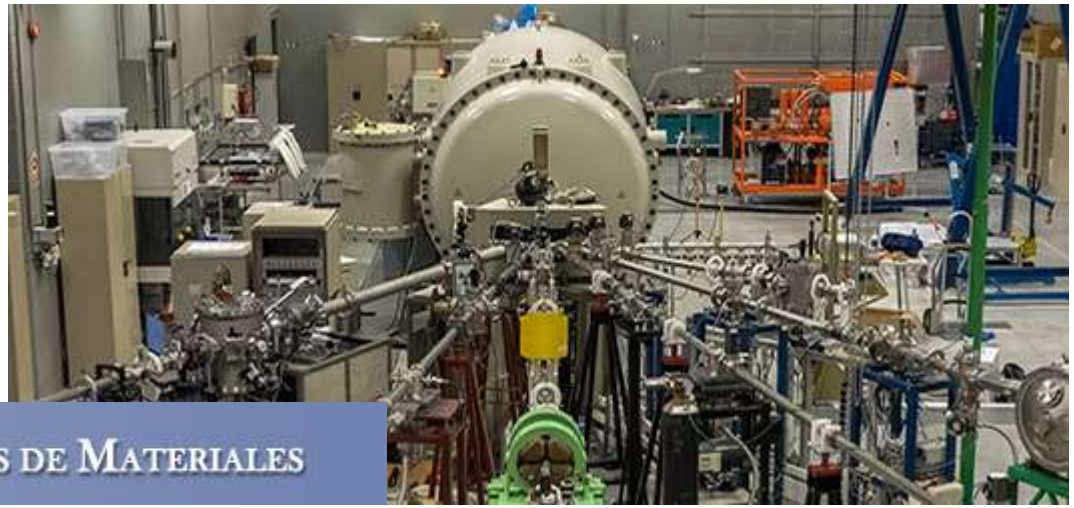




Material characterization in large facilities



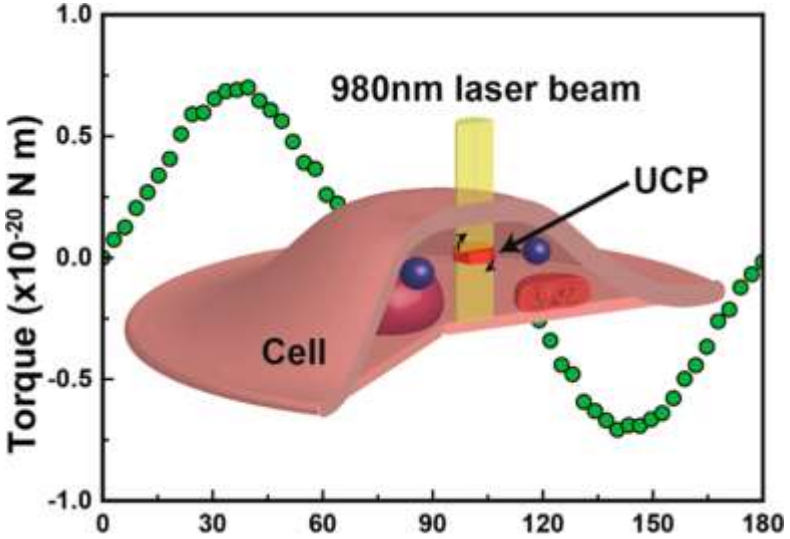
Ion accelerator with a maximum terminal voltage of 5 MV, devoted to the analysis and modification of materials

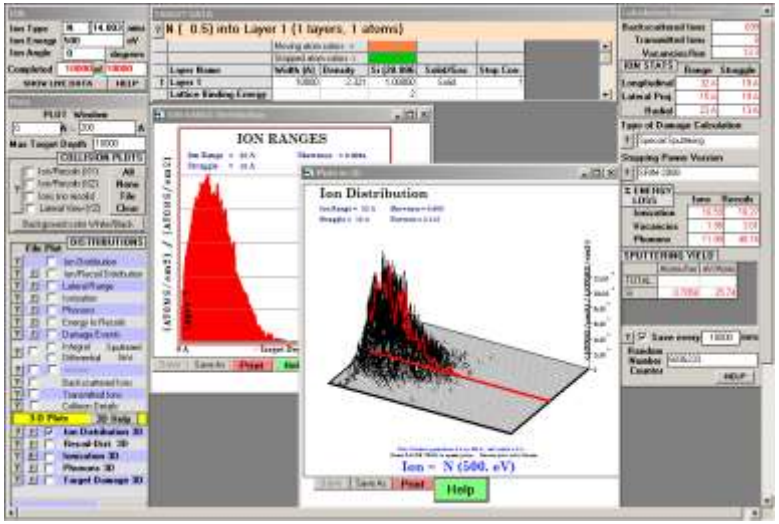


CMAM CENTRO DE MICRO-ANÁLISIS DE MATERIALES

Máster en Materiales Avanzados

Materials and physical techniques in biology and environment





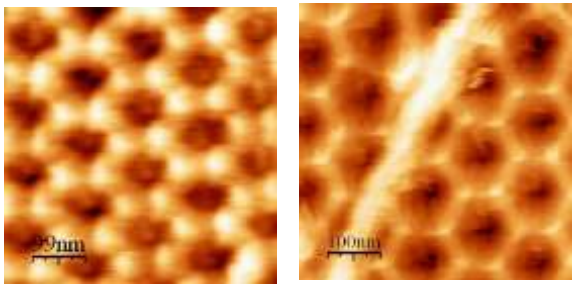
Simulation and numerical methods in materials

Nanocharacterization by microscopic techniques

AFM

Morphology, Elastic Properties

AFM IMAGING INDIVIDUAL SWNTs

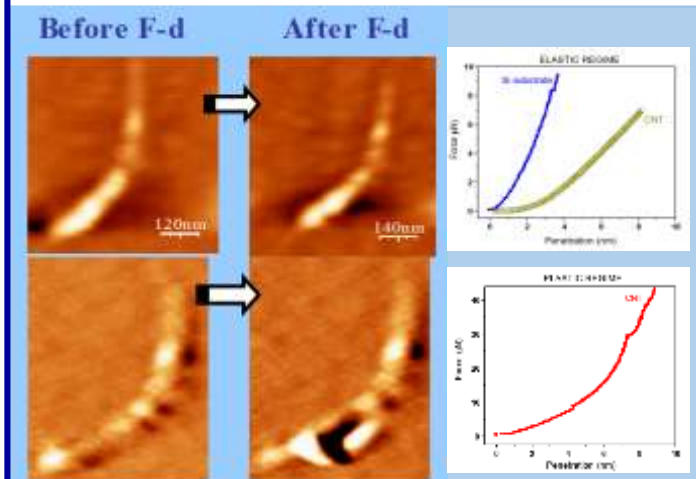


• Anodized aluminum oxide (AAO) membranes were fabricated and NTs were deposited on them to measure the elastic modulus of the SWNT.

•AFM is used to image and to apply nanoforces onto SWNTs that are crossing the nanometric AAO pores. By measuring the deflection, we can obtain the Young´s modulus of the individual SWNT.

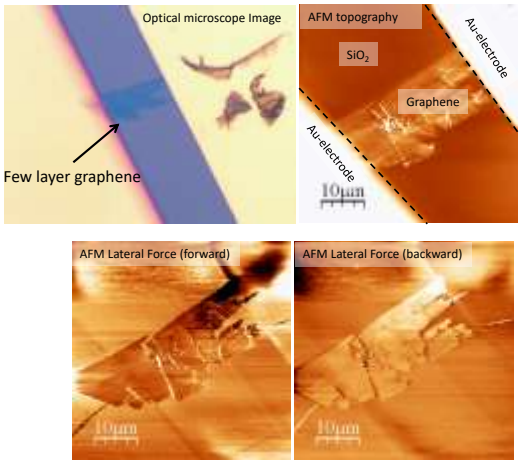
Hardness

MECHANICAL PROPERTIES OF CNTs



Friction

GRAPHENE FRICTION

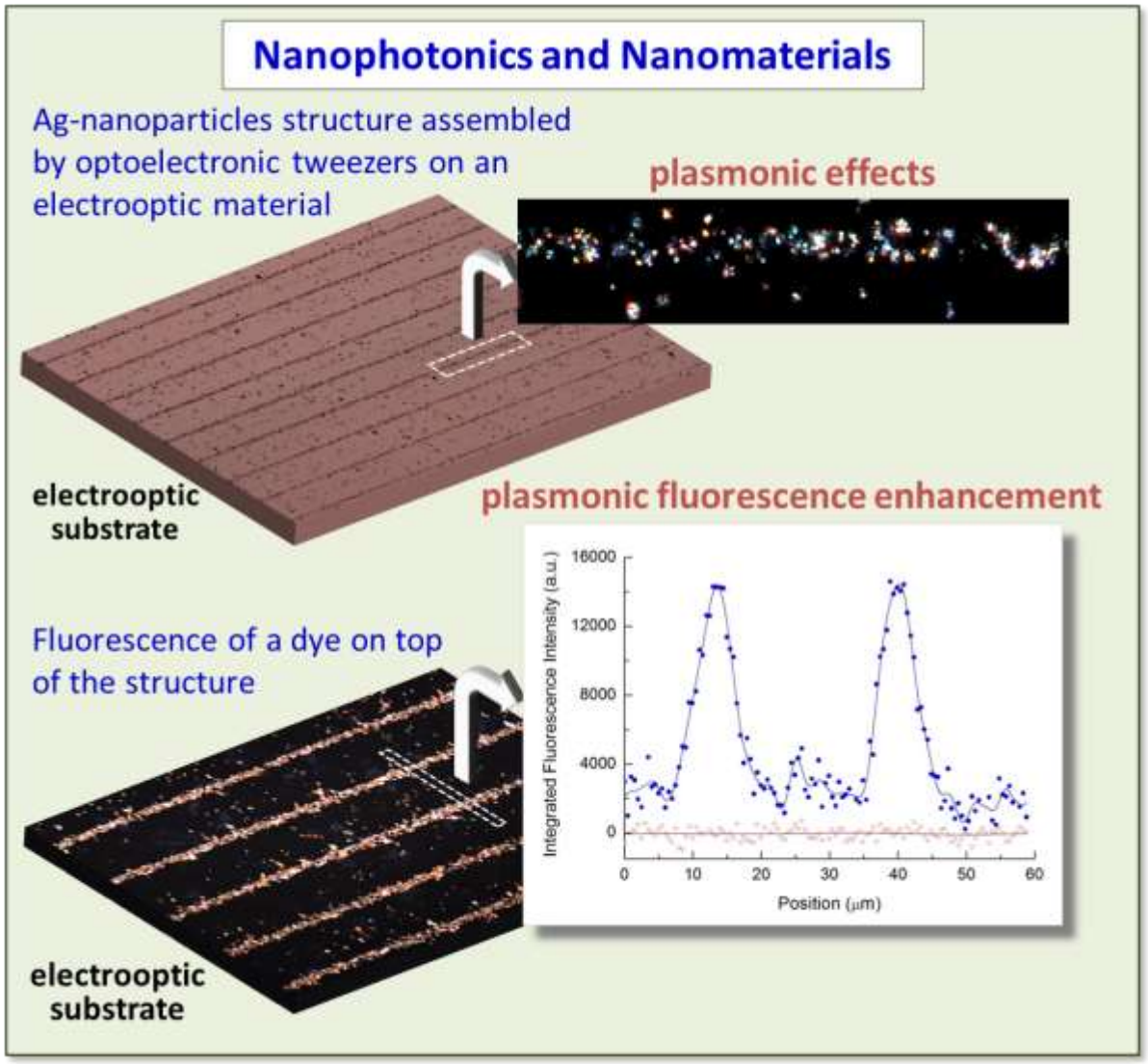


c.morant@uam.es

Materials for solar applications

Materials for photovoltaic solar cells (from Si to the ultimate technologies)
Materials for termal use of solar energy
Hydrogen as energy storage

Photonic Materials



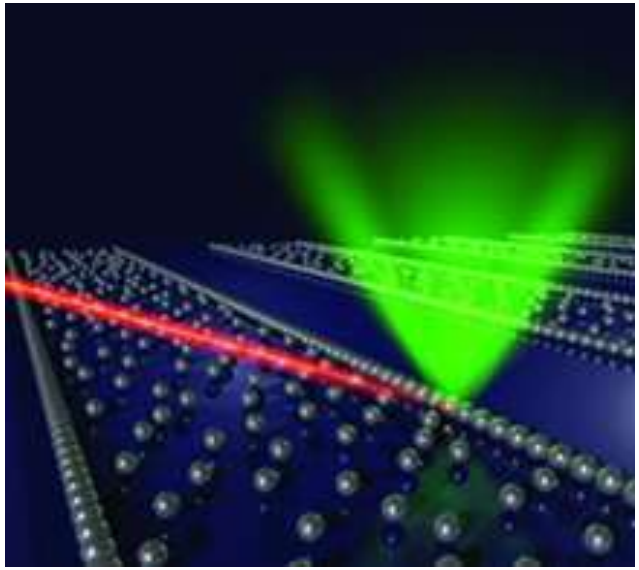
Nonlinear optical materials

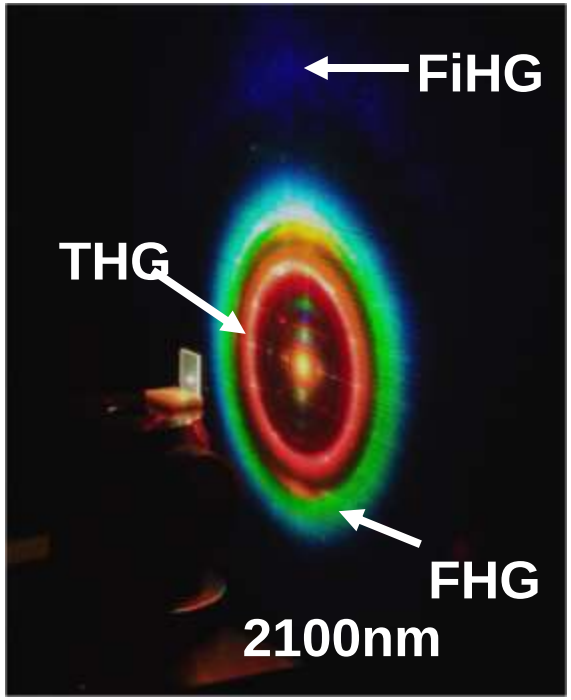
Nanophotonics

Lasers and applications

Principles, optical resonators, types,

applications in nanotechnologies

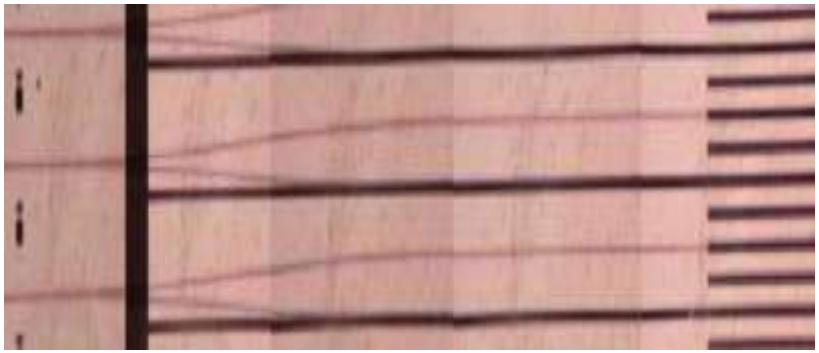




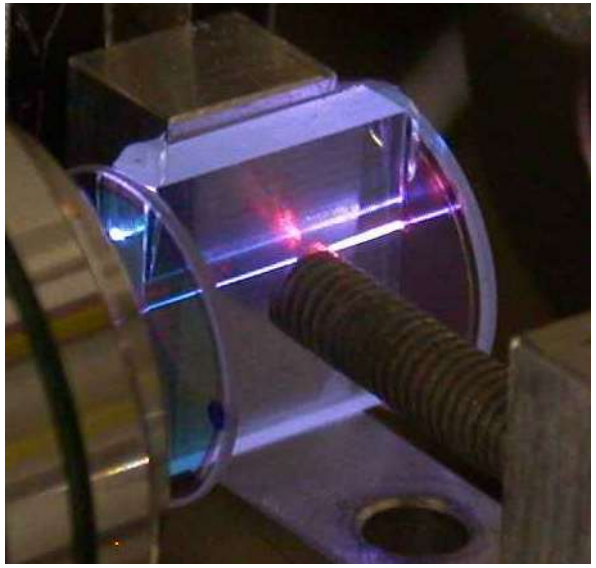
Integrated photonics and optical communications

Optical confinement structures,

circuits and fibers



Electrooptical Modulator



Integrated Laser

Master Thesis (15 ECTS)

Experimental work

In one of the 2 departments

In on-campus Institutes ICMM, ICV, IMDEA

In other institutes

In companies

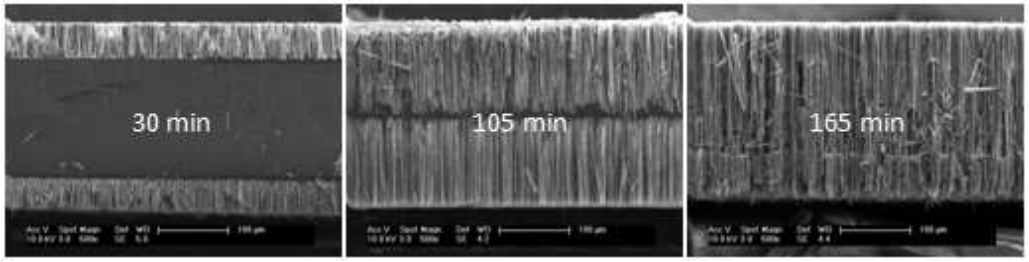
Doctorate Program

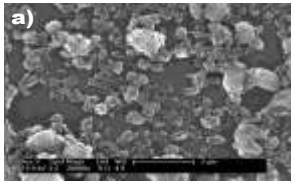
Advanced Materials and Nanotechnology

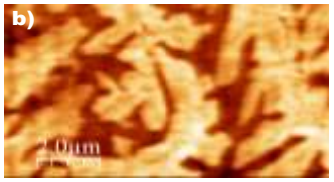
Master Thesis

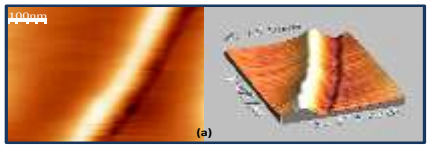
Some examples from the last years

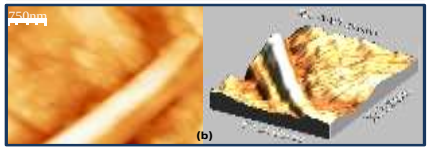
- Silicon and graphene nanowires in lithium-ion battery anodes



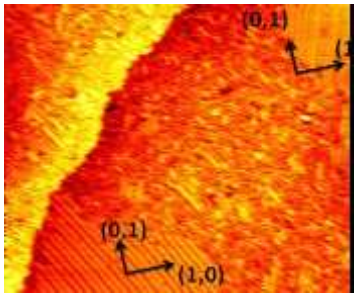


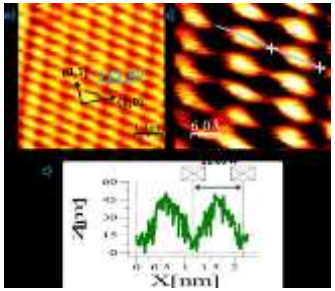




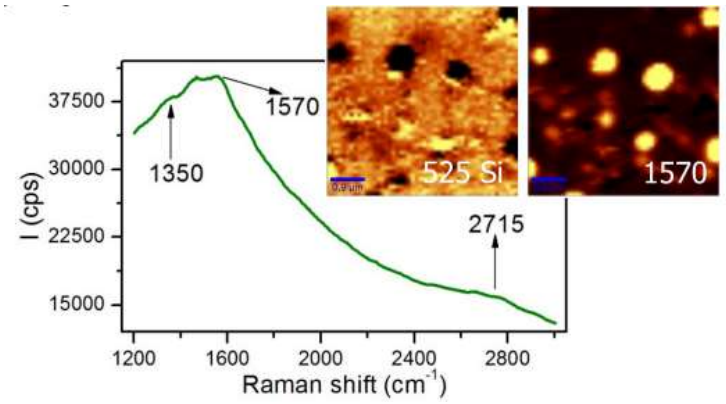


- Polymerization of p-aminophenol on the surface of Cu (110)



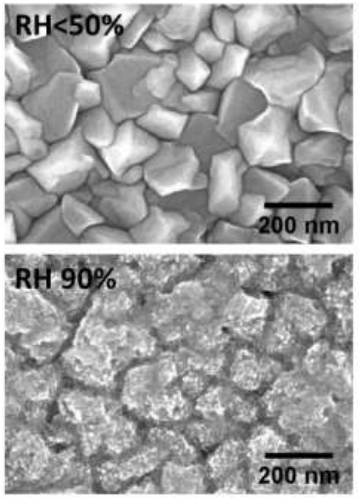


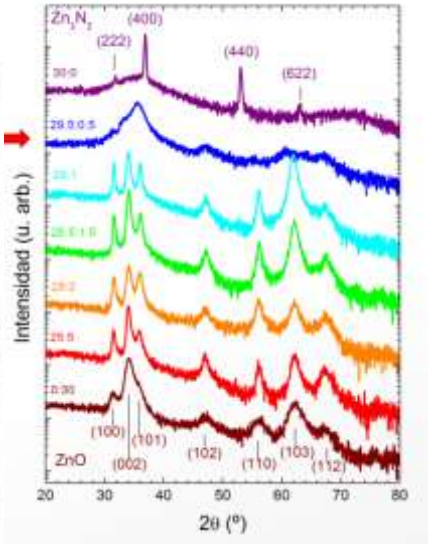
Master Thesis



- Towards growing $B_xC_{1-x}N_x$ monolayers

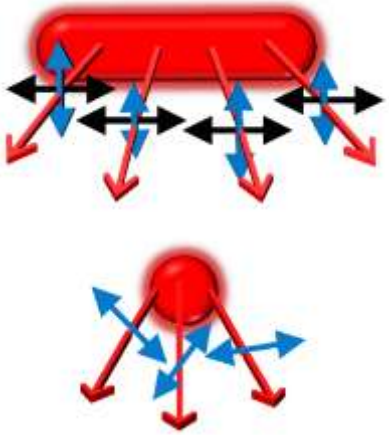
- Optical and electrical transformation of Zn_3N_2 by oxidation in humid environment



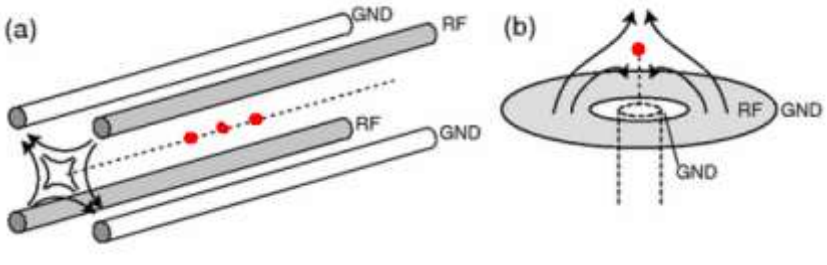


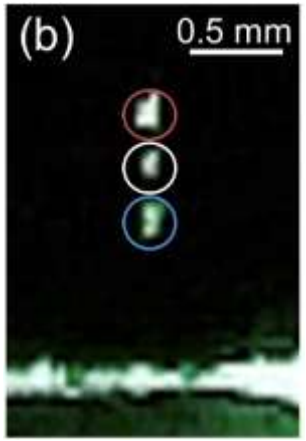
Master Thesis

- Determination of the orientation of optical trapped nanocylinders of $NaYF_4$: Er^{3+}, Yb^{3+} through their polarized emission



Lucía Labrador Páez

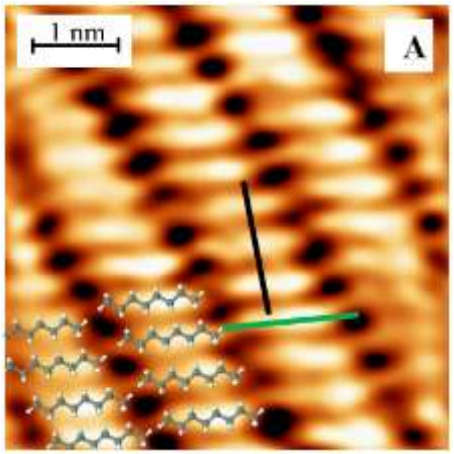




- **Manipulation of a single nanoparticle in a point Paul trap**

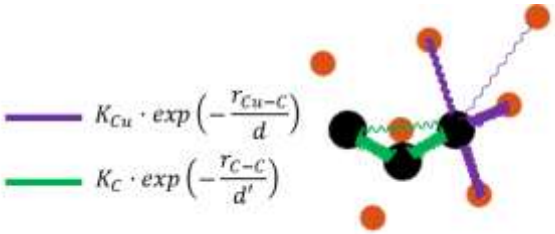
  Irene Alda[1, 2]

Master Thesis



Tilted lamella
(Even number of carbons)

- On-surface fragmentation of tetracosane ($C_{24}H_{50}$) on Cu(111)



Fragmentation model

- Synthesis of magnetic nanoparticles: Review of the obtaining processes and selection of an industrial-scale synthesis route.

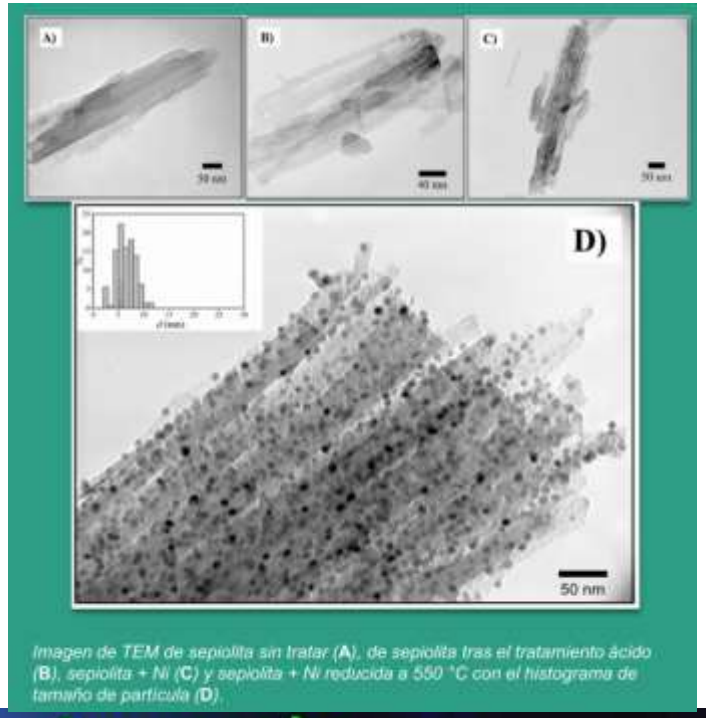
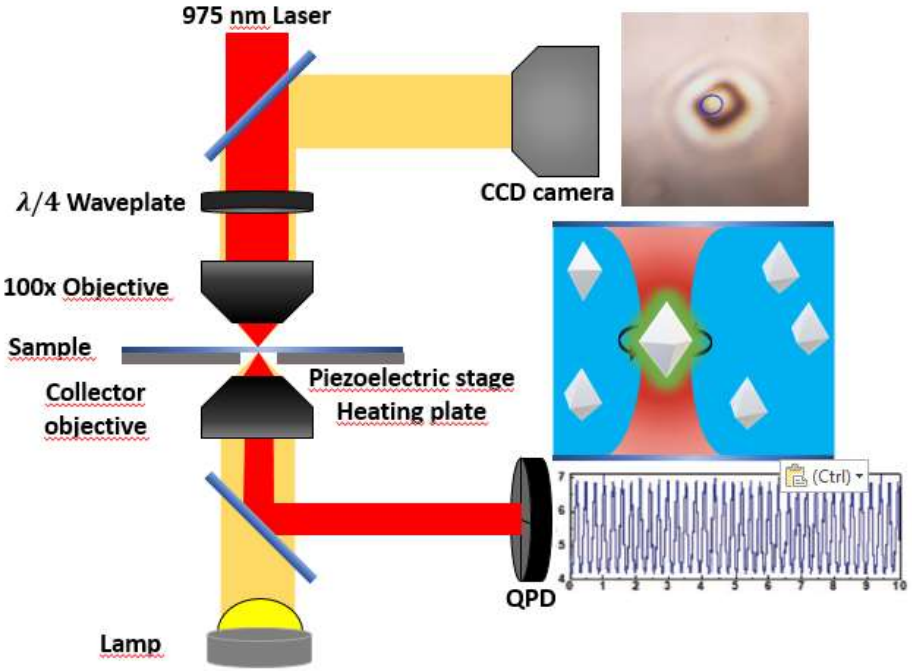
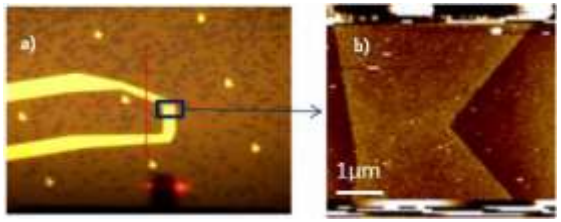


*Imagen de TEM de sepiolita sin tratar (**A**), de sepiolita tras el tratamiento ácido (**B**), sepiolita + Ni (**C**) y sepiolita + Ni reducida a 550 °C con el histograma de tamaño de partícula (**D**).*

Master Thesis

- Spinning $LiYF_4:Er^{3+}/Yb^{3+}$ microparticles for thermometry applications





- Channel reduction of a field-effect transistor by local oxidation nanolithography of a thin layer of MoS_2

Thank you for
your attention

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