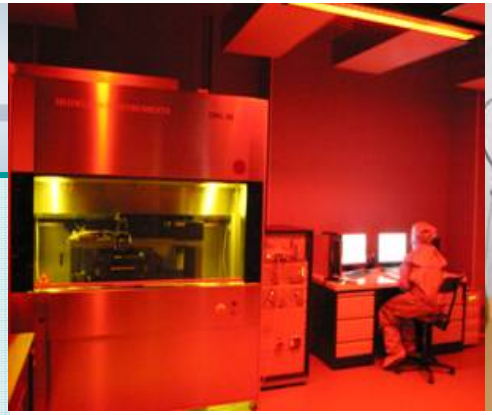

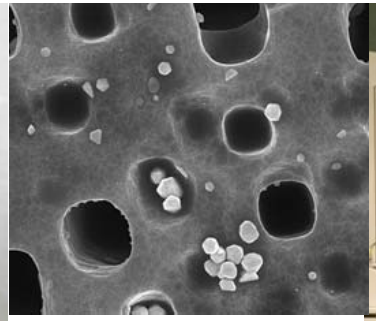

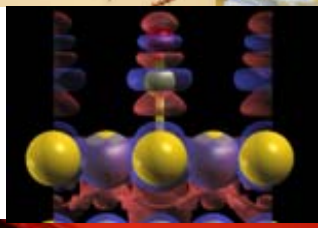


IMT-MINAFAB as a platform of interaction in nanoscience and nanotechnologies

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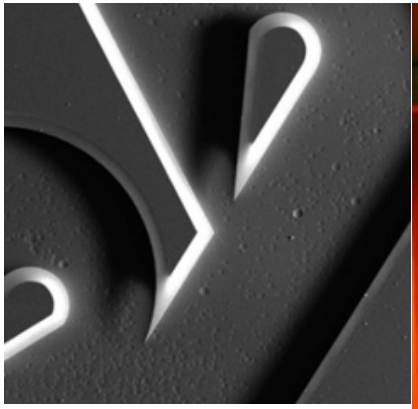
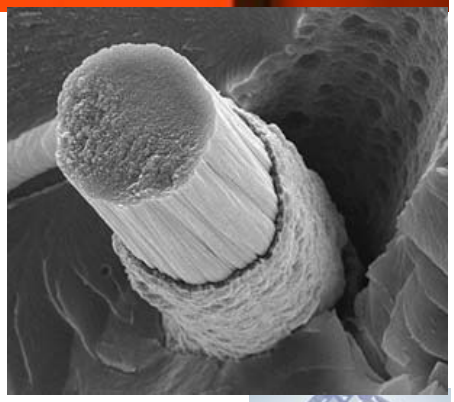
www.imt.ro - www.imt.ro/MINAFAB

10 ani de nanostiinta si nanotehnologie, Bucuresti 2010

Summary



- About IMT-MINAFAB in brief.
- Main facts, main figures.
- Major fields of research.
- Current projects.
- Equipment overview.
- Collaboration and perspectives.



About IMT-MINAFAB, in brief

- State of the art research infrastructure, operating since September 2008.

- Center of services for micro- and nanofabrication and
- Platform of interaction as open-centre for research and education-by-research, focused on multidisciplinary innovation and knowledge transfer to industry.

- Enables highly efficient exploitation of IMT's existing tangible and intangible assets in nano-science/technologies (clean-room facility, advanced equipments, knowledge and experience, partners and clients).

- Complex technological platform: CAD tools, mask shop sector, analysis and characterization, nanobio fabrication, reliability tests.

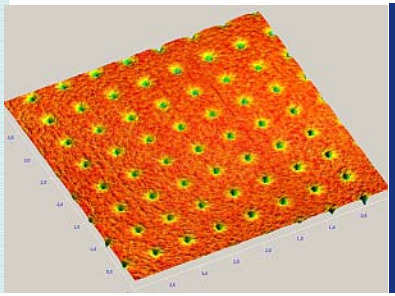
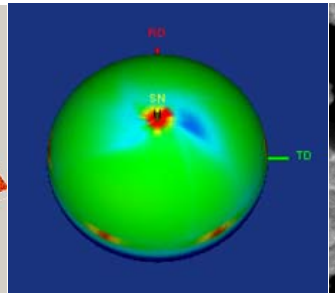
- Access is facilitated in a variety of ways, with notable accent on developing common R&D projects and on offering direct access of innovative companies to nanoscience and nanotechnology expertise and tools.

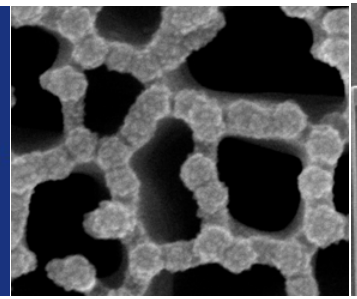
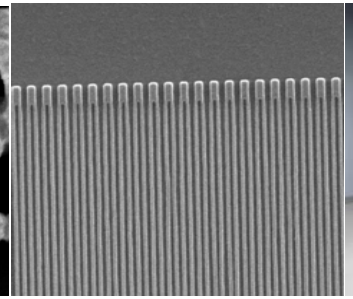
Main facts, main figures [1]

- Class 1000 clean room (220 sqm) for the mask shop and the most demanding technological processes.
- Class 100,000 clean room - so called “grey area” - (200 sqm), mostly for the characterization equipments.
- Class 10,000 clean room (120 sqm) for thin films by CVD techniques, RTP, etc. (to become operational).

- Accumulated total investment in equipments and infrastructure: about 9 M euro (2006-2009: 7 M euro; 2008: 3.5 M, mainly from Capacities projects).

- Large range of services. Main categories:
  - micro/nanofabrication for devices and systems
  - inspection, analysis and characterization of surfaces, films, crystals, nanostructures
  - design, modeling and simulation
  - complex RDI services - from design, to reliability testing


Main facts, main figures [2]

- Over 60 national users as partners in consortia, or based on bilateral agreements: 30 companies, 15 research institutes, 15 universities.
- Over 30 industrial users, as partners in consortia or contracted service users: Austria(1), Finland(1), France(1), Germany(8), Greece(1), Hungary(2), Italy(3), Poland(1), Slovakia(2), Spain(1), Sweden(6), The Netherlands(3), etc.
- Over 30 partners in research - FP6-7, bilateral projects: Belgium(2), Finland(1), France(2), Germany(11), Greece(1), Hungary(1), Italy(2), Ireland(1), Israel(1), Poland(1), Spain(1), The Netherlands(3), UK(1), Singapore(1), etc.
- Master courses and hands-on training for students of Polytechnic University of Bucharest.
- Operation of IMT-MINAFAB conforms with best technical/technological/ management standards (e.g., degree of decontamination, safety of operation




Main facts, main figures [3]

- Accumulated funding based on:
  - three projects for technological networks (2005-2008) - NanoScaleLab and NanoBioLab labs created in this context: nuclei of some current experimental labs .
  - four infrastructure projects (2006-2008) - extension of capabilities.
  - eight infrastructure projects from the “Capacities” programme (2007-2009) - five of them consolidated the “Centre of nanotechnologies”; reconstruction/updating of the premises.
  - MIMOMEMS project of centre of excellence, funded by the EU.
  - Various research projects in national programmes.
  - Individual themes of research in the “core programme”.

- Result:
  - IMT-MINAFAB as an integrated cluster of new experimental laboratories initiated and operated by various research groups. Other equipments that can be used for production (mask shop, wafer processing etc.) are managed by execution personnel, in a dedicated department.

  - Provides the experimental support for a number of interdisciplinary groups, such as:
    - **Centre of Nanotechnology** (CNT-IMT) under the aegis of Romanian Academy.
    - **MIMOMEMS Centre of Excellence** from IMT (RF and Opto MEMS), EC 2008-2011.
    - **LEA (Associated European Laboratory)** “Smart MEMS”, IMT-Bucharest in association with LAAS/CNRS, Toulouse (France) and FORTH, Heraklion (Greece).

  - Infrastructure providing state of the art services in micro-nanotechnology and hands-on education and training.

Major fields of R&D

- Collaborative multidisciplinary research, focusing on convergent micro-nano-bio technologies, based on **structuring and characterization at the nanoscale**.

- Components for nanoelectronics, photonics and microwaves
  - new fabrication technologies in Si, as well as in wide bandgap semiconductors, dielectrics, polymers.
  - CNT/graphene-based nanostructures for nanoelectronics (transistors and chip interconnections).
  - new concepts and structures for optical MEMS and RF-MEMS.

- Advanced nanomaterials and nanostructures for therapies, biosensing, energy and other industries
  - functionalized nanoporous materials, nanocomposite particles, microarrays.
  - nanocomposite and film assemblies for fuel cells and photovoltaics.
  - SAM's, immobilization and combined studies of molecular interactions.
  - microfluidic components and biochips for biosensing and monitoring.
  - functional films and nanocomposites for: neurosensing, constructions.

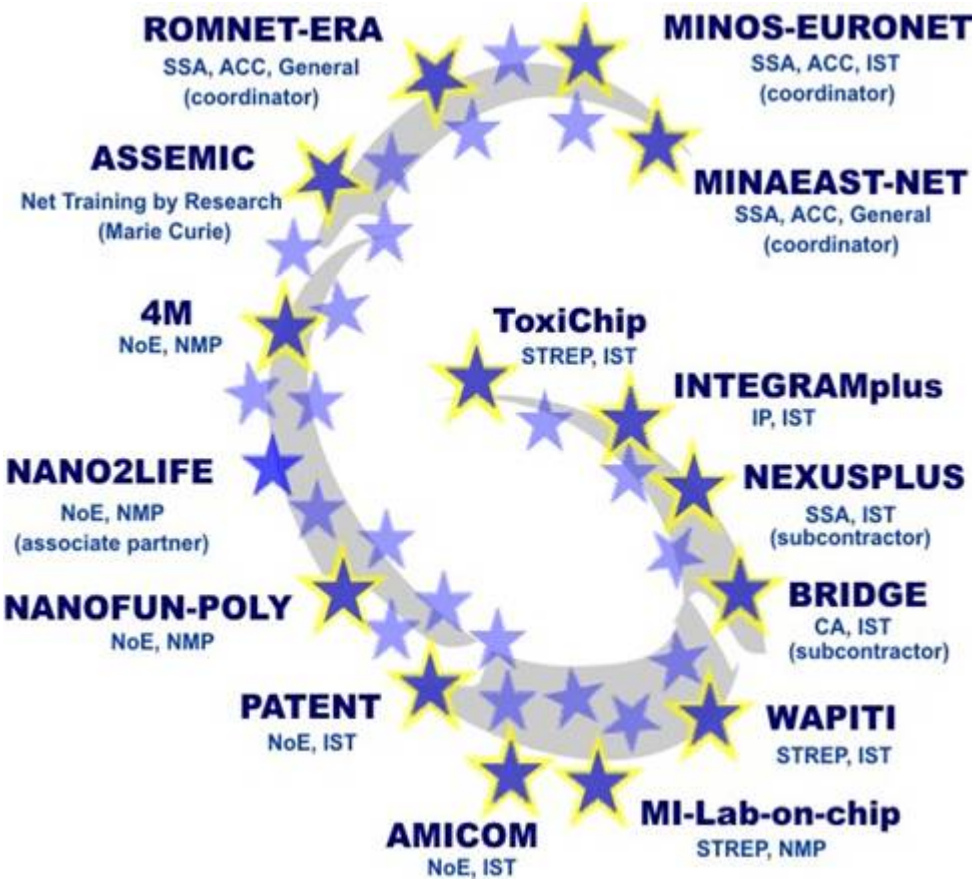
Major fields of R&D

- New technologies for fabrication and characterization
  - nanolithography, mask-free nano-connections, high aspect-ratio nanostructures.
  - silicon nanoelectrodes, functional porous silicon, bio-active materials, field emission nanostructures.
  - soft-lithography and replication.
  - rapid prototyping: dip-pen nanolithography, laser micromachining, 3D and inkjet printing.
  - nanomechanical characterization of materials.

IMT-MINAFAB currently provides a complex technological platform for basic research, application-oriented R&D and even small-scale production.

Current projects [1]

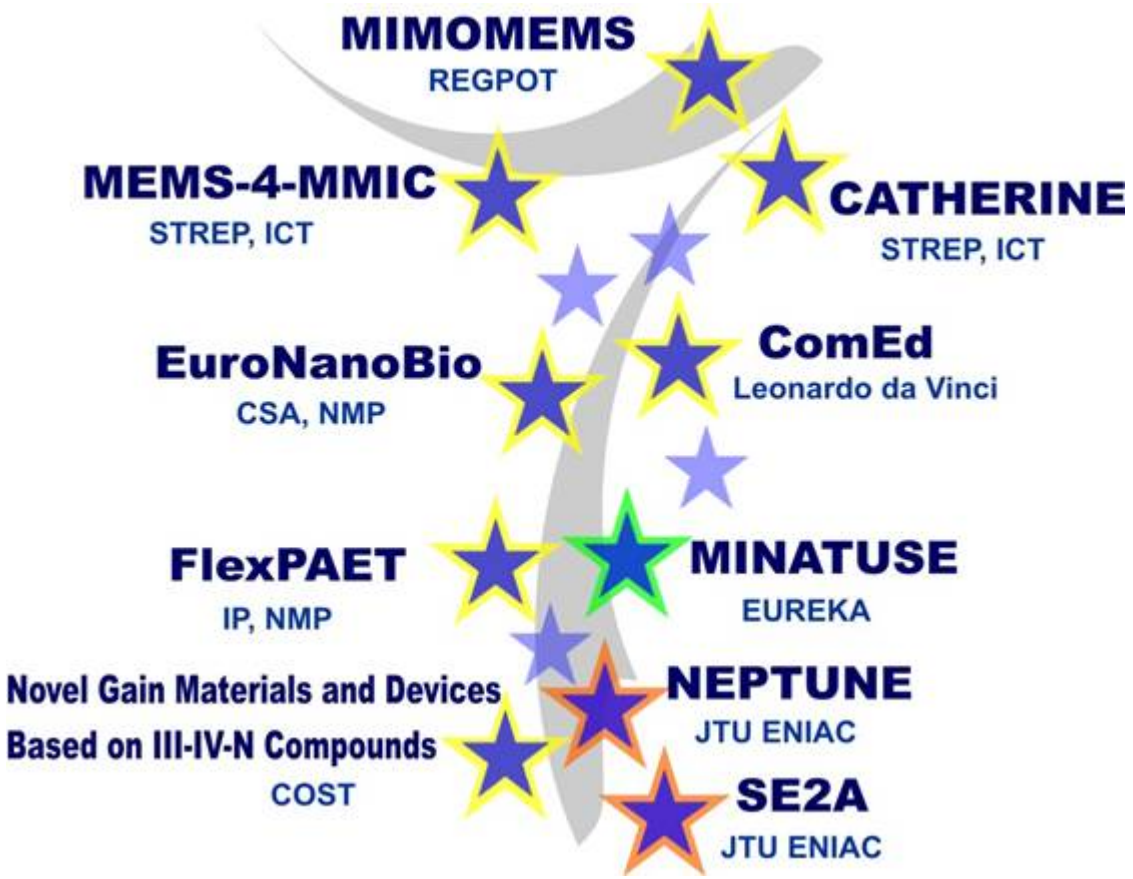
- FP6 projects



IMT was acting as coordinator, partner, associate partner or subcontractor.

Current projects [2]

- FP7 (and related) projects



Current projects [3]

- European Centre of Excellence in Microwave, Millimetre Wave and Optical Devices, based on Micro-Electro-Mechanical Systems for Advanced Communication Systems and Sensors – MIMOMEMS, Contract no. 202897, **REGPOT**, 2008-2011. Coordinator: IMT-Bucharest. Contact: Dr. Alexandru Muller (alexandru.muller@imt.ro).

- Enabling MEMS-MMIC technology for cost-effective multifunctional RF-system integration - MEMS-4-MMIC, Contract no.: 204101, **STREP, ICT**, 2008-2011. Coordinator: IMST GmbH, Germany. Coordinator: Dr. Stephen Trueman, CONSORZIO SAPIENZA INNOVAZIONE, Italy. IMT role: Partner. IMT Contact: Dr. Dan Neculoiu (dan.neculoiu@imt.ro).

- Carbon nAnotube Technology for High-speed nExt-geneRation nano-InterconNEcts - CATHERINE, Contract no. 216215, **STREP, ICT**, 2008-2011. IMT role: Partner. IMT Contact: Adrian Dinescu (adrian.dinescu@imt.ro).

- Flexible Patterning of Complex Micro Structures using Adaptive Embossing Technology – FlexPAET, **IP, NMP**, 2008-2010. Coordinator: Dr.-Ing. Christian Wenzel, Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V. Fraunhofer Institut für Produktionstechnolgie (IPT), Germany. IMT role: Partner. IMT Contact: Dr. Dana Cristea (dana.cristea@imt.ro).

- European scale infrastructure in NanoBiotechnology - EuroNanoBio, **CSA, NMP**, 2009-2010. Coordinator: Prof. Patrick Boisseau CEA, France. IMT role: Partner. IMT contact: Prof. Dan Dascalu (dan.dascalu@imt.ro).

Current projects [4]

- Nanoelectronics for Safe, Fuel Efficient and Environment Friendly Automotive Solution – SE2A; **ENIAC** nanoelectronics - Coord: NXP Semiconductor Netherlands BV, The Netherlands. IMT contact: Dr. Alexandru Muller (alexandru.muller@imt.ro).

- Novel Gain Materials and Devices Based on III-V-N Compounds; **COST** Action - Coord: University of Essex, UK. IMT contact: Dr. Alexandru Muller (alexandru.muller@imt.ro),

- Micro Nano Technology Use by SME's- MINATUSE; **EUREKA** - Coord: IMEC, Belgium. IMT Contact: Ionica Miresteanu (ionica.miresteanu@imt.ro).

- Development of competences of educational staff by integrating operational tasks into measures of vocational training and further education – ComEd; **Leonardo da Vinci** - Coord: BWAW Thüringen GmbH, Germany. IMT Contact: Dr. Raluca Muller (raluca.muller@imt.ro).

- A system-in-a-microfluidic package approach for focused diagnostic DNA microchips – DNASIP; **ERA-NET** - Coord: Université catolique de Louvain, Belgium. IMT contact: Monica Simion (monica.simion@imt.ro).

- Nanostructural carbonaceous films for cold emitters – NANOCAFE; **ERA-NET** - Coord: Industrial Institute of Electronics, Poland. IMT contact: Florea Craciunoiu (florea.craciunoiu@imt.ro).

Bilateral research cooperation with organizations from: Italy, France, Belgium, UK, Japan, Singapore, South-Africa.

Equipment overview [1]

- Main tool categories:
  - lithography – chrome, maskless, nano
  - 4-6” processes – e-beam induced, physical/chemical depositions, thermal...
  - characterization and testing – electron/contact/X-ray/UV/Vis/NIR /chemical/mechanical/electrical/thermal
  - CAD and simulation – coupled analysis, M(O)EMS, RF-MEMS, microfluidics...

Equipment overview

Pattern generator for mask manufacturing
DWL 66 fs
Heidelberg Instruments Mikrotechnik, Germany

Mask manufacturing for all semiconductor applications
Minimum pattern : 1µm

Direct writing - HeCd 442-nm laser - (wafers, different substrate types) using various photosensitive coatings (positive and negative resists, SU8, photosensitive polyimide)

-3D structuring in thick photosensitive materials

Equipment overview

Dip Pen Nanolithography Writer
NSCRIPTOR
NanoInk, Inc., USA

Scanning probe lithography technique for patterning in nanometre range.

Direct writing method that can use molecular and biomolecular “inks” on a variety of substrates: polymers, sol-gel precursors, nanopowder, complex molecules, quantum dots etc.

Pattern width down to **30 nm**.

RIE Plasma Etcher
Etchlab 200
SENTECH Instruments, Germany)

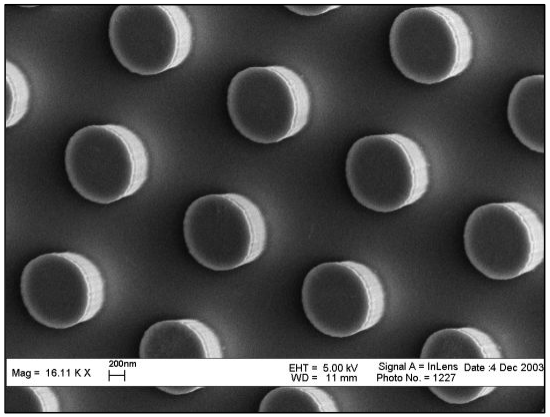
Conventional and non-conventional processes:

- **Etching:** Si, SiC, SiO2, polySi, Si3N4, TiO2, SU8, PDMS, PMMA

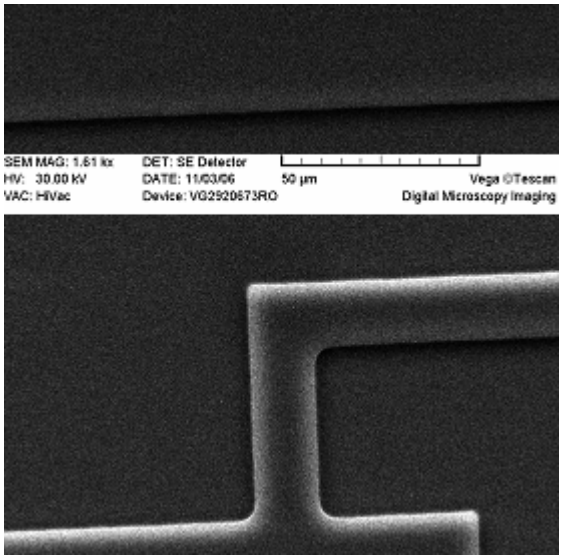
- Physical-chemical reactions at room temperature for the **modification of the surfaces** (contact angle, superficial polymerization, hydrophilic and/or hydrophobic surfaces).

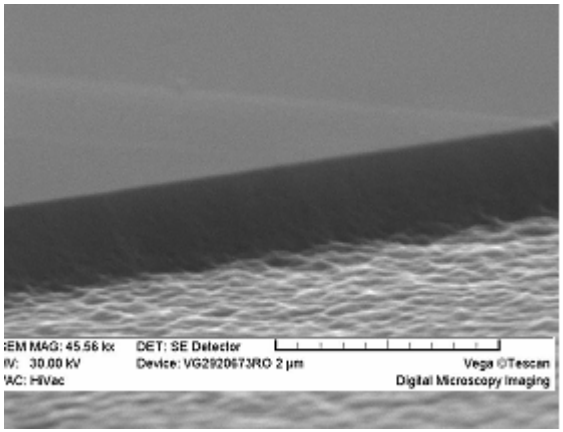
- Plasma RF treatments for **improving the substrate adherence.**

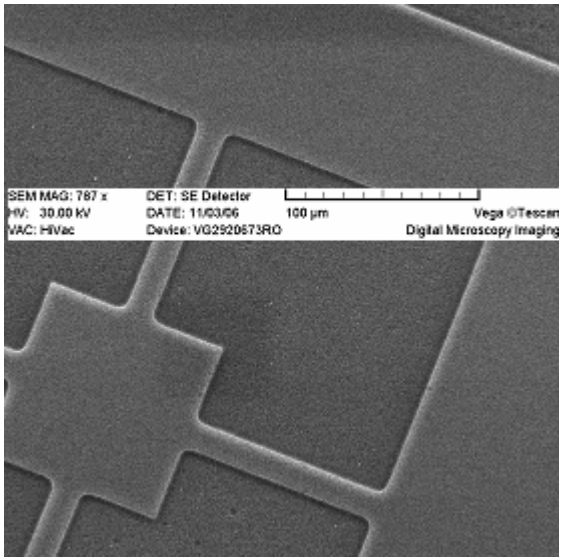
Using RIE in micro- and nanophotonics



III-V quantum dots. The PL and Raman responses confirmed negligible damage during the etching process







Fresnel mirrors obtained by plasma etching of silicon and silicon dioxide

Equipment overview

Electron Beam Evaporation and DC sputtering system
AUTO 500
BOC Edwards, UK

Film deposition processes:
- **DC sputtering**
- **e-beam evaporation**

Chamber size: 500mm x 500mm

Coating materials: Al, Ni, Cr, Au, Pt, Ti, W, etc

Up to 6 coatings in a single vaccum process (4 e-beam, and 2 sputtering)

Resolution: 0.1nm

NanoScale Lab

Electron beam lithography and nanoengineering workstation *e_Line* Raith, Germany

- **high resolution FE SEM**
- **direct writing Electron Beam nanoLithography (EBL)**
- **nanomanipulation: e-beam induced deposition (EBID), e-beam induced etching (EBIE)**

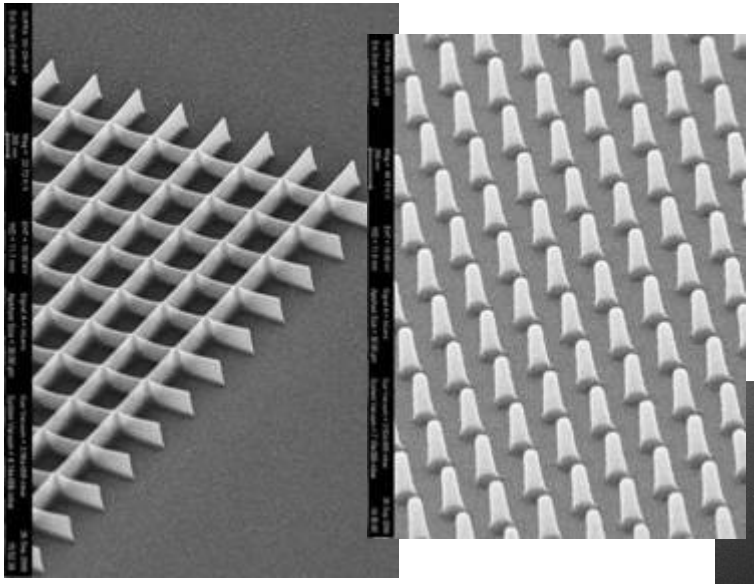
Stage:
laser interferometer;
100mmx100mm;
2nm resolution

Minimum line width:
10-20nm

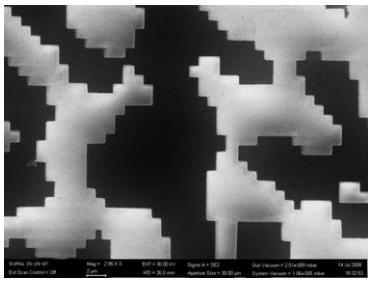
Stitching accuracy:
40nm

NanoScale Lab

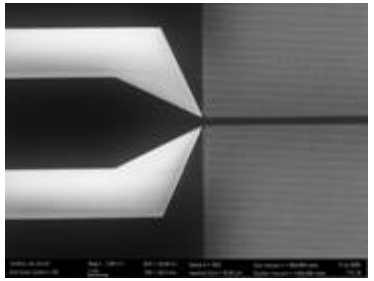
High aspect ratio (12:1) structures in PMMA

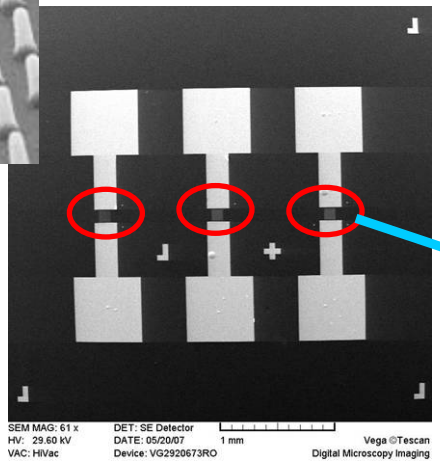


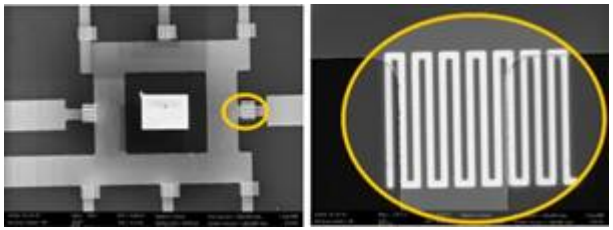
Diffractive Optical Element (DOE) for photonics applications



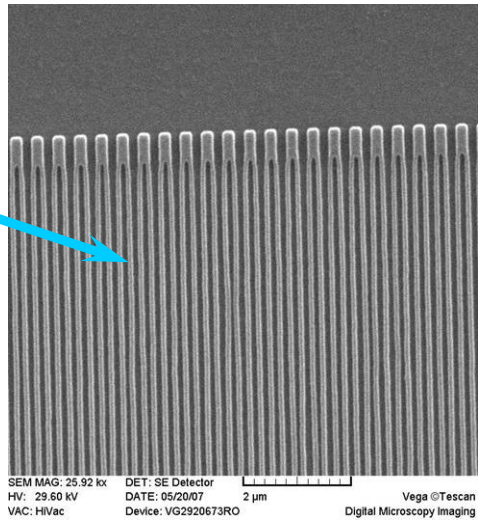
Photonic cristals in PMMA on silicon for near IR applications







Mix-and-match lithography for biomedical applications: optical lithography (left), combined with EBL (right)



Mix-and-match lithography for 300 nm fingers used for SAW devices (Cooperation IMT Bucharest- IESL FORTH)

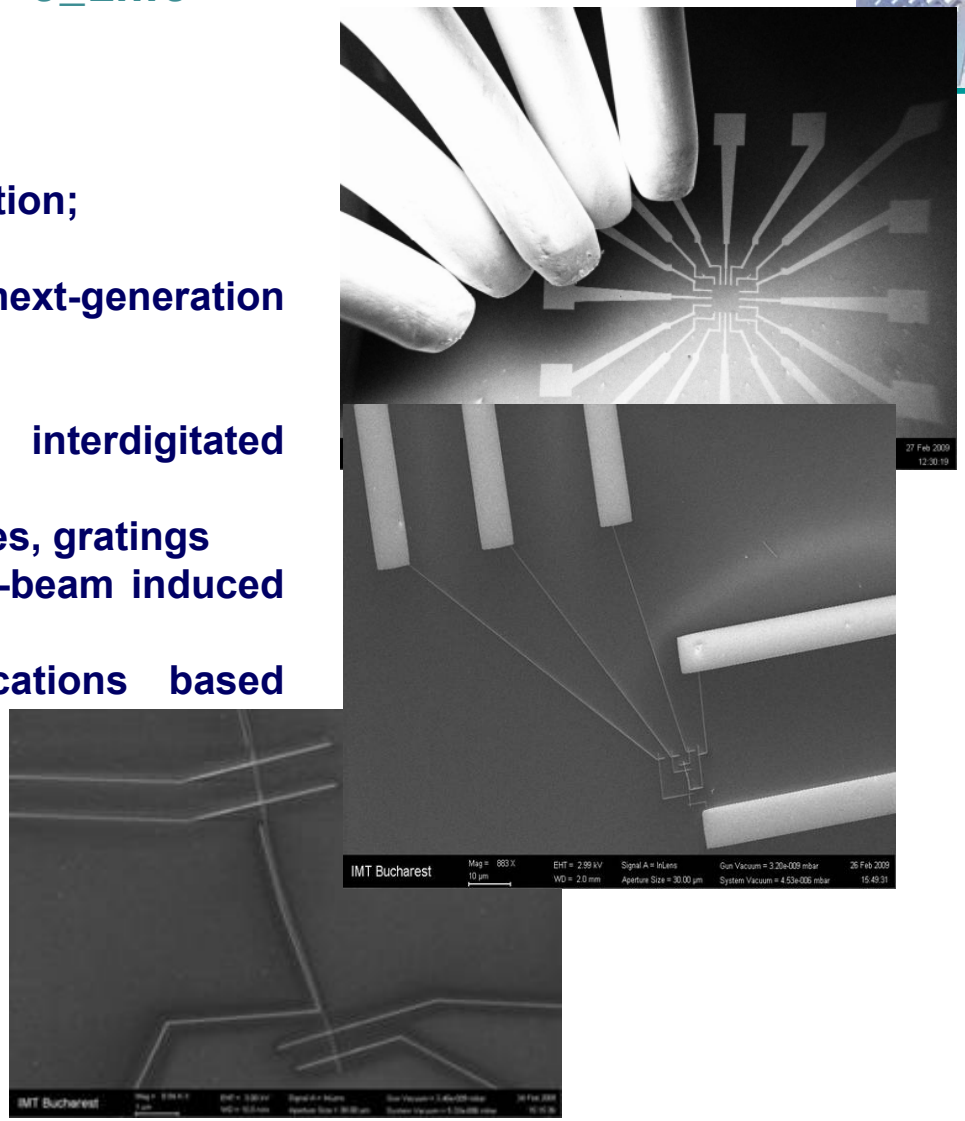
NanoScale Lab

Research Topics

- **Nanolithography with sub 20 nm resolution;**
- **Three-dimensional nanostructures;**
- **CNT based interconnections for next-generation integrated circuits**
- **CNT based nanodevices**
- **SAW devices with nanometer interdigitated electrodes;**
- **Optical devices, holograms, micro lenses, gratings**
- **Development of Nanodevices using E-beam induced deposition and etching**
- **Development of circuits for communications based on photonic crystals**

Cooperation

- **FP7 CATHERINE Project FET- STREP:** Carbon nAnotube Technology for High-speed nExt-geneRation nano-InterconNEcts
- **INFN- Roma**
- **MIMOMEMS**
- **UCL**
- **Inst. Biodinamica**
- **INCDFLPR**
- **Zoom - Soft SRL**



Structure obtained using conventional lithography and EBID for 4-probe measurements of electrical properties of a polymer nanowire
(Cooperation **IMT Bucharest – UCL**)

NanoScale Lab

Field Emission Gun Scanning Electron Microscope (FEG-SEM)
Nova NanoSEM 630
FEI Company, USA

- ultra high resolution in the nanoscale range, for a variety of applications that involve sample characterization, analysis for S/TEM sample preparation

Research

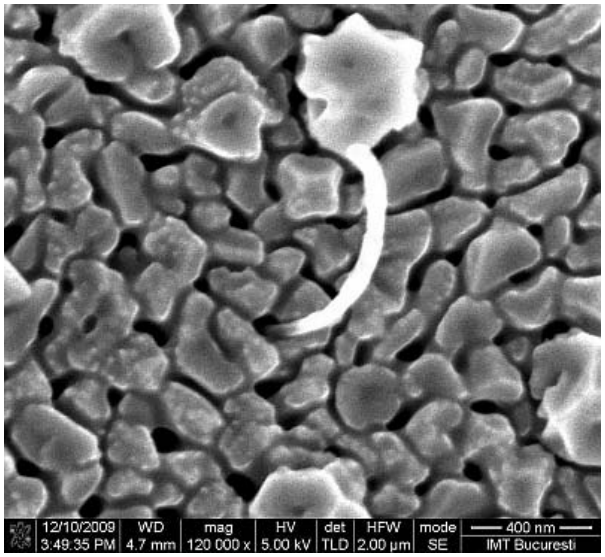
- Materials Qualification
- Surface morphology inspection
- Nanometrology
- Device Characterization

Main current cooperation

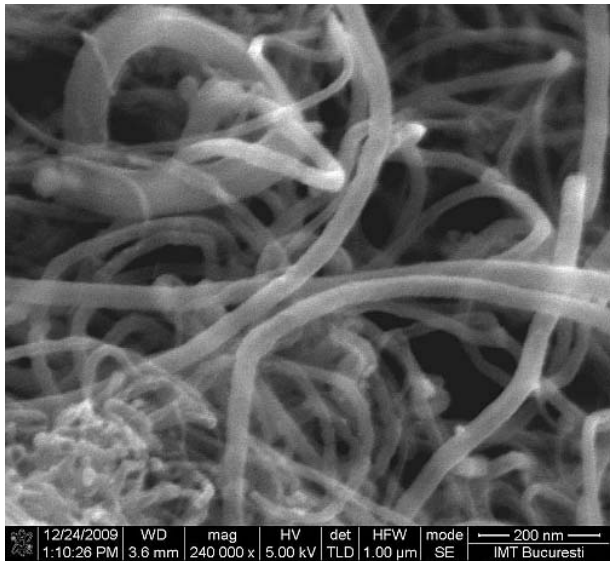
- *INFN Rome*
- *FORTH Heraklion*
- *Univ. Salerno*
- *Univ. Kyoto*

NanoScale Lab

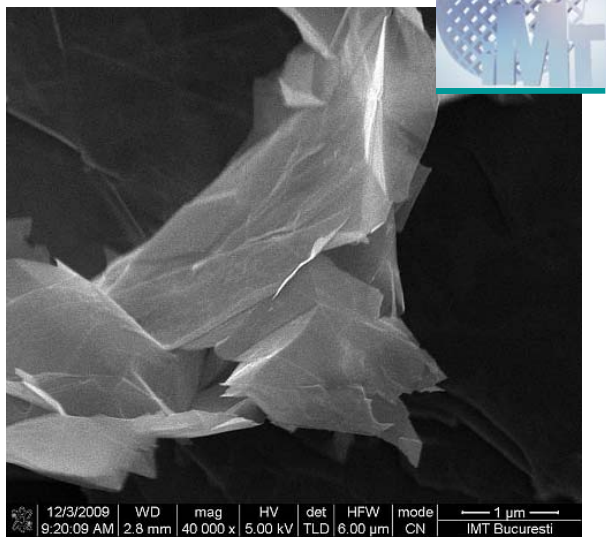
Nova NanoSEM 630



Carbon nanotube grown in porous Al2O3
(IMT Bucharest for **FP7 CATHERINE**)



CNT "buckypaper"
(IMT Bucharest for **national project**)



CNT "buckypaper"
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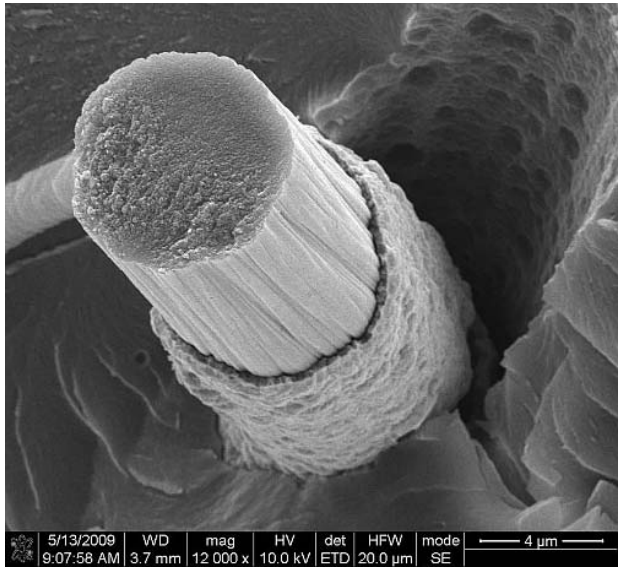
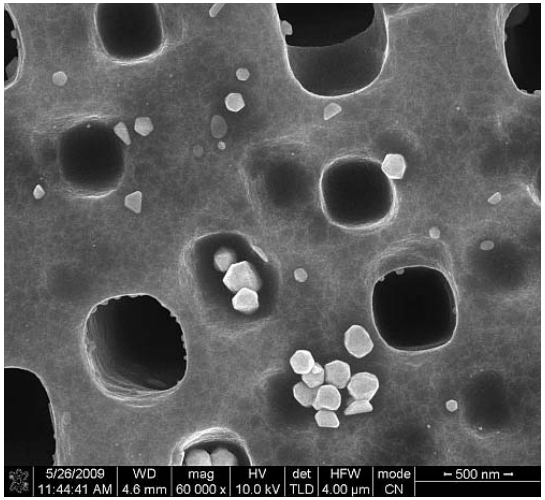
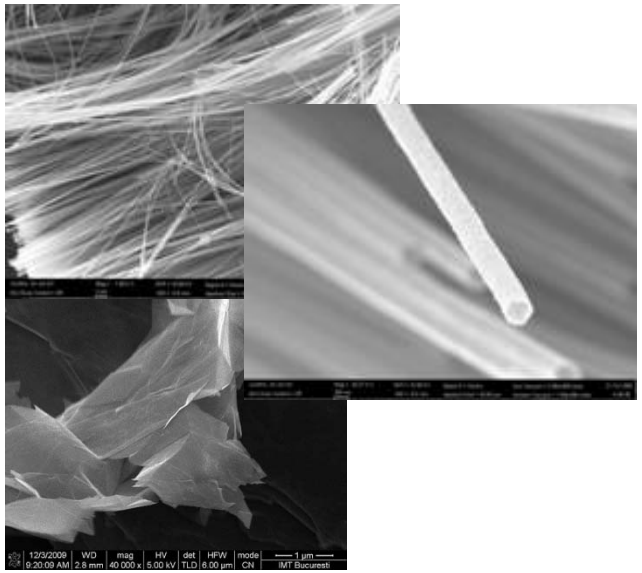


Nanofiber bundle coated with Ni, embedded in polymer susbtrate - applications in aeronatics (radar screening) - sample from INFN Rome



Au nanoparticle clusters on porous Si
(**national project**, biosensing)



CNT's and graphene

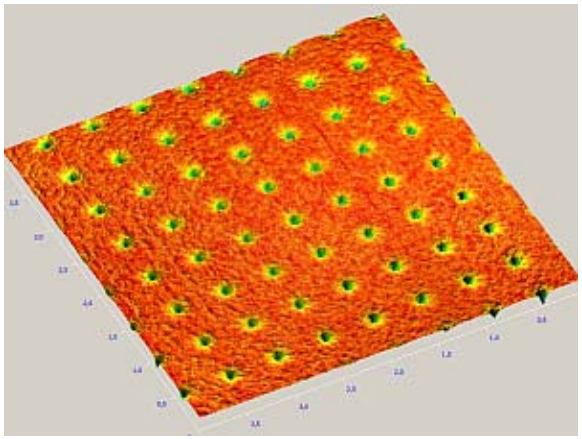
NanoScale Lab

Scanning Probe Microscope
NTEGRA Aura
NT-MDT Co., Russia

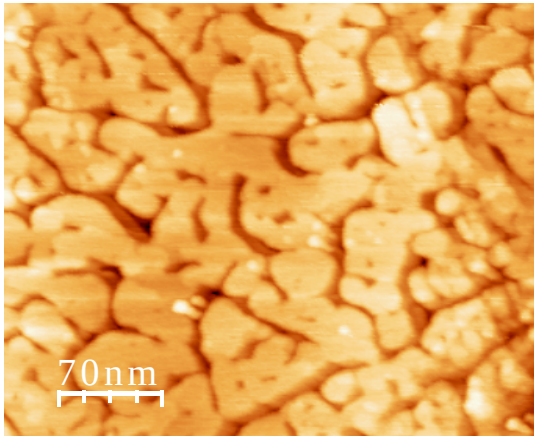
- **AFM - dry**
- **AFM - wet cell**
- **STM**
- **LFM**
- **etc.**

Research

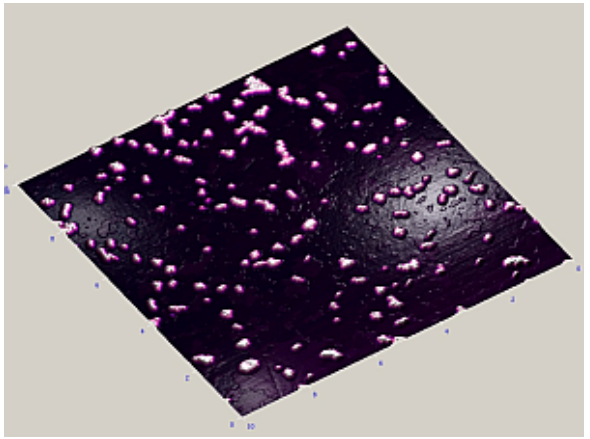
- Surface morphology inspection
- Quantitative measurement of surface features at nanometric level
- Nano-surface texture/ roughness measurement
- High-resolution surface profilometry
- Evaluation and optimization of thin film coatings for various applications (optical, packaging, paintings, wear-resistant etc)
- Grain and particle size analysis
- Surface cleaning and polishing studies
- Morphological studies of biological and biocompatible materials



AFM: EBL 80nm pits



STM: Terrraces of template stripped gold



AFM: Latex nanoparticles on quartz

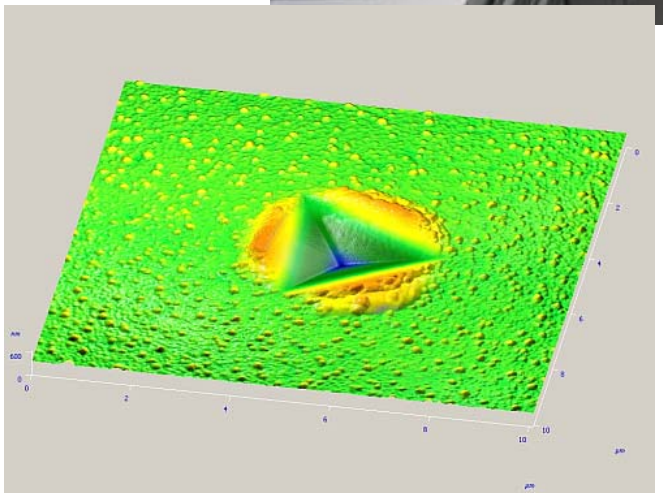
NanoScale Lab

Nanomechanical Characterization equipment
Nano Indenter G200
Agilent Technologies, USA

Research

•High resolution *mechanical characterization* of a wide variety of materials in small volumes, thin films and coatings:
-metals,
-semiconductors
-ceramics
-biocompatible material.

•Determine:
-hardness,
-film adherence
-wear behaviour, etc.



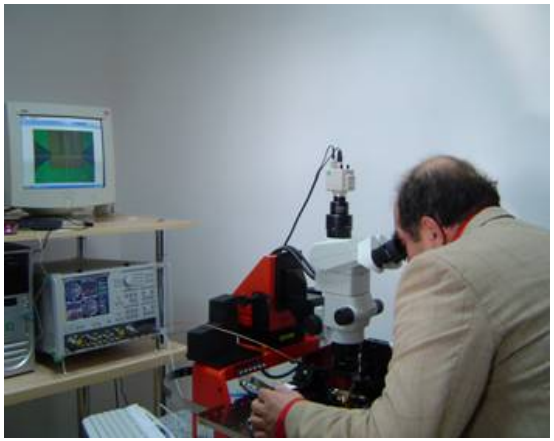
Al indentation study

MIMOMEMS labs

MIMOMEMS

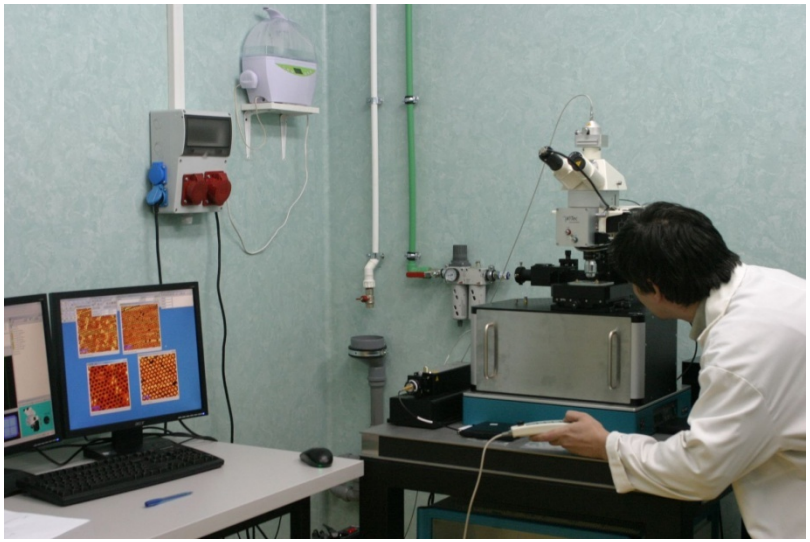
Equipments acquired in the MIMOMEMS project

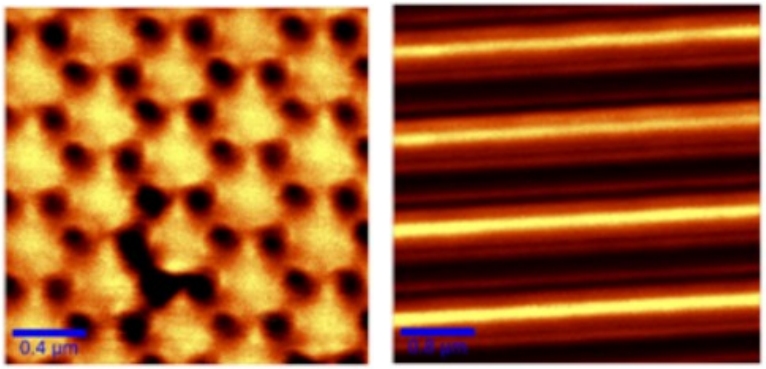
- **Vector Network Analyzer (VNA) up to 110 GHz** and **on wafer measurement facilities in order to upgrade the 0.8-65 GHz existing on wafer characterization system**
- **Frequency synthesiser up to 65GHz**
- **Au plating facility for semiconductor wafers**
- **White light interferometer- optical profiling system for research applications**
- **Near field scanning optical microscope (SNOM)**



MIMOMEMS labs

Scanning Near-field Optical Microscope
alpha 300S
Witec, Germany





Nanostructure characterization by near field scanning optical microscopy: a) transmission mode image of a hexagonal array of aluminium regions deposited on a glass substrate (Fisher pattern). b) reflection mode image of an array of polymer stripes realized by electron beam lithography.

Operating Modes:

***Near-field microscopy*: transmission, reflection, collection, fluorescence**

***Confocal microscopy*: transmission, reflection, fluorescence, can be upgraded with a Raman spectrometer**

***Atomic Force Microscopy* contact and AC-Mode**

Applications:

- Imaging the optical properties of a sample with resolution *below the diffraction limit* with applications in nanotechnology, nanophotonics, nanooptics and plasmonics
- Life sciences
- Materials research
- Single molecule detection.

Cooperation examples:

- MIMOMEMS-REGPOT-FP7
- FLEXPAET-IP- FP7/NMP

XRD lab

X-ray Diffraction System (triple axis rotating anode)
SmartLab
Rigaku Corporation, Japan

Technical characteristics:

- 9kW rotating anode, 200mm wafer
- Triple axis, vertical goniometer
- Independent Theta - Theta rotation
- Horizontal sample position; X-Y Micro Area Mapping

X- Ray methods and applications for structural Analysis:

X-ray Powder diffraction (XRPD)

High resolution X-ray diffraction (HRXRD) - phase analysis, crystal orientation, thermal stability

X-ray reflectometry (XRR, including HRMR XRR) - layer thickness, density, roughness, interface layers;

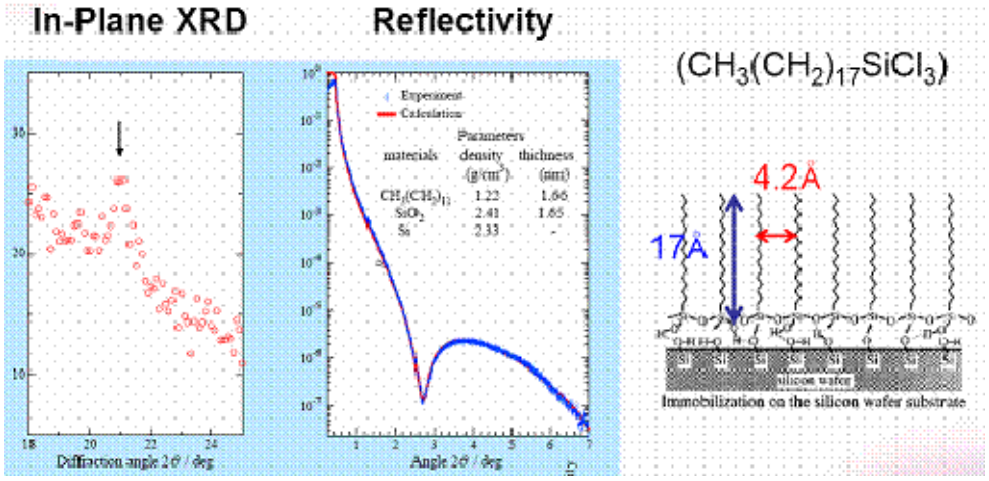
Grazing incidence diffraction (GIXRD) - texture analysis and pole figures

In-plane grazing incidence diffraction (IPGID)

Small angle X-ray scattering (SAXS)

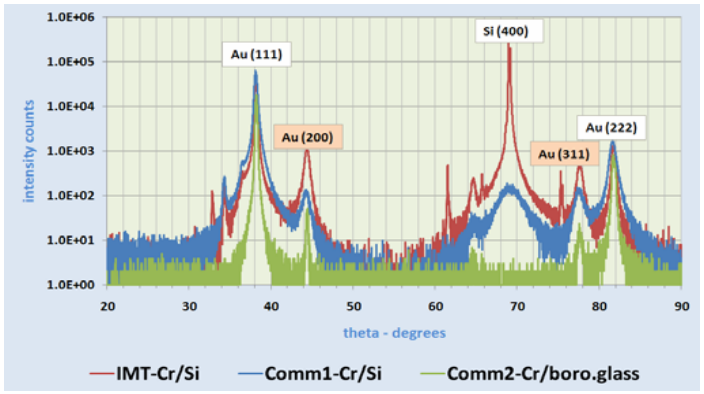
Single crystal diffraction (SCD)

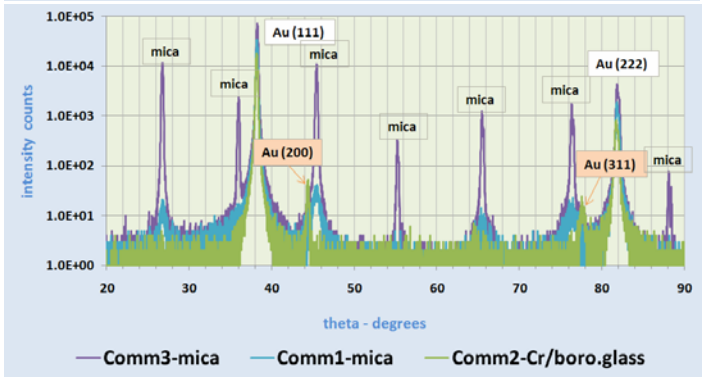
Investigation of the $CH_3(CH_2)_{17}SiCl_3$ organic film_monolayer

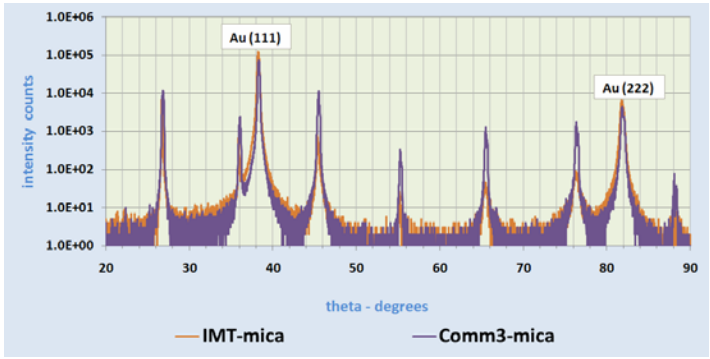


XRD lab

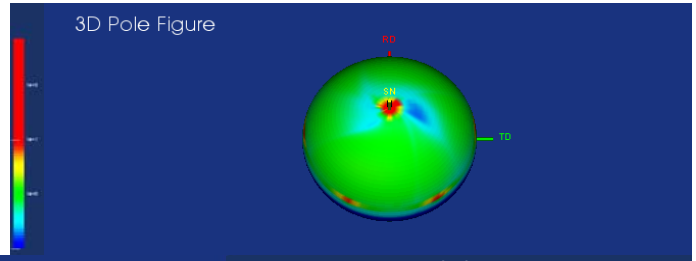
SmartLab

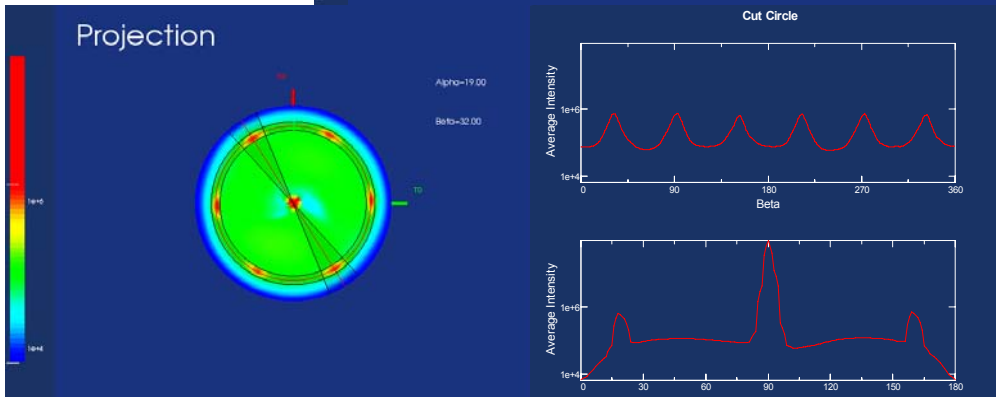






Investigation of IMT-optimized Au 111 deposition



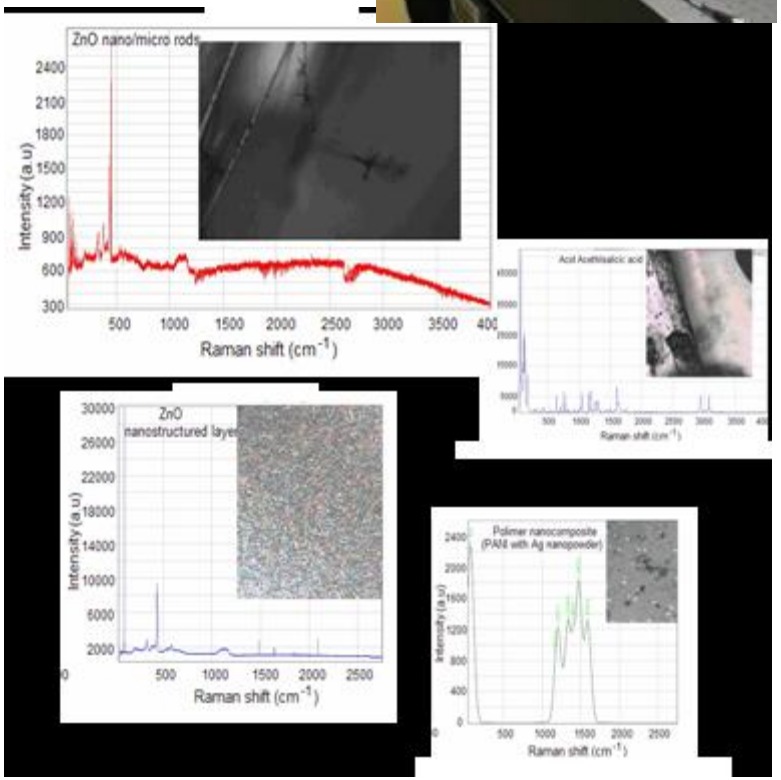


RAMAN lab

High Resolution Raman Spectrometer
LabRAM HR 800
HORIBA Jobin Yvon, Japan

μ- Raman investigations of micro/nano structures

- composition and phase (crystalline/amorphous) of composites materials;
- nature of oxides on compound semiconductors;
- polymers characterizations and polimer nanocomposites;
- chemical and biological detection using SERS technique;
- micro/nano structures characterization - micro/nanorods, carbon nanotubes (CNT), self
- self assembled molecule (SAM) on functionalized substrate for nano- bio applications



Nanobiotechnology laboratory: NanoBioLab

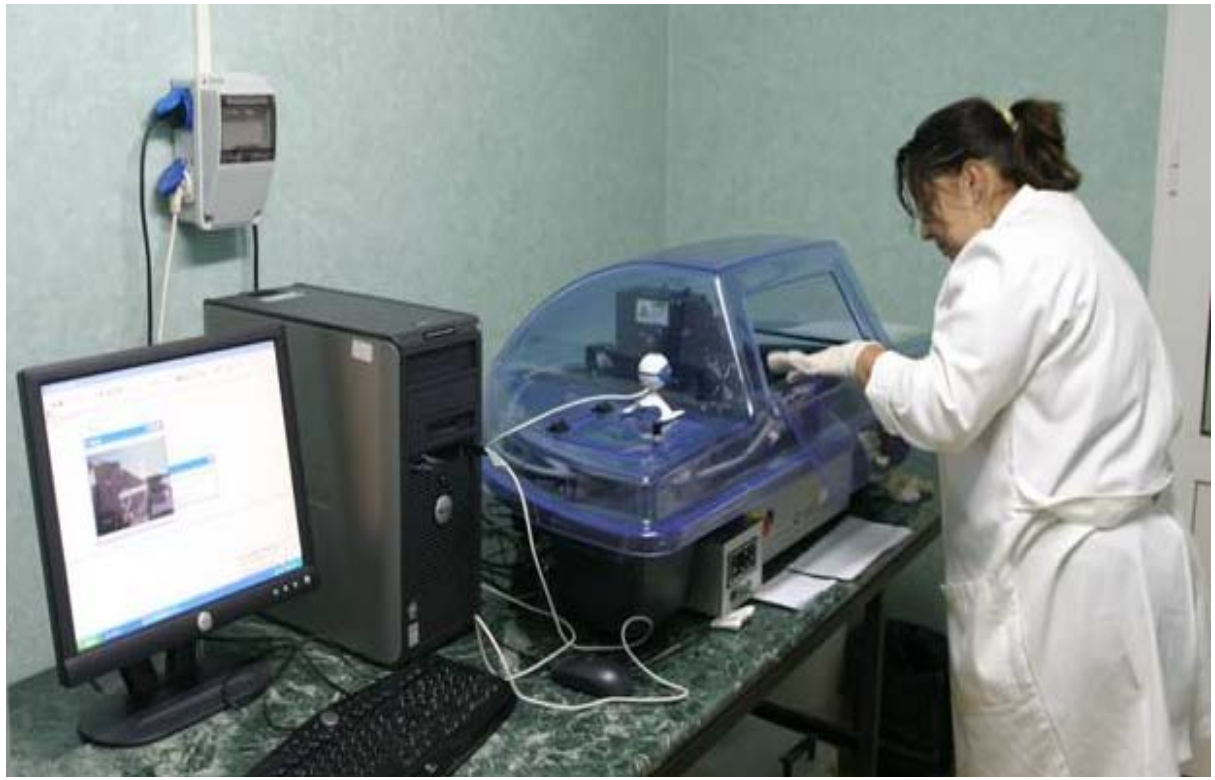
NanoBioLab

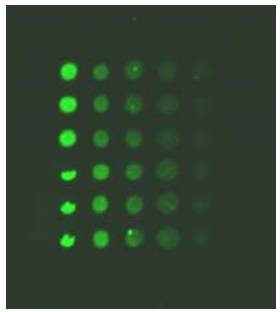
Micro-Nano Plotter
OmniGrid
Genomic Solutions Ltd., UK

Dip and spot a given volume of sample solution onto a solid surface

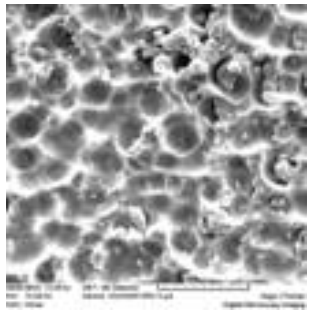
Print speed:
10,000 spots/11 slides in less than 3.5 hr

Vacuum wash station for washing between sample transfers; humidity control minimizes sample evaporation





Microarray sample



Au/PS samples after BSA printing - SEM

Cooperation example:

- DNASIP-ERA-NET- focused diagnostic DNA chips

NanoBioLab

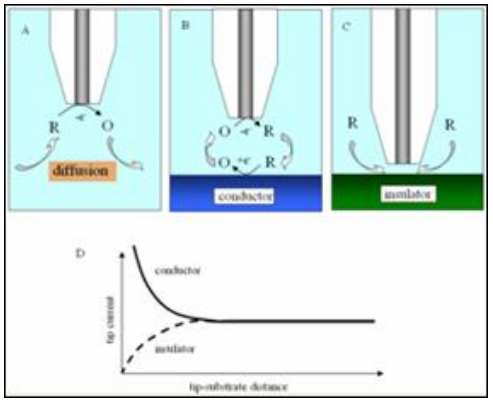
Scanning Electrochemical Microscope
ElProScan
HEKA, Germany

• Positioning system with 3 stepper motors (XY - 100 nm or 15 nm stepper motors) and a piezo translator (5 nm resolution and 100 mm scan range, closed loop regulated) mounted on a granite portal including fundamental plate

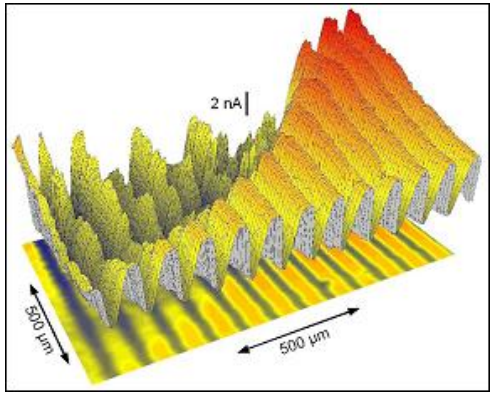
• Bipotentiostat/Galvanostat PG 340 with two low current Preamplifiers

• Software POTPULSE with SCAN extension

Principle of detection



Directly measuring of the catalytic activity of biosensor microelectrode arrays

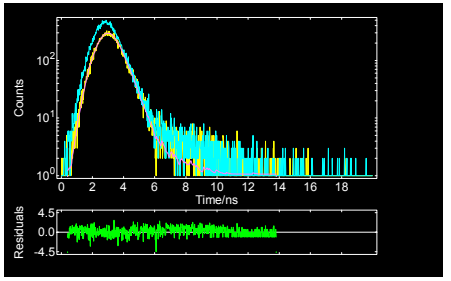


Applications:

- *Constant - distance Nano-SECM → Substrate imaging (Topography);*
- *Temperature-Controlled SECM;*
- *SECM for local corrosion investigation;*
- *Chemical reactivity → Heterogeneous electron transfer reactions studies; Electrocatalysis*
- *Probing patterned biological systems*
- *Bio SECM - Membrane transport*

NanoBioLab

Combined Time Resolved and Steady State Fluorescence Spectrometer - *FLS920P* - Edinburgh Instruments, UK



Fluorescence decay of BSA-Cy3

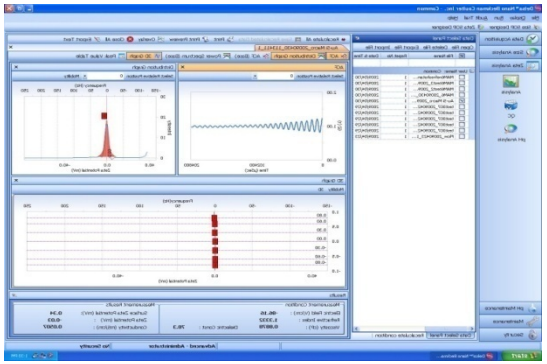
Applications: photophysics, photochemistry, biophysics and semiconductor.

Biomedical field: study of enzymes, dynamics and structure of nucleic acids, protein folding and DNA sequencing.

Pharmaceutical : monitoring drug interactions**.**

Materials physics: study nanostructures such as quantum wells and quantum dots; characterisation of doping or impurity level in semiconductors.

Zeta Potential and Submicron Particle Size Analyzer - *DelsaNano* - Beckman Coulter, USA



Applications

- **Formulation / tableting**
- **Final QC**
- **Formulation stability**
- **Research**
  - **Virus, bacteria**
  - **protein applications (aggregation)**
  - **bio-nanoparticles**
  - **Lyposomes, lipids, polysaccharides**
  - **Colloid drug carrier systems**
  - **Parenteral and oral drugs**
  - **micelles**
- **Zeta potential of tablet surface**

Reliability lab

Testing for reliability

- **Semiconductor Characterization System (DC) with Wafer Probing Station - *4200SCS/C/-***
  - various modules- (Keithley Instruments, USA)
- **Mobile Thermal Airstream System - *ThermoStream TP04300A-8C3-11*** (Temptronic, USA)
- **Damp heat Climatic chamber** (Angelantoni, Italy)
- **Electrodynamic vibration system with thermal and electrical tests - *TV 55240/LS*** (TIRA, Germany)
- **Thermal shock chamber - *TSE-11-A*** (Espec Europe, Germany)
- **Universal Ovens with electrical testing - *UFB 400*** (Memmert, Germany)
- **Highly Accelerated Stress Test Chamber - temperature, humidity, pressure, polarization - *EHS-211M*** (Espec Europe, Germany)
- **Free Fall Shock Machine - *0707-20*** (MRAD, USA)

CAD/CAE/Multiphysics

Simulation, Modeling, CAD / CAE, Multiphyiscs

Coupled analysis for MEMS

CoventorWare 2008.010 (COVENTOR, USA)

ARCHITECT, DESIGNER, ANALYZER, MemElectro, MemMech, CoSolveEM, MemETherm, MemPZR, MemPZE, Damping MM, InertiaMM, MemHenry, MemCFD, Netflow, SwitchSim, ReactSim, MemFSI, BubbleSim, DropSim, SEMulator3D, EM3D

Ansys Multiphysics 11.0 (ANSYS, USA) - structural, thermal, acoustic, electromagnetic and coupled field analyses, CFD

COMSOL Multiphysics

Photonic components - simulation, modeling and design

Opti FDTD 8.1, Opti-HS, OptiBPM 9.0, OptiGrating (Optiwave, Canada)

Microwave and millimeter wave circuits and microsystems: design and modeling

IE3D, FIDELITY (Zeland, USA)

Quantum physics/chemistry : electronic structure calculations and *ab initio* molecular dynamics simulations of molecules and solids

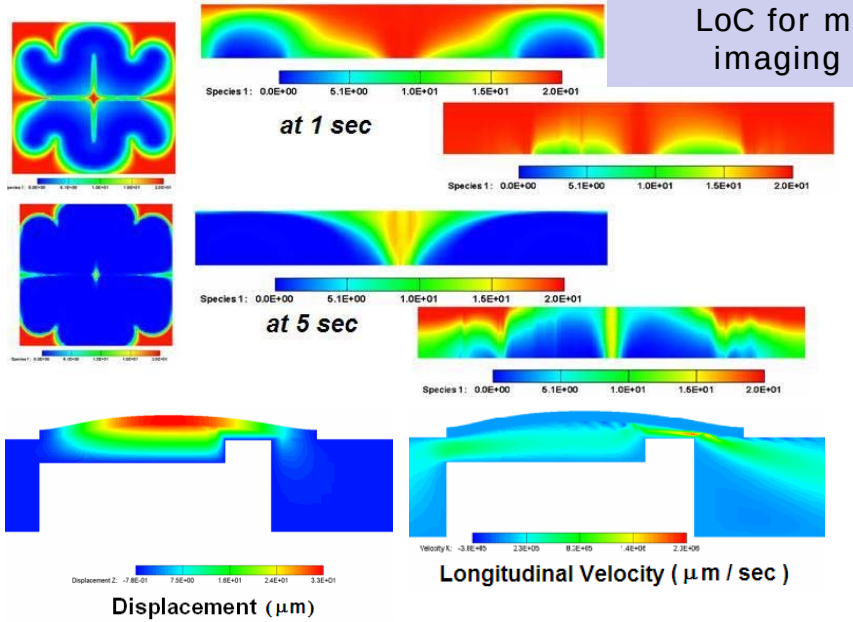
SIESTA (ICMAB-SIESTA)

Other tools

TransMagic STANDARD (TWeatherford, USA)
SolidWorks Office Professional (SolidWorks, USA)- 3D CAD design software
Mathematica 7 (Wolfram, USA)
Matlab 7 (The MathWorks, USA)
OriginPro 8 (OriginLab, USA)
Visual Studio 2008 Pro Programming tool for RAD and IDE.

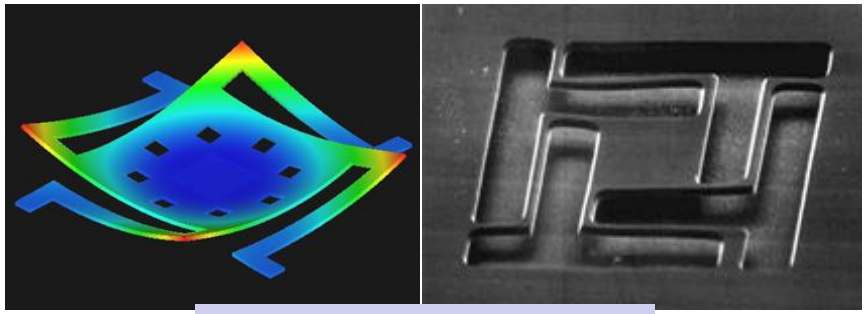
CAD/CAE/Multiphysics

LoC for molecular imaging agents

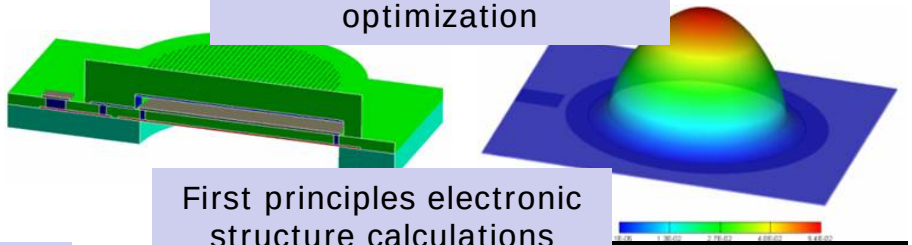


MI-Lab-on-Chip - FP6 STREP/NMP

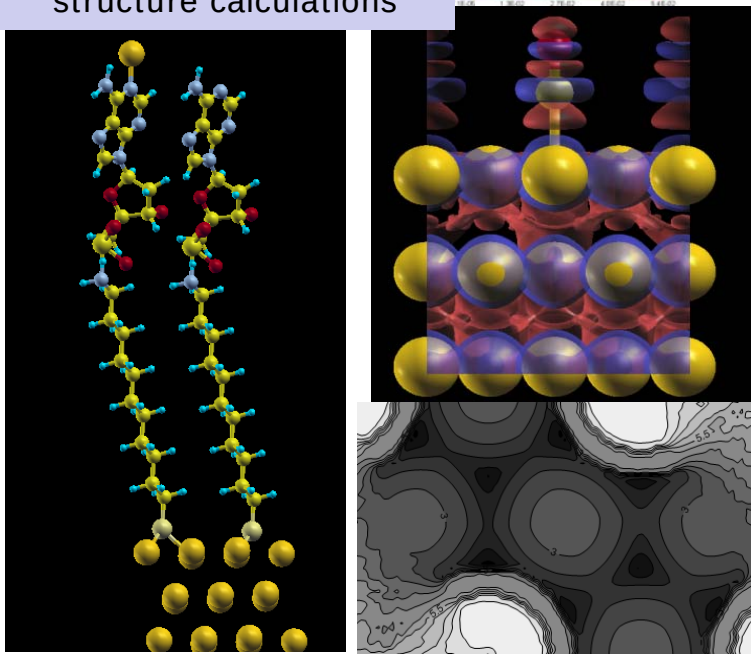
Si microreflector optimization



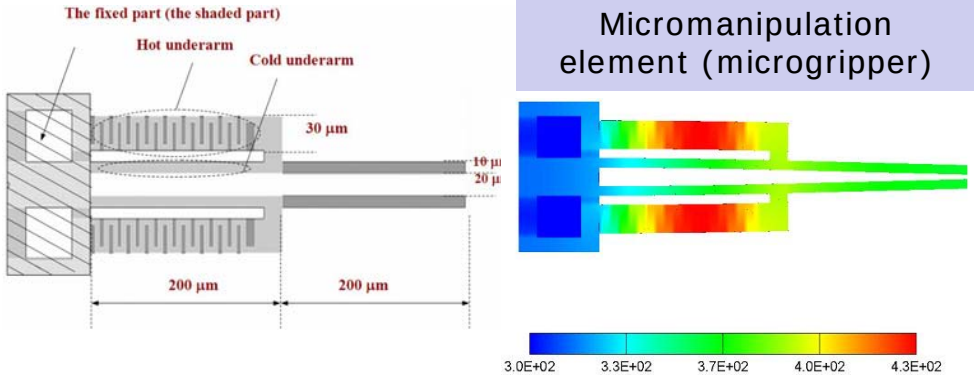
Capacitive microphone optimization



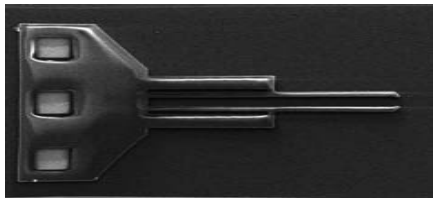
First principles electronic structure calculations



Micromanipulation element (microgripper)



MEMSAS - CEEX



Collaboration matrix

	Partnerships in RTD activities, sharing the IP resulting from research	Scientific and technological **services**, including design and consulting	**Direct access**, "hands-on" activities (after proper training)
Research groups outside IMT-Bucharest	- usually financed by a contract of partnership agreement.	- typically, specific activities will be performed by IMT-Bucharest as a subcontractor (technological processes, analysis and characterization, design and simulation, etc.) with no IP rights.	- direct access of researchers from partner organizations, as part of common RTD.
Educational bodies for Ph.D. and postdoctoral studies, M.Sc. studies, "hands-on" training etc.	- supported by individual grants or following an agreement with universities, specifying the cost and intellectual property issues.	- occasionally.	- as part of a common research activity, or providing training on a commercial basis.
Companies (Industry)	- based on special NDA and IP agreements.	- services provided on commercial basis.	- companies may use their own IP rights.

Complete information

- **IMT-MINAFAB full info** -
  www.imt.ro/MINAFAB/

- **Current projects and achievements:** **IMT-Bucharest - SCIENTIFIC REPORT 2008** -
  www.imt.ro/raport_anual_2008.pdf (soon available for 2009)

- **IMT-Bucharest - Brochure for scientific-technological services** -
  www.imt.ro/brosura_imt_bucuresti_2009.pdf

- **Quick list of capabilities and tools** -
  http://www.imt.ro/MINAFAB/description.htm

Thank you for your attention!