"Un nou concept in actiune: accesul la tehnologie"

Acad. Dan DASCALU,

director general al INCD-Microtehnologie

CCIB/CCIR (10 aprilie 2009)

Introducere (1)

- **Potentialul inovativ al noilor tehnologii si in special al micro- si nanotehnologiilor si al tehnologiilor convergente este urias**, nu numai in industriile high-tech, ci si in cele traditionale;
  - Platforma tehnologica europeana MINAM (MIcro- and NAnoManufacturing);
- IMM-urile inovative sunt deosebit de potrivite pentru a explora noile posibilitati si uneori pentru a acoperi anumite “nise de piata”;
- Costurile aparaturii / echipamentelor specifice pot fi uneori prohibitive pentru firmele mai mici; si gama de competente este limitata. Ca urmare se pune problema accesului la tehnologie **colaborarea cu centrele CD** se impune. Circumstante favorabile:
  - anumite echipamente tehnologice pot fi folosite atat pentru activitati CD, cat si pentru microproductie;
  - in unele cazuri, dupa fabricarea unei matrite cu dimensiuni caracteristice de ordinul micronilor, se merge pe

Introducere (2)

- Formele de asistenta ale IMM-urilor sunt variate:
  - Centre de competenta foarte specializate (de ex. in microfluidica);
  - Centre de consultanta “one-stop shop”, care activeaza impreuna cu centre de proiectare, centre de fabricatie;
  - Centre CD deschise colaborarii cu industria (model adoptat de IMT); colectivele interne ar trebui sa fie la randul lor “centre de competenta specializate;
- IMT a fost receptiv la cooperarea cu firmele, creand **parcul stiintific** si tehnologic de micro- si nanotehnologie MINATECH-RO; unele firme au instalat propriile echipamente in parc, facand schimb de servicii cu IMT-uls-a initiat si o “retea pentru transfer de cunostiinte si de tehnologie”
- Investitiile substantiale din IMT facute in ultima perioada creaza un mare potential pentru inovare. In acest moment apare **IMT-MINAFAB (centru de micro- si nanofabricatie)** care – printre altele – va favoriza colaborarea cu firmele, in forme variate.

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Ca centru de nanotehnologie “deschis” colaborarii

- **Cercetare multidisciplinara**, colective din diverse laboratoare ale IMT, cercetatori din exterior. Platforma experimentala pentru interactia intre fizicieni, chimisti, biologi, ingineri …..

- **Cursuri de “Master”**
  - Facultatea de Fizica, Universitatea Bucuresti (curs de nanostiinta)
  - Facultatea de Electronica si Telecomunicatii, Univ. “Politehnica” din Buc.

- **Cooperarea cu firmele din domeniu** (echipamente prea costisitoare pentru micile firme)
  - Amplasarea de echipamente de fabricatie in spatiile tehnologice (schimb de servicii);
  - Acces direct la dotarile IMT
  - Servicii complexe pentru firme (“one-stop shop”)

Conceptul de “centru deschis”. Modelul este larg folosit in SUA. Sistemul se dezvolta si in Europa de vest. Nu se cunosc institutii similare in noile state membre ale UE.

Domeniu de activitate

INCD-Microtehnologie (IMT-Bucuresti)

- In sistemul ANCS:
  - Domeniul – microtehnologie (un institut)
  - Comisia 4: Materiale noi, micro- si nanotehnologii (alaturi de INCD-IE/ICPE CA);
- Domeniul (tematica) in sistemul de prioritati la PN II este legata de:
  - Tehnologia comunicatiilor si a informatiei;
  - Materiale, procese si produse inovative;
  - *Aplicatii in*: sanatate, agricultura, mediu, energie
- Domeniul (tematica) in sistemul de prioritati la PC7 este legata de:
  - Tehnologia informatiei si a comunicatiilor (ICT);
  - Nanotehnologie, materiale, productie (NMP)
- Denumirea curenta a domeniului pe plan mondial: **micro- si nanotehnologii**
- Evolutia strategica a IMT spre convergenta tehnologiilor: micro-nano-bio-info (Conform Comisiei Europene, 2004: orientare strategica in tehnologia secolului XXI)

Potentialul tehnologiilor inalte pentru inovare.

Particularitati ale investitiilor in micro-si nanotehnologii

Conditii de curatenie: camera alba (nr. particule de praf pe unitatea de volum); conditii de clima (temperatura si umiditate controlata); infrastructura suport (fluide pure, exhaustare)

Conditii de stabilitate mecanica.

Procese chimice care implica gaze periculoase.

Varietate de materiale implicate (inclusiv “bio”).

Organizare: concentrarea facilitatilor experimentale in “centre”; asigurarea infrastructurii suport; controlul accesului

Detalii fine, realizate:
- prin scriere directa (fascicul electroni, laser, proba AFM);
- tehnici de “printare”;
- tehnici de “mascare”;

Complexitatea structurilor si/sau structuri multiple:
- in plan (eventual structuri multiple);
- in adancime (mascari succesive).

Particularitati ale echipamentelor/aparaturii:
- combinatie mecanica de precizie, optica, electronica;
- combinatia tehnicilor de “structurare” cu cele de caracterizare la scara micro-nano

Ce ofera in prezent IMT-MINAFAB din punct de vedere tehnic (1)

- **Camera alba clasa 1000** pentru:
  - fabricatie masti,
  - fotogravura, aliniere dubla fata, corodare chimica si in plasma,
  - depunere in vid prin pulverizare si fascicul de electroni,
  - tehnici neconventionale de micro-si nanolitografie.
- **Camera alba clasa 100.000** (zona “gri”) cu:
  - nanolitografie cu fascicul de electroni, depunere si corodare indusa de fascicul de electroni,
  - microscopie electronica de baleaj (cu fascicul de electroni), microscopie cu proba de baleiaj (AFM, STM etc.), microscopie de baleiaj tip SNOM (combinatie AFM si microscopie confocala), profilometrie cu interferometru de lumina alba (WLI),
  - spectroscopie Raman, difractometrie cu raxe X, microscopie cu scanare electrochimica, spectrometrie de impedanta, spectrometrie de fluorescenta, spectrometru masurare dimensiuni nanoparticule si potential zeta,
  - nano-plotter si nano-scanner (pentru material biologic).

Ce ofera in prezent IMT-MINAFAB din punct de vedere tehnic (2)

- **Alte dotari tehnologice**: cuptoare pentru difuzie si oxidare, implantator ionic, instalatie de depunere prin evaporare in vid etc. (spatiu neclimatizat), sistem caracterizare semiconductori, nano-indenter (clasa 100.000).
- **Alte laboratoare de caracterizare**: masuratori optice si in microunde unde milimetrice (65/110 GHz)
- **Laboratoare de fiabilitate** pentru teste mecano-climatice si defectoscopie.
- **Laborator de simulare si proiectare asistata de calculator** (proiectare microsisteme, microfluidica etc.). Simulare si proiectare in optica si radiofrecventa (in laboratoare specializate).
- **Sisteme "home-made"** pentru testare senzori si microfluidica.
- **Prin schimb de servicii cu firmele din parc:** acces la dotari mecanice, lipire pe ambaza, lipire fire, incapsulare (inchidere).

Vor fi disponibile in cursul anului 2009.

- **O noua camera alba:** echipamente de depunere chimica din faza de vapori de diverse tipuri, procesare termica rapida etc.
- **Laborator "**rapid prototyping"

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Oferta catre exterior

Complex de facilitati experimentale si de proiectare (simulare si proiectare asistata de calculator, “mask-shop”, procese tehnologice, caracterizare fizico-chimica, testare functionala, fiabilitate).

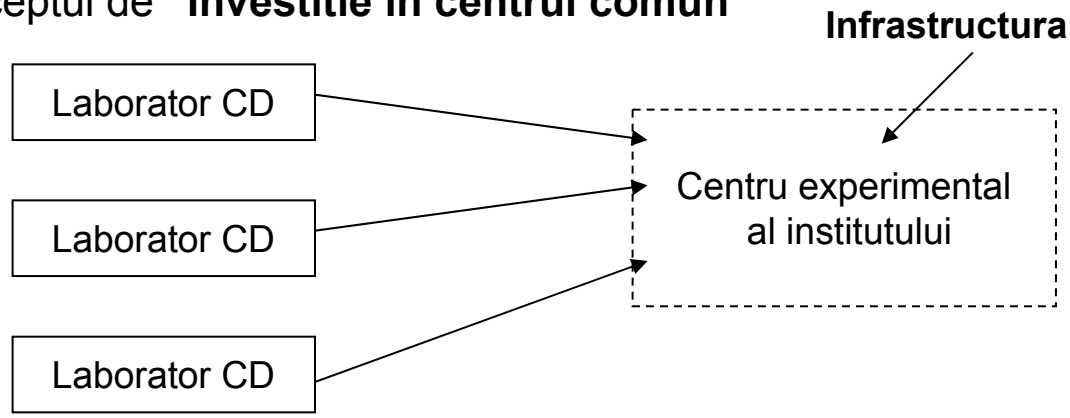
Servicii

- **Suport pentru activitati CDI realizate in colaborare cu colectivele din IMT**
- **Suport pentru activitatile de instruire si educatie (instruire practica, educatie prin cercetare de ex. doctorat)**
- **Servicii tehnice executate la comanda**
- **Servicii complexe plus consultanta (“one-stop shop”)**
- **Acces direct la echipamente**

Probleme organizatorice in realizarea si exploatarea investitiilor

Sursa de finantare. Finantarea este fragmentata pe numeroase proiecte castigate de diverse laboratoare

Conceptul de **"Investitie in centrul comun"**



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-**Optimizarea functionarii laboratoarelor experimentale**

-**Oferta complexa in exterior**

Laboratoarele CD "investesc" in centrul experimental comun, ca intr-un "holding".

Obligatii:

Dotarile sunt accesibile tuturor cercetatorilor din institut.

Se asigura si servicii in exterior.

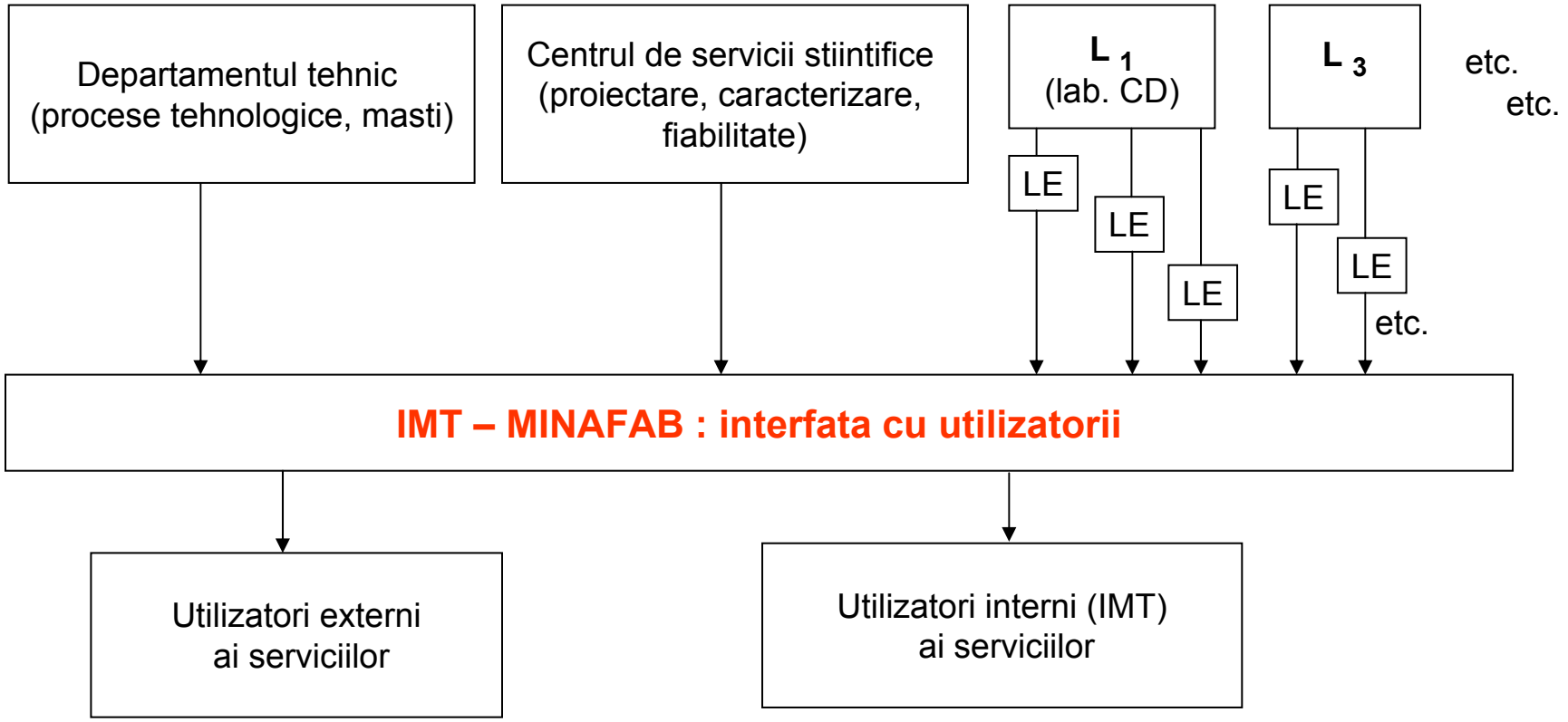
Drepturi:

Laboratoarele au drept de initiativa, de preemptiune etc.

Se asigura suport tehnic, stimulente materiale si morale.

Centrul IMT- MINAFAB

si structura interna a IMT



Rolul IMT - MINAFAB

Sarcini curente

- Organizarea suportului tehnic al functionarii centrului experimental
- Evaluarea si rationalizarea costurilor de functionare ale centrului experimental
- Standardizarea si acreditarea serviciilor oferite

Evolutii strategice (sub coordonarea conducerii IMT)

- Corelarea si planificarea investitiilor
- Formarea resurselor umane
- Asigurarea sinergiei cu activitatile CD, de inovare si de educatie
- Facilitarea parteneriatelor cu furnizori similari sau cu clienti importanti.

Complementaritate cu CTT-Baneasa (servicii curente, consultanta, etc.)

Ce vede utilizator-ul intern (din IMT) al sistemului IMT-MINAFAB

Pagina de web interactiva in sistemul Intranet.

- Informatii “la zi” despre echipamentele disponibile si starea acestora;
- Formulare de precomanda, cate unul pentru fiecare tip mai important de echipamente, formular care permite inregistrarea datelor esentiale legate de efectuarea unor lucrari pe baza de contract;
- Fisa tehnica detaliata necesara pentru lansarea unei anumite comenzi;
- Formular de cautare, care permite identificarea comenzilor pentru anumite tipuri de lucrari (selectiv, ingineri de proces);
- Formular de cautare care permite evidentierea lucrarilor comandate in cadrul unui anumit contract (selectiv, responsabilii de contract).

Ce va vedea utilizatorul extern al IMT-MINAFAB ?

Pagina de web publica a IMT-MINAFAB

- Descrierea principalelor dotari experimentale care pot fi folosite direct sau indirect de catre utilizatorii “externi” (din afara IMT);
- Exemple de rezultate relevante obtinute pe dotarile din centru (cateva exemple ilustrative);
- Formular de inscriere pentru utilizatorii potentiali (pentru acces cu parola).

Pagina cu acces controlat (pentru utilizatorii potentiali);

- Detalii privind performantele echipamentelor si stadiul lor de functionare;
- Exemple mai numeroase de utilizare;
- Formular de comanda a lucrarilor (pentru inregistrarea preliminara si precomanda);
- Lista de preturi pentru accesul direct (cost utilizare echipament/ora sau zi);
- Biblioteca de lucrari publicate cu rezultate obtinute pe dotarile din IMT-MINAFAB.

Ino related to the new facilities (I):

- *the clean room area –class 1000*

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View from the new cleanroom

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Reactive Ion Etching (RIE), SENTECH equipment

Working gases: CF4, CHF3, SF6, O2, Ar
RF power could be varied between 0 si 600 W,
pressure in reactor between 1 – 100 Pa, and wafers of 3 and 4 inch

Conventional and non-conventional technological 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.**

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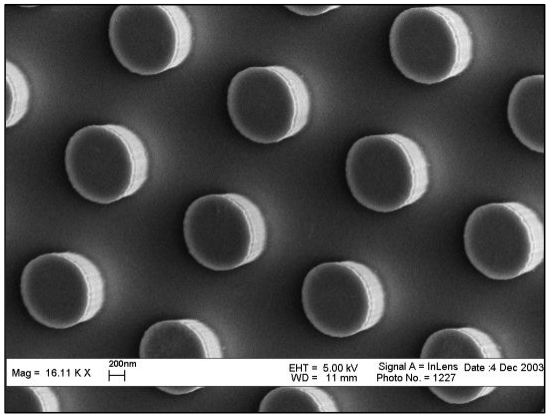
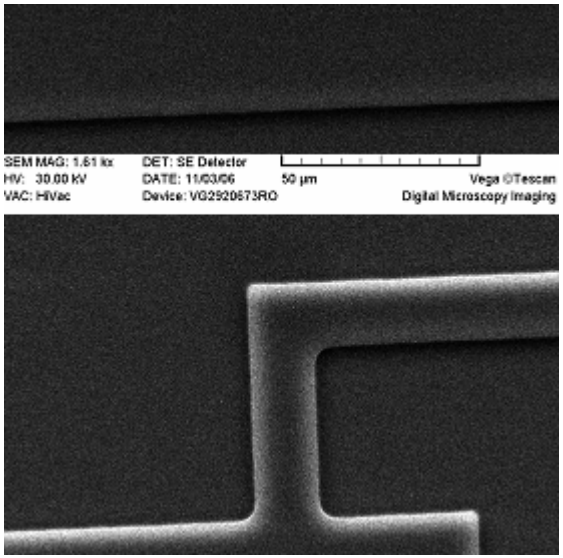
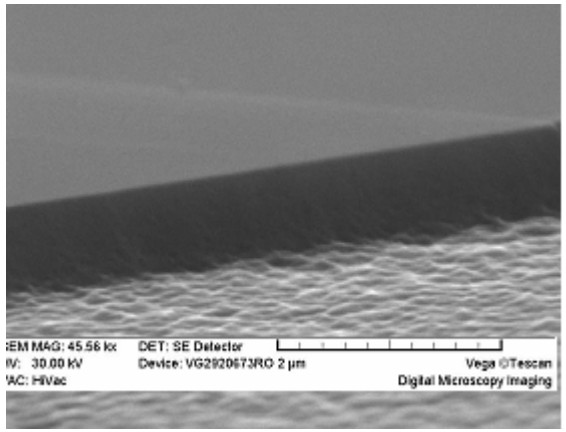
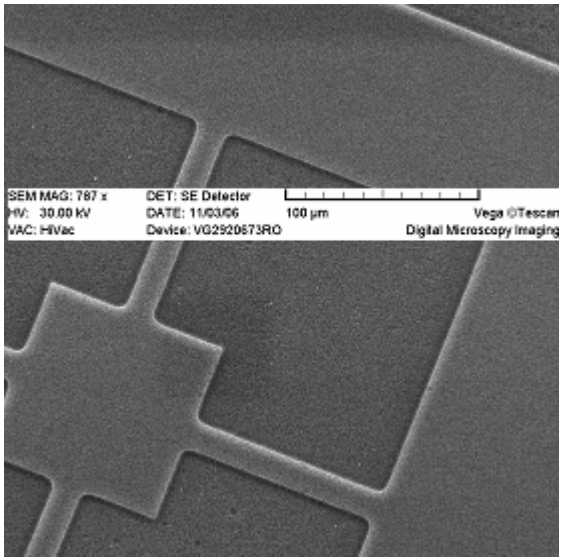
Using RIE in micro- and nanophotonics



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

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Vacuum coating system

Processes:
- **DC sputtering**
- **e-beam**

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)

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Pattern generator for mask manufacturing

Direct laser writing (DWL) with HeCd 442-nm laser

Creates masks or writes on wafers up to **6”**;

Minimum pattern size: **0.6 μm**.

Info related to the new facilities (II):

experimental labs of:

- ***"Centre for nanotechnologies"***

(under the aegis of the Romanian Academy)

- "***European Centre of excellence***"

(MIMOMES – RF and Opto MEMS)

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Scanning Probe Microscope (SPM)

Various techniques

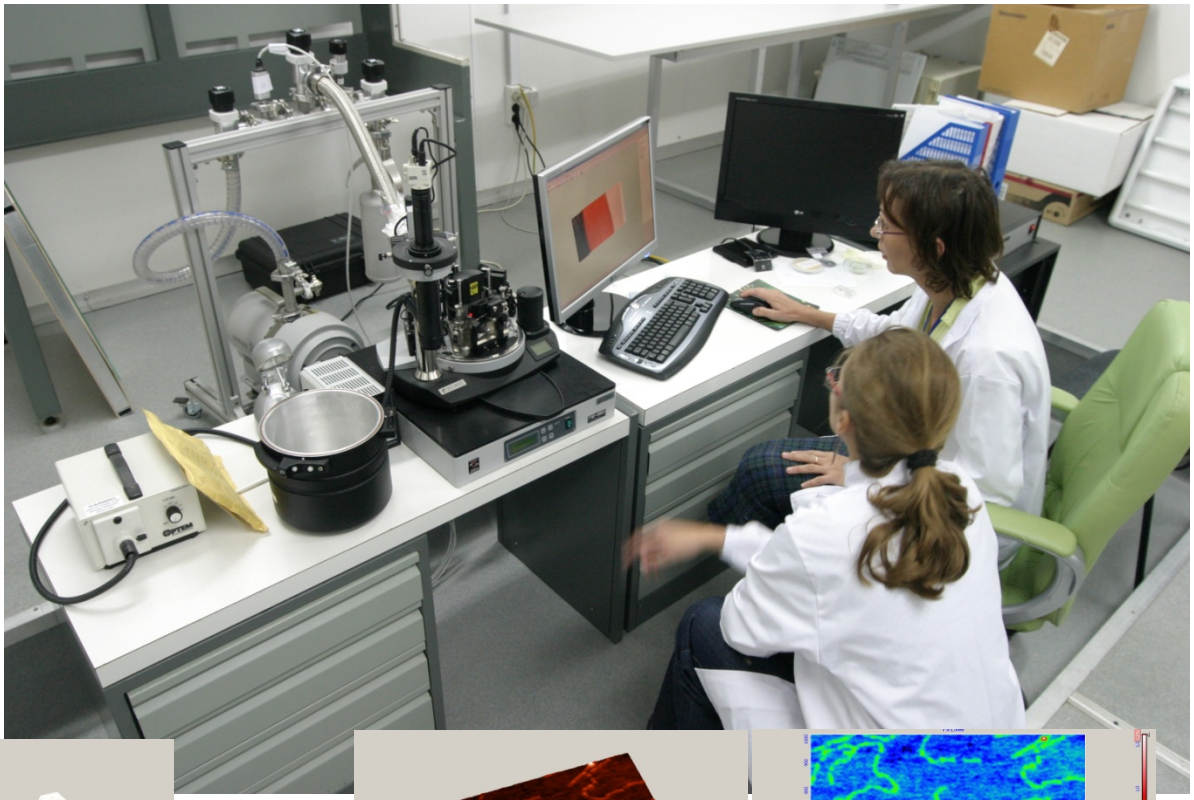
AFM, STM etc.

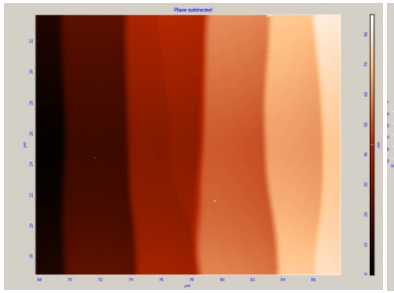
Environments:
air, liquid, controlled gaseous atmosphere, low vacuum

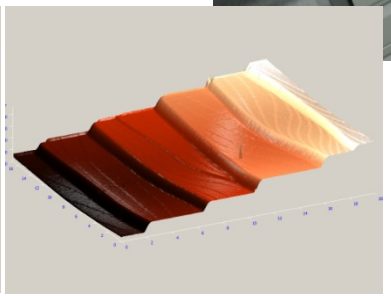
Scan range:
100x100x10 µm

Noise level:
XY: 0,3 nm, Z: 0,06 nm

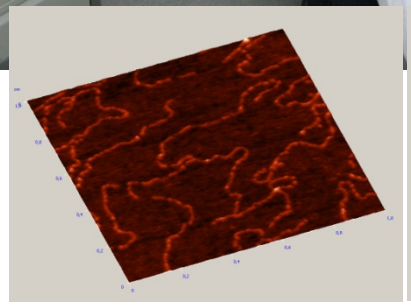
Non-linearity in X, Y with closed-loop sensors:
< 0.15 %

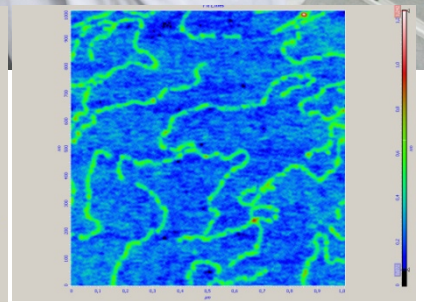






AFM image of step patterned Si. Individual step height: 15 nm





AFM image of linear DNA molecules deposited on freshly cleaved mica. Average DNA molecule diameter: 2 nm.

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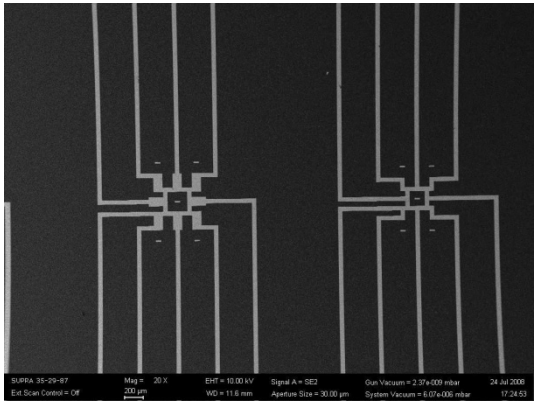
SEM-EBL (Electron-Beam-Lithography)

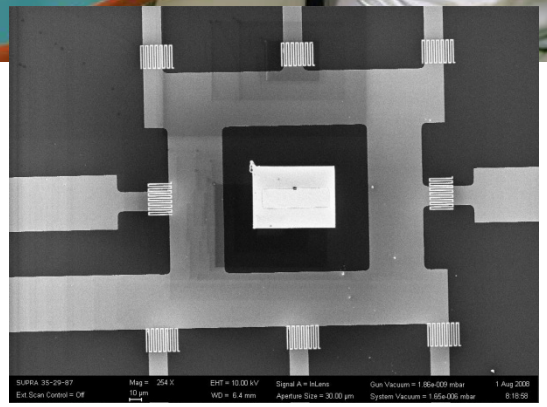
Accelerating voltage:
200V - 30KV

Resolution:
3nm at 30kV

Dwell time:
160 ns - 10 ms per pixel

Image size:
up to 8,192 × 8,192 pixels





Mix-and-match lithography; optical lithography (left), combined with e-beam lithography (right).

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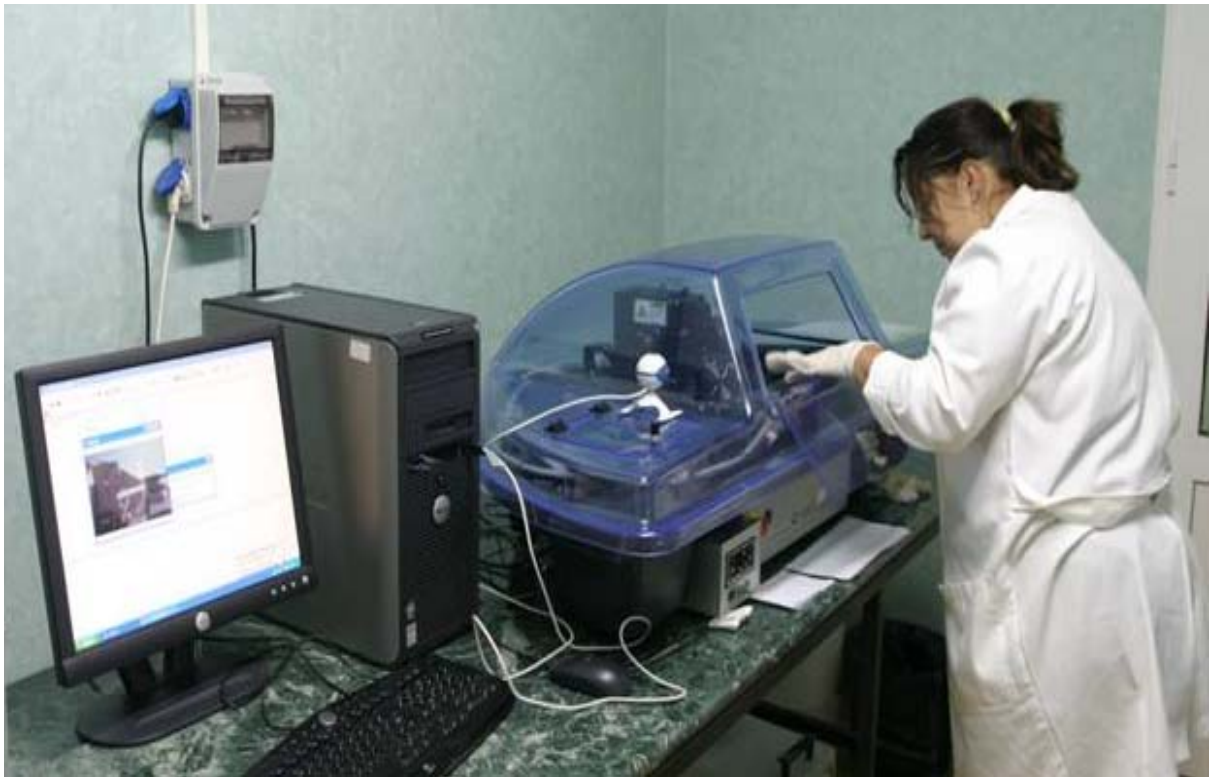
Nanobiotechnology laboratory: NanoBioLab

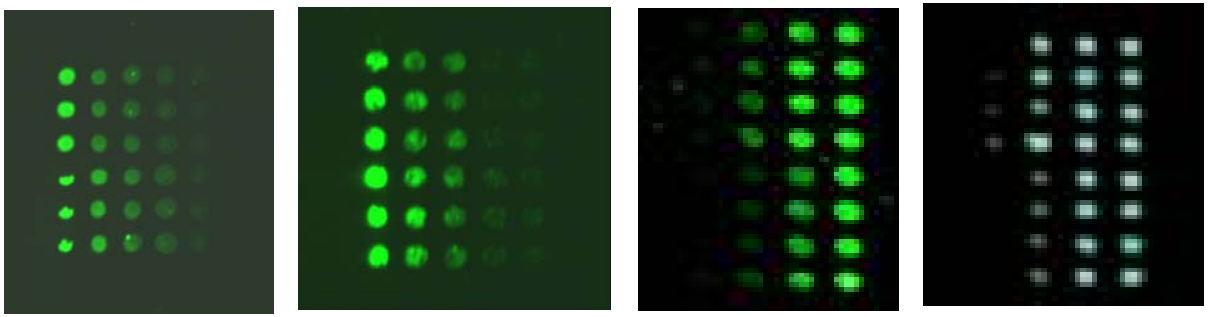
Micro-Nano Plotter – biomolecule array printer

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 samples

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Nanobiotechnology laboratory: NanoBioLab

Microarray Scanner

Two color lasers: green (532nm) and red (635nm)

Microarray analysis software for imaging, collection and storage of large data sets.

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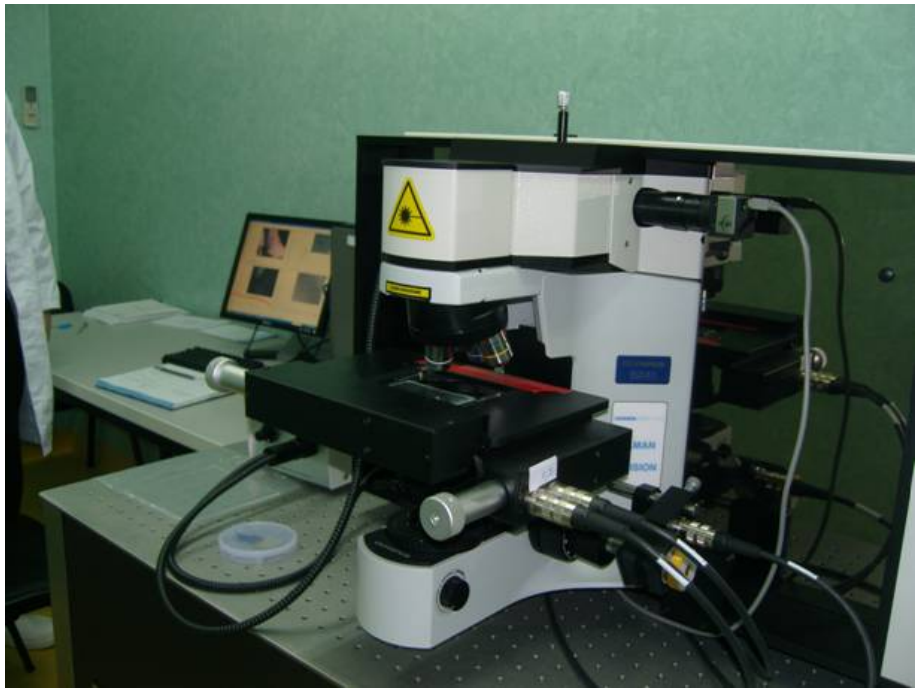
Raman Spectrometer



Spectral range
400–1050nm

Spectral resolution
0.35cm-1/pixel for laser of 633 nm and diffraction gratings of 1800 gr/mm

Spatial resolution of confocal microscope
laser beam diameter less than 1mm and axial confocal performance better than 2mm.

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Scanning Electron Microscope with Field Emission Gun

- Sample characterization, analysis, prototyping

- Wide variety of nanotechnology materials: metals, magnetic materials, nano-particles and powders, nano-tubes and -wires, porous materials (e.g. silicon), plastic Electronics, glass substrates, organic materials, diamond films, cross-sections etc

High stability Schottky field emission gun - enables a beam current up to 100 nA for analysis

Maximum resolution in high vacuum: 1.0 nm at 15 kV (TLD-SE); 1.6 nm at 1 kV (TLD-SE); 0.8 nm at 30 kV (STEM)

Latest features allowing advanced characterization in presence of charging and/or contamination

Low/very low kV backscattered electron imaging for compositional characterization in high and low vacuum

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X-Ray Diffractometer

X ray diffraction at large angles (WAXRD):
with/without focalisation
with and/or without monochromatization
with and/or without analyzer crystal

X ray diffraction at low angles (SAXS)

X ray reflectivity (XRR)

Microdiffraction:
X ray spot size 20-50 microns

9kW rotating anode

Rated tube: 20- 45 kV

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X-Ray Diffractometer

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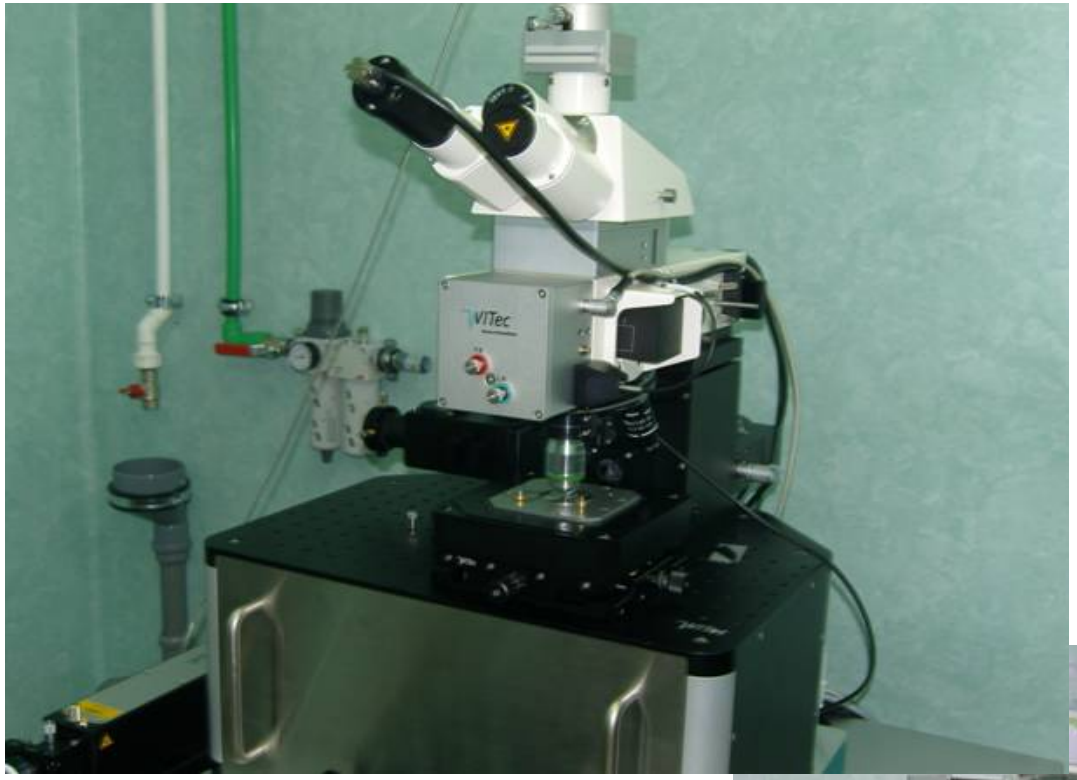
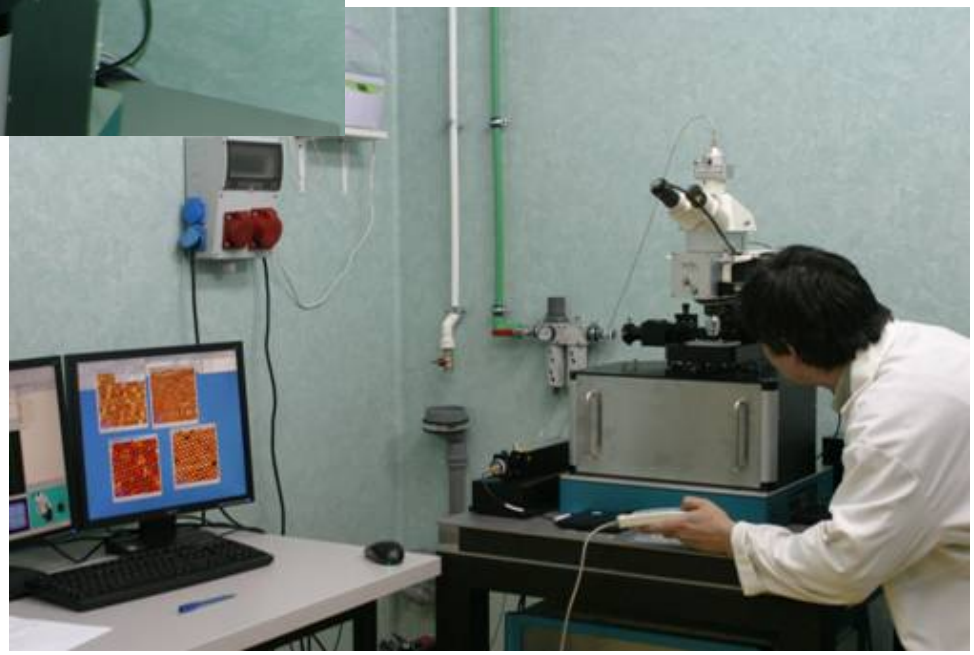
Scanning Near-field Optical Microscope (SNOM)



Combines **in a single instrument:** SNOM, Confocal Microscopy and Atomic Force Microscopy

Uses patented micro-fabricated SNOM cantilever sensors (aperture size typically 100nm)

Spatial optical resolution below the diffraction limit: 50 – 100 nm.



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White Light Interferometer (WLI)

Non-contact (optical) profiling of rough surfaces

Sub-nanometer vertical resolution (down to 0.1nm) at all magnifications

All axes motorization: enables automatic stitching of multiples fields of view

Sub-nanometric roughness measurements

Measures transparent films

No sample preparation required

NANOSCALE LAB

Main Techniques:

- ►**EBL**
- ►**AFM/SPM**
- ►**SEM - FEG**
  - ►Nanoidentation – *New!*

EBL - Direct write Electron Beam nanoLithography

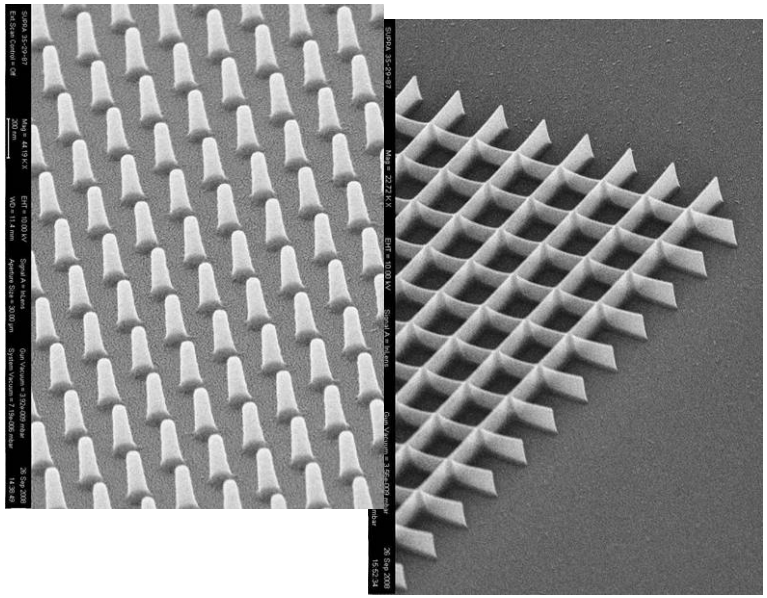
- is an ideal tool for nanotechnology research
- **e-line ERL nanoengineering workstation from RAITH** is a versatil equipment with specific requirements for interdisciplinary research:

- options for **nanomanipulations**
- **EBID** : Electron Beam Induced Deposition
- **EBIE**: Electron Beam Induced Etching

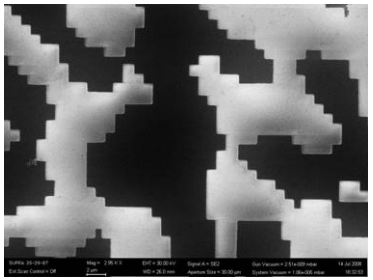
The group was involved in the development of **different applications as**:
- **fabrication of nanodevices for SAW and bio applications;**
- **Difractive Optic Elements (DOE), Photonic Crystals;**
- **high aspect ration pillars and nanostructures**

NANOSCALE LAB

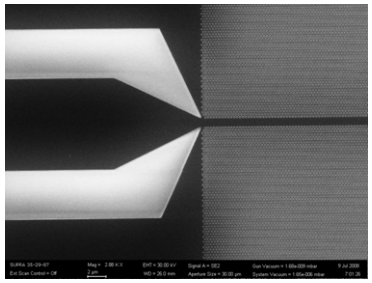
High aspect ratio (12:1) structures in PMMA

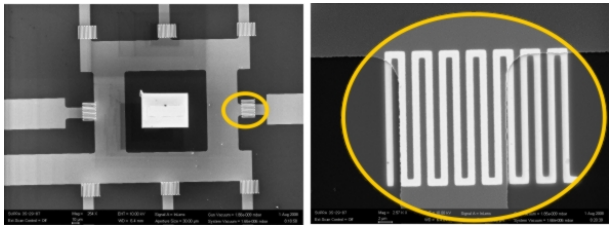


Diffractive Optical Element (DOE) for photonics applications

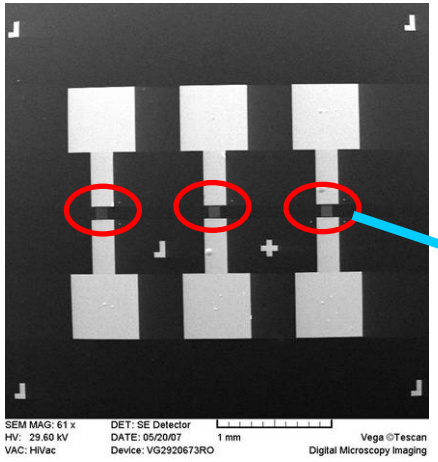


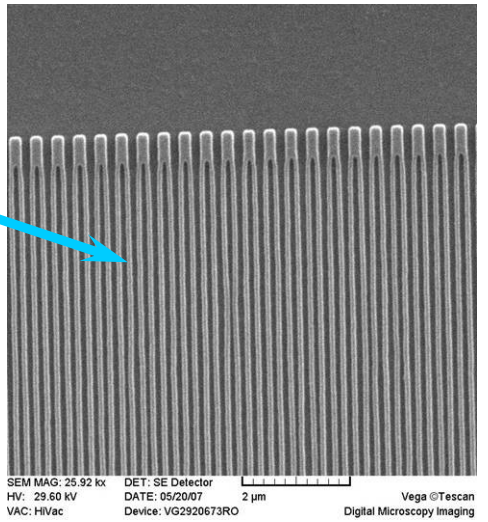
Photonic cristals in PMMA on silicon for near IR applications





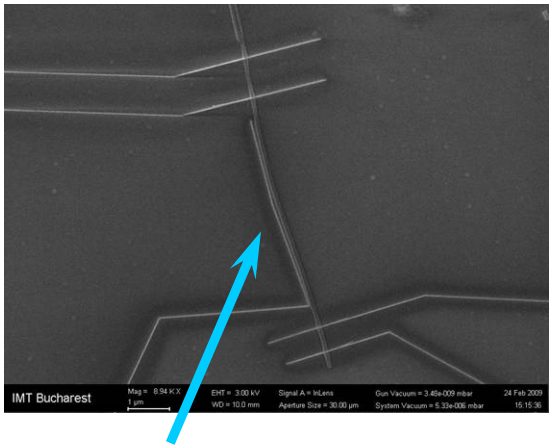
Mix-and-match lithography for biomedical applications: optical lithography (left), combined with EBL (right)





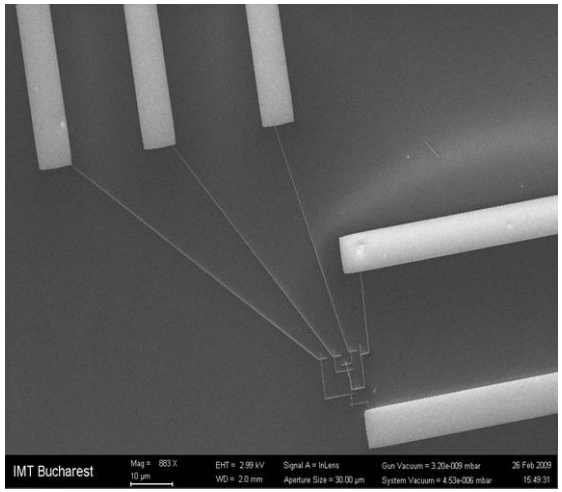
Mix- match lithography for 300 nm fingers used for SAW devices (Cooperation IMT Bucharest- IESL FORTH)

NANOSCALELAB



Polymer nanowire electrically contacted using EBID (Cooperation IMT Bucharest – UCL)

Structure obtained using conventional lithography and EBID for 4 probes measurements of electrical properties of a polymer nanowire (Coopertation IMT Bucharest – UCL)



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**


Raith
LINE

NANOSCALE LAB

Scanning Probe Microscope (SPM) NTEGRA Aura - NT-MDT

Main applications: in the field of surface **metrology**, for quantitative measurements of the 3D surface topography for a large variety of samples.

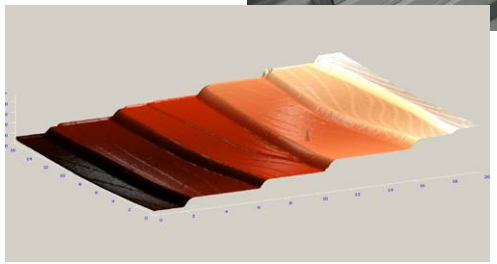
Key advantages:

-ability of measuring the vertical dimensions of the samples together with lateral ones with little or no sample preparation required

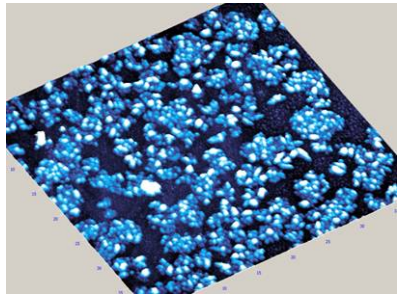
-samples could be measured in various environments (normal ambient, controlled gaseous, liquid, low vacuum)

Research Topics

- 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 image of step patterned Si. Individual step height: 15 nm. Individual atomic planes could be noticed in the 3D rendered image.



AFM image of a ZnO thin film on Si. Scan range: 40x40 microns. The AFM image was used for evaluating the growth pattern of ZnO, for applications in optolectronic devices and gas sensors.

Partners

- research institutes
- universities
- companies

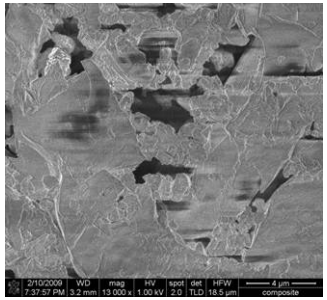
NANOSCALE LAB

Nova™ NanoSEM 630

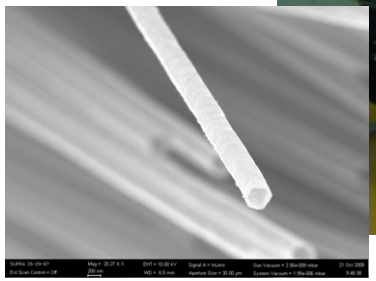
The FEI Nova NanoSEM 630 provides ultra high resolution, in the nanoscale range, for a variety of applications that involve sample characterization, analysis for S/TEM sample preparation.

Research Topics

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



The structure of a composite material used in aeronautics- sample from INFN Italy

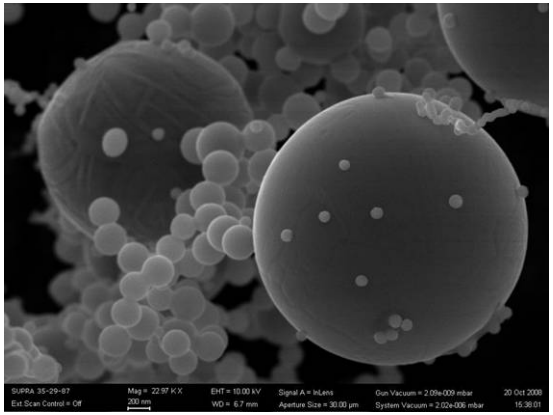


High resolution CNTs imaging

Applications:

We can investigate a variety of challenging nanotechnology materials such as metals, magnetic materials, nano-particles and powders, nano-tubes and -wires, porous materials (e.g. silicon), plastic Electronics, glass substrates, organic materials, diamond films, cross-sections etc

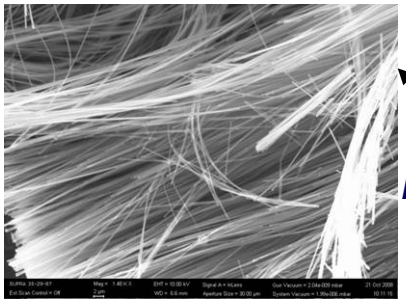
High resolution image of a ITO layer deposited on glass



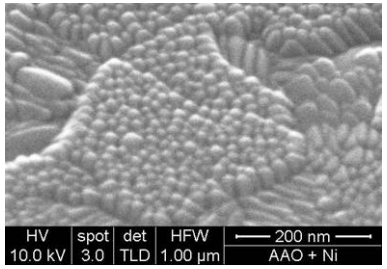
Micro and nanospheres produced in the process of CNTs growth (cooperation with INFN Rome)

Cooperation:

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



CNT bundels



Contact persons: Dr. Raluca Muller, raluca.muller@imt.ro; Drd. Adrian Dinescu adrian.dinescu@imt.ro

Dip pen nanolithography Laboratory

Main equipment:

- **Dip Pen Nanolithography system**

A nanolithography system that „prints" and „ink" directly on the substrate. The size of the geometrical features can vary from few tens of nanometers (in best conditions – 20 nm) up to several microns. It allows both a bottom-up approach and a top-down one when contructing the nanostructures.

The working principle is that of wetting an AFM-type cantilever with an "ink" and writing down onto a substrate, similar with an ink pen that writes on a paper.

Seting-up the system. Left monitor: used for working with the CAD-like software that controols the system; right monitor (orange): real-time imaging of the cantilever tip; extreme right (blue): the NScriptorTM system The window of the environmental chamber is open

The process is serial and is quite slow, but can be highly parallelized by using 2D arrays of cantilevers (55,000 such cantilevers on an array) and thus becomes efficient from the speed and throughoutput points of view. Many materials can be used as "inks", as are solutions of polymers, small organic molecules, sol-gel precursors, macromolecules, nanoparticle colloids.

Dip pen nanolithography Laboratory

Applications:

- surface functionalization (with direct liaison to proteomics, DNA recognition, virus identification)
- photolithographic masks correction
- molecular electronics
- realization of master stamps for NIL (Nanoimprint lithography)
- novel devices (photonic and electronic)

Results:

It is newly put into function. We are still in the training period. However, some results are obtained, as seen in the figure.

The logo of the National Institute for Microtechnologies – Bucharest written with MHA (16 – Mercaptohexadecanoic Acid) on Gold substrate. Image size is of 5 microns x 5 microns, the width of the letters is of 115 nm while the dot on "i" radius is of 180 nm. The image was read at an angle of 10^0.

Contact person: Dr. Gabriel Moagar-Poladian, gabriel.moagar@imt.ro

Nou: completarea ofertei de servicii
cu facilitatile oferite de firmele din parc
(o *noua generatie* de firme ……in parc)

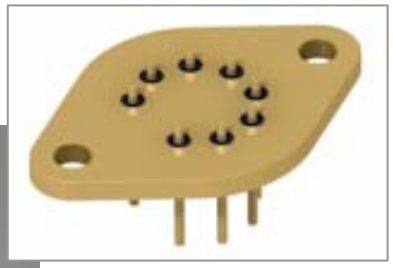
S.C.CARBOTEL.S.R.L

Domeniul de activitate al firmei este productia componentele electrice si subansamble (baze , ambaze, capote pentru componentele electronice, structuri metalice si prelucrari mecanice, reparatii mecanice, instalatii si reparatii electrice.

Servicii oferite de SC.CARBOTEL.S.R.L.

- prelucrari mecanice;
- sinterizare sticla;
- treceri metal-sticla;
- stantari si deformari prin presare;
- masuratori etanseitate si dimensionale profil;
- realizarea de capsule metalice pentru componente electronice (imaginile alaturate)

Spatii in curs de amenajare.



Recunoastere profesionala: SC.CARBOTEL.S.R.L. a obtinut

- locul 39 in clasamentul pe domeniu la editia a XV-a a topului National al firmelor private in anul 2006.
- locul 40 in clasamentul pe domeniu la editia a XVI-a a topului National al firmelor private in anul 2007.

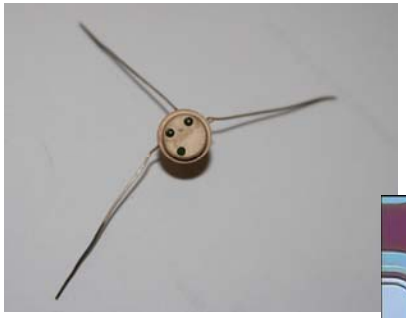
S.C. MICROELECTRONIC BĂNEASA S.R.L.

Domeniul de activitate:

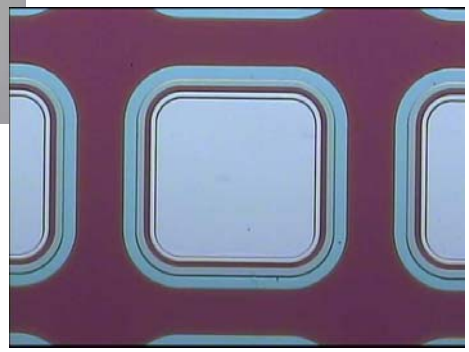
- montajul diverselor componente electronice in capsule metalice;
- testarea, caracterizarea si fiabilizarea unor dispozitive propri cat si a unora importate din diverse tari pentru aplicatii speciale;
- activitati de cercetare privind realizarea de structuri pentru dispozitivele solicitate de aplicatiile speciale;
- activitati de cercetare in domeniul tehnologiilor noi de montaj;
- activitati de import export;

Proiectele de viitor ale firmei cuprind domenii largi cum ar fi :

- proiectare dispozitive incluzand faza de structura si realizarea lor in cooperare cu IMT;
- proiectare si microproductie de circuite hibride;
- cooperarea cu firme americane si cu IMT in domeniul nanotehnologiei;



Tranzistor 2N 1671



Diode Zenner 3V6
Structurile pentru diode Zenner in lucru in IMT;

Echipament pentru inchidere capsule metalice

Firma va ofera servicii de incapsulare, testare si deasemenea acces la echipamentele sale ori de cate ori va dori IMT.

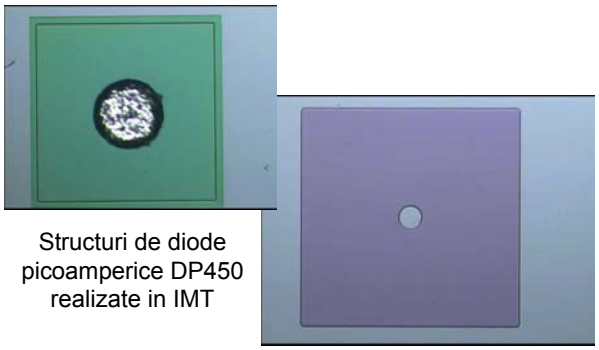
S.C. BĂNEASA SILICON S.R.L.

Domeniu de activitate:

- Fabricatia componentelor electronice (diode, tiristori de mica, medie si mare putere);
- Activitate cercetare-dezvoltare in domeniul componentelor electronice;

Servicii solicitate IMT-ului:

1. realizarea de structuri de diode planare in cadrul Atelierului de procesari tehnologice al IMT-Bucuresti;
2. fiabilizarea unor produse in conformitate cu standardele internationale in cadrul laboratorului de fiabilitate din IMT-Bucuresti;



Structuri de diode picoamperice DP450 realizate in IMT

Echipamente de caracterizare electrica din cadrul laboratorului de fiabilitate din IMT-Bucuresti (Echipamante Keithley, Temptronic)

Echipamnete de incercari Mecano- Climatice, laboratorul de fiabilitate din IMT-Bucuresti