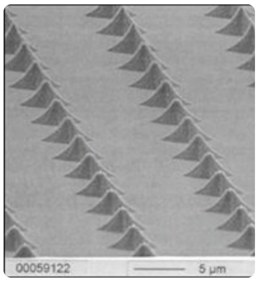
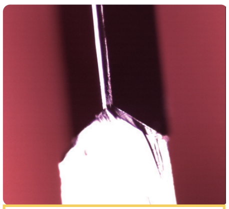
Laboratory of Nanotechnology, Department of Multidisciplinary Research, IMT-Bucharest

Contact Person: Dr. Irina Kleps, irinak@imt.ro

Competence/Resources: Our previous results in this area are related to fabrication of silicon based nanostructures or nanostructured (composite) materials and investigation of their properties from morphological, electrical, optical point of view or as biocompatible materials. In order to obtain a functionalized surface area for applications in biology, different physical-chemical methods have been developed. The standard biocompatibility tests demonstrates that silicon based nanostructured materials are biocompatible and can be integrated in biomedical devices; also the highly responsive surface area recommend for sensing applications.Silicon based nanoelectrodes have been fabricated and were used as working electrode in an electrochemical system with high level of sensitivity and also as recording electrode in an integrated microfluidic device for biological material electrophysiological investigation / DNA electrophoresis. We have full access to IMT technological resources: - fabrication: semiconductor technological facilities, clean room (100 class) - characterization: material/system morphologies - optical / fluorescence microscope, atomic force microscope (AFM), scanning electron microscope (SEM), elliposometer; material physical properties: photoluminescence spectrometer, IR spectrometer, UV-VIS-NIR spectrometer, electrical testing system.



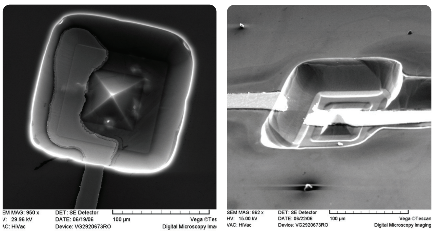
SEM image of Si nanoelectrode arrays



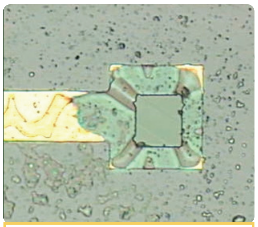
Optical image of Si membrane suspended at the middle of Si wafer in depth

Proposal/Interest: Our scientific and technological background allows us to participate to development of Si based microchips for applications in biomedicine or environmental monitoring area:

- nanostructured silicon, due to its reactive surface area, can be used as sensitive element to investigate the interaction mechanisms between inorganic/organic materials;
- nanoelectrodes, due to their sensitivity, allow study of electronic transport mechanism in biological materials and at their interface with inorganic material.



SEM images of a Si nanoelectrode positioned in reaction chamber for cell investigation



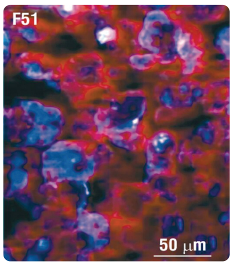
Optical image of test microchip structures for drug delivery after reservoir cap dissolution process

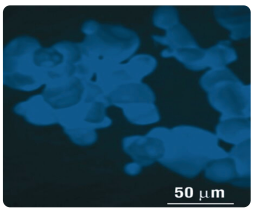
The compatibility of both types of structure fabrication process with other standard processes from semiconductor technology allows us to integrate in miniaturized complex devices for fundamental biological studies, as for example:
(i) CELL-Lab-on-a-chip for in-vitro drug testing and
(ii) DNA - Lab-on-a-chip for genetic diagnosis.

Advanced research issues, such as nanoelectronics and nanophotonics will be used for biological material detection and monitoring. A new generation of complex tools for protecting health that will work like a bio-laboratory-on-a-chip using silicon micro and nanotechnology will be developed. Due to their versatility, these devices could be used by a wide range of interested groups from hospitals, clinics or drug companies for research aims or could become industrial devices.

Inorganic Compounds Laboratory, Solid State Chemistry Group, *"Raluca Ripan" Institute for Research in Chemistry,* Cluj-Napoca, Romania

Dr. Elisabeth-Jeanne POPOVICI, ennypopovici@yahoo.com





CL-SEM images of some luminescent powders

Luminescent powders and films/layers

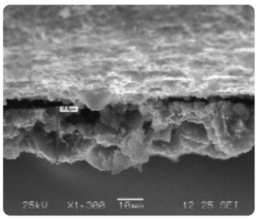
<u>**Human resources:**</u> 6 PhD and 5 PhD students;

⦿ <u>Material basis for powder synthesis and thin film deposition</u>, e.g. *Traditional and sol-gel/coloidal routes; Chemical bath deposition and dip-coating techniques; *Pyrolysis/ thermal dissociation methods;*Thermal treatments up to1500C; air/N2

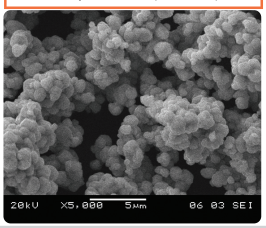
⦿ <u>Available investigations</u>: *Optical methods, e.g. FTIR, UV-Vis and PL spectroscopy ; *Thermal analysis, e.g. TG-DTA-DTG-DSC measurements; *Optical microscopy; *Chemical analysis;*Profilometry ; *SEM/TEM ; *BET surface area.

<u>**Chemists group with competence in preparation of:**</u>

⦿ Micro-and nanocrystalline powders with luminescent properties;
⦿ Nanostructured thin films with special optoelectronic (e.g. luminescent) properties;
⦿ Microcrystalline layers for X-Ray intensifying screens (EIRX-for radiodyiagnosis)
⦿ Porous layers on metallic substrate for catalytic purposes;
⦿ Micro-and nanocrystalline powders with catalytic activity;
⦿ Catalysts for ozone decomposition and evaluation of their catalytic efficieny in ozone decomposition;
⦿ Ozone properties and uses;
⦿ Metallic and oxydic materials e.g., micro-and nanocrystalline powders to be used as inorganic fillers in coatings and compozite materials;



Catalysts and metallic pigments
Porous layer on metalic support (left;);
Cu-powder (bellow)



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