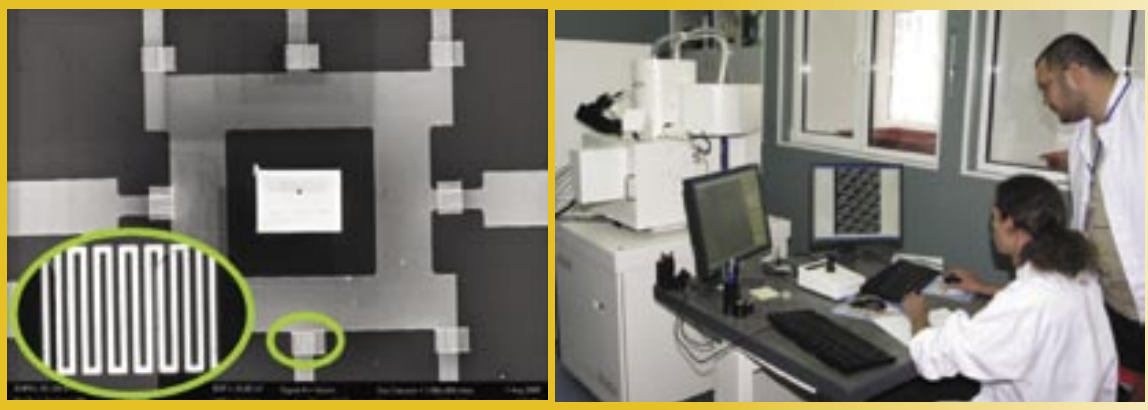
IMT-MINAFAB as an experimental facility for micro-and nanotechnologies in Bucharest, Romania.

IMT-MINAFAB (IMT facility for **MI**cro and **NA**no **FAB**rication, www.imt.ro/MINAFAB) is an interface of the potential user with a complex system of the services along the following coordinates: (a) technological processes, including mask fabrication; (b) characterization and functional testing, including reliability; (c) computer simulation and design. *The system is providing access of research partners, Ph. D. students and companies.*

IMT-Bucharest is embarked (2007-2009) on large scale changes and upgrades of its technological infrastructure, with special focus on expanding the existing clean room area, as well as on reorganizing and regrouping the technological equipment. Following several important acquisitions of state-of-the-art equipment, a new clean room zone (class 1000) was already opened, with a semiconductor mask shop and a nanoengineering and characterization area. *We are providing here for the first time information about the newest technological facilities.*

As far as the micro- and nanostructuring is concerned, IMT is providing mask fabrication (DWL - direct writing with laser down to 0,6 μm), EBL (electron-beam lithography) down to tens of nanometers (which can be combined with optical lithography), as well as "deep pen nanolithography". The last two techniques are illustrated below.

In June 2008 in IMT Bucharest was installed (see the figure below) a **ultra high resolution electron beam lithography** system: Raith **e_Line**. This lithography technique consists of scanning a beam of electrons across a surface covered with a resist film sensitive to electrons, thus creating the desired pattern in the film. The options for nanomanipulation, in-situ deposition and etching expand this system to a versatile nano-engineering workstation. The state-of-the-art e_LiNE electron column matches perfectly with *a number of key applications in carbon nanotube research, thin film engineering, photonic crystals, and quantum physics*. **e_Line** is the newest nanolithographic product on the market being able to obtain a resolution better than 20 nm on the whole working area (10cm x 10cm).



The figure also shows mix-and-match lithorgraphy for biomedical applications: optical lithography (left)

The **Dip Pen Nanolithography** system already available in IMT is realizing structures with sizes from a few tens of nanometers up to several microns. The system works by wetting an AFM-type cantilever with an "ink" and writing down onto a substrate. Such "inks" can be solutions of polymers, small organic molecules, sol-gel precursors, macromolecules, nanoparticle colloids. *Applications lie in surface functionalization (with direct liaison to proteomics, DNA recognition, virus identification), photolithographic masks correction, molecular electronics, realization of master stamps for NIL (Nanoimprint lithography).*

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. Substrate used is gold and the text is written with MHA (16 – Mercaptohexadecanoic Acid). The image was read at an angle of 10^0. The text represents the logo of the National Institute of Microtechnology – Bucharest.

Another strong point is the new laboratory for thin film processes based on CVD (chemical vapor deposition), which will become operational in the first quarter of 2009, that will be dedicated to 4-inch fabrication – thermal, and plasma-assisted - and testing of thin film materials for semiconductor research and applications. The new facility includes PE (plasma enhanced) CVD, LP (low pressure) CVD, AP (atmospheric pressure) CVD, as well as profilometry, ellipsometry and photospectrometry tools. This will enable deposition of doped and undoped silicon oxides, low stress polysilicon and silicon nitrides, silicon carbide, 1-D micro and nanostructures. These technologies will support IMT's new development projects in *M/NEMS, RF-MEMS, MOEMS, photovoltaics, nanobiotechnology* and will offer a strong basis for the step up of the services offered externally.

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