

Experimental Facility: IMT-MINAFAB

Constant and coordinated investments in the experimental infrastructure represented a priority of IMT Bucharest. These investments allowed the institute to launch in April 2009 a renewed, state-of-the-art research infrastructure. The technical and administrative user interface of this new, open facility is the **IMT-centre for Micro- NANOFABrication (IMT-MINAFAB)**.

IMT-MINAFAB operates several clean-room areas and specialized laboratories - totaling a surface of almost 700 m² and modern equipments worth more than 8 Meuro; some of them are unique at national and regional level. Since June 2011, the services and administrative activities of the centre are SR EN ISO 9001:2008 certified by TÜV Thüringen e.V. IMT-MINAFAB manages one of the very few class 1.000 clean rooms currently running in Romania, and provides a unique concentration of state-of-the art research equipments for micro-nanotechnology at national level.

This research infrastructure enabled IMT to extend its R&D capabilities, leading to participation in more demanding international projects (FP7, ENIAC) and to new contacts and collaborations with multinational companies operating in Romania (Honeywell, Infineon) and with other leading international partners. The main results achieved by IMT are in the field of the micro-nanoelectronics (more specifically micro-nanosystems) and photonics, two of the Key

Enabling Technologies (KETs). A new investment of 6 Meuro in the CENASIC centre (to be finalized in April 2015) is presented separately in this report, and it will allow IMT to extend its existing capabilities in nanotechnologies and advanced materials, another two KETs. The strategic goal of IMT is to become a technological platform for integration of KETs, which is an important direction of development within EU programme for RDI, "Horizon 2020".

A short presentation of the most important components of the research infrastructure follows.

- A class 1000 clean room (220 m²) for the mask shop and the most demanding technological processes (in use since September 2008);
- A class 100,000 clean room, the so called "Grey Area" (200 m²), mostly for the characterization equipments (in use since September 2008);
- A class 10,000 clean room (105 m²) for thin layer deposition by CVD techniques: LPCVD, PECVD; DRIE; RTP etc. (fully in use since early 2012);

• Photolithography (chrome, maskless, wafer double-side alignment and exposure)

Pattern generator - DWL 66fs Laser Lithography System (Heidelberg Instruments Mikrotechnik, Germany)

Double Side Mask Aligner - MA6/BA6 (Suss MicroTec, Germany)



• Nanolithography (EBL, EBID, EBIE, Dip-pen) and SEM

Electron Beam Lithography and nanoengineering workstation - e_Line (Raith, Germany)

Dip Pen Nanolithography - NSCRIPTOR (NanoInk, Inc., USA)

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

• Physical depositions of materials in high-vacuum

Electron Beam Evaporation - TEMESCAL FC-2000 (Temescal, USA)

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

• Chemical depositions, thermal processing

PECVD - LPX-CVD, with LDS module (SPTS, UK)

LPCVD - LC100 (AnnealSys, France)

Rapid thermal processing/annealing - AS-One (AnnealSys, France)

• Precision etching of materials (plasma reactive ion, humid, shallow and deep)

DRIE- Plasmalab System 100- ICP Deep Reactive Ion Etching System (Oxford Instruments, UK)

RIE Plasma Etcher - Etchlab 200 (SENTECH Instruments, Germany)



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IMT centre for Micro- and NanoFABrication (IMT-MINAFAB) was the first “open” research infrastructure in this field from Eastern Europe (2009), providing access for research, education and industry, as clearly explained on the web page www.imt.ro/MINAFAB. IMT is maintaining this advantage, because in 2013 it was the only organization from this region selected to participate to EUMINAFab 2, a proposal for a network of “advanced nanofabrication”, to be financed in “Horizon 2020”. In the EUMINAFab consortium IMT is offering Laser Lithography (2D and

3D patterning), Electron Beam Lithography (down to 20 nm), thin film technology (PECVD/LPCVD), plasma etching (RIE/DRIE), micro-nanoprinting, on wafer RF characterization up to 110 GHz, spectroscopy (FT-IR, Raman, fluorescence), X-ray metrology, reliability testing. What is essential behind the participation of IMT in a proposal aiming at “integration and opening of essential European infrastructures”, it is the scientific expertise of researchers operating most of the more complex equipments (see also the presentation of R&D laboratories).

• X-Ray diffractometry

X-ray Diffraction System (triple axis rotating anode) - SmartLab - 9kW rotating anode, in-plane arm (Rigaku Corporation, Japan)

• Scanning probe microscopy: AFM, STM, SNOM, confocal, Raman mapping

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

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

• Nanomechanical characterization

Nanomechanical Characterization equipment - Nano Indenter G200 - (Agilent Technologies, USA)

• Microarray spotting/scanning

Micro-Nano Plotter - OmniGrid (Genomic Solutions Ltd., UK)

Microarray Scanner - GeneTAC UC4 (Genomic Solutions Ltd., UK)

• Analytical characterization tools

Scanning Electrochemical Microscope

ElProScan (HEKA, Germany)

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

Fluorescence Spectrometer - FLS920P (Edinburgh Instruments, UK)

• Interferometry/profilometry; Spectroscopy

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

White Light Interferometer - Photomap 3D (FOGALE nanotech, France)

Electrochemical Impedance Spectrometer - PARSTAT 2273 (Princeton Applied Research, USA)

Fourier-Transform Infrared Spectrometer - Tensor 27 (Bruker Optics, Germany)

UV-Vis-NIR Thermo-Electric Cooled Fiber Optic Spectrometer - AvaSpec-2048 TEC (Avantes,

The Netherlands)

Refractometer for layer thickness measurements - NanoCalc-XR (Oceanoptics, USA)

• Probers, on-wafer; electrical characterization

Semiconductor Characterization System (DC) with Wafer Probing Station - 4200-SCS/C/Keithley

Easyprobe EP6/ Suss MicroTec (Keithley Instruments, USA; Suss MicroTec, Germany)

Semiconductor Characterization System - 4200-SCS, C-V 3532-50, DMM 2700-7700, 2002, 6211-2182 (Keithley Instruments, USA)

Microwave network analyzer (0.1-110GHz) with Manual Probing Station (Anritsu, Japan; Suss MicroTec, Germany)

Frequency Synthesizer up to 110 GHz (Agilent, USA)

Spectrum Analyzer up to 110 GHz (Anritsu, Japan)

