“Danubian” countries review

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Barcelona, Spain

May 15 - 17, 2017

- Delegates
- Romania
  - National Strategy and funding programmes
  - MNT Research in Romania
- Bulgaria
- Czech Republic
- Hungary
- Republic of Moldova

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Barcelona, Spain

May 15 - 17, 2017

Romania

Dr. Adrian Dinescu - Chief-delegate, author of the country&region report

CEO and President of the Board, IMT Bucharest

Presentation: *Danubian Countries Review*

Prof. Dan Dascalu

Coordinator of the Center for Nanotechnologies, IMT Bucharest

Co-author of the "Danubian Countries Review" presentation

Dr. Carmen Moldovan

Head of Laboratory for Microsystems in Biomedical and Environmental Applications, IMT Bucharest

Presentation: *Autonomous MicroSystems for Environment monitoring and Food quality control*

Dr. Alexandra Stefanescu

Senior researcher, Micromachined structures, microwave circuits and devices Laboratory (RF-MEMS), IMT Bucharest

Presentation: *SAW pressure sensors based on micromachining and nanolithographic processing of GaN/Si*

Poland

Dr. Piotr Dumania

Vice Director for Industrial development and implementation

Institute of Electron Technology (ITE)

Presentation: *MEMS competences in Poland*

Romania

National Strategy / National Research - Development and Innovation (RDI) Plan III for 2015-2020

- **New and Emerging Technologies - national priority domain in the public sector**
- **Main focus on *smart specialisation*:**
  - Bioeconomy
  - ICT, Security and Space
  - Energy, Environmental and Climate Change
  - Eco-Nano-Technologies and Advanced Materials

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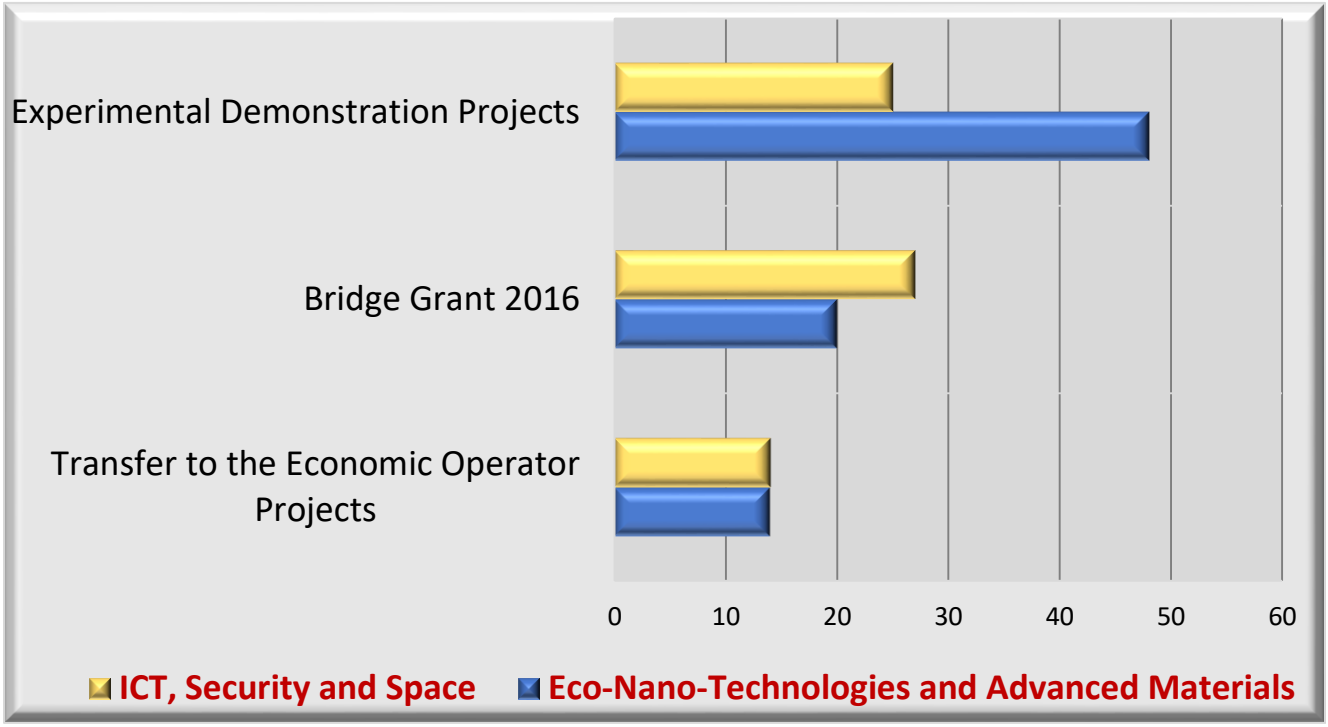
Number of projects financed by National RDI Plan III

Programme: "Increase economic competitiveness through RDI", 2016 calls



Other programmes:

National RDI Plan III:

- Programme “European and international cooperation”
  - **Bilateral / multilateral cooperation** between Romania and France, Walloon Community (Belgium), Rep. of Moldova
- Programme “Research in areas of strategic interest”
  - **Space Technology and Advanced Research Programme “STAR”** coordinated by Romanian Space Agency (ROSA) - national representative in the cooperative agreements with international organizations, such as European Space Agency (ESA) and Committee on Space Research (COSPAR)

EEA & Norway Grants

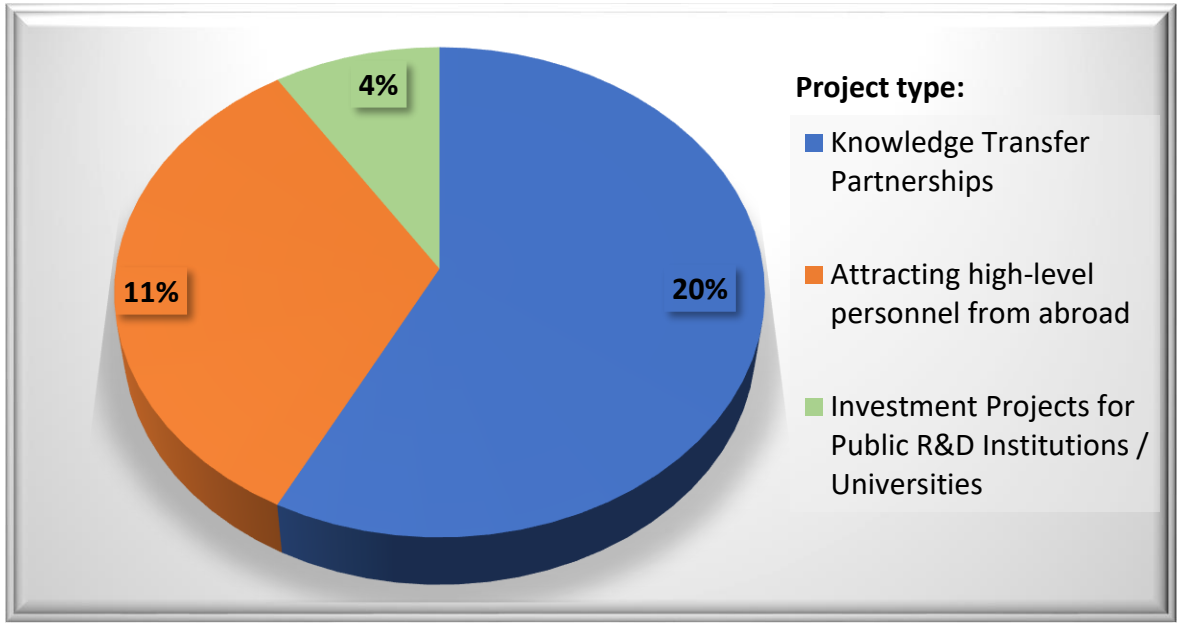
- EEA Financial Mechanism 2014-2021; between donor countries (Norway, Iceland and Liechtenstein) and Romanian Government
- Norwegian Financial Mechanism 2014-2021

Structural Funds
Competitiveness Operational Programme (POC)

Projects financed for thematic priority

Eco-Nano-Technologies and Advanced Materials

(contracts starting Sept. 2016 - January 2017)



Funding sources for POC:
- Regional Development Fund (ERDF)
- State Budget

Project type	Total non-reimbursed financial assistance	State Budget
Knowledge Transfer Partnerships	46 M€	7.5 M€
Attracting high-level personnel from abroad	30 M€	4.7 M€
Investment Projects for Public R&D Institutions / Universities	42.5 M€	7.8 M€

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Projects for knowledge transfer to companies *("Knowledge Transfer Partnerships"), (contracts starting Sept. 2016 – Jan.2017)*

Thematic priority

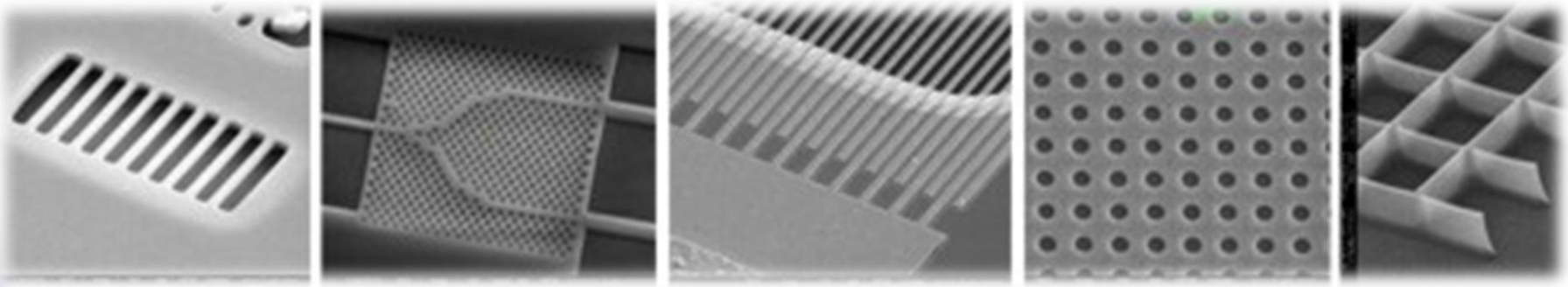
Eco-Nano-Technologies and Advanced Materials

Project coordinator	No. of projects
National Institute of Materials Physics	2
National Institute for R&D in Optoelectronics	2
Institute of Macromolecular Chemistry "Petru Poni" Iasi	1
National Institute for Laser, Plasma & Radiation Physics	1
"Horia Hulubei" National Institute for Physics and Nuclear Engineering	1
National R&D Institute for Electrical Engineering ICPE-CA	1
National Institute of R&D in Mechatronics and Measurement Technique	1
National R&D Institute for Nonferrous and Rare Metals	1
COMOTI Romanian R&D Institute for Gas Turbines	1
University „POLITEHNICA" of Bucharest	2
Technical University of Cluj-Napoca	2
„Babes-Bolyai" University Cluj-Napoca	1
„Ovidius" University of Constanta	1
University "Constantin Brancusi" Targu Jiu	1
University of Craiova	1

Thematic priority

ICT, Security and Space

Project coordinator	No. of projects
National Institute for R&D in Microtechnologies - IMT Bucharest	1
National R&D Institute for Electrical Engineering ICPE-CA	1
University „POLITEHNICA" of Bucharest	2
University of Medicine and Pharmacy Cluj-Napoca	1
University of Craiova	1
University "Alexandru Ioan Cuza" Iasi	1



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May 15 - 17, 2017

IMT Bucharest

National Institute for R&D in Microtechnologies

126 A Erou Iancu Nicolae Str.
077190, Voluntari-Ilfov
Romania

http://www.imt.ro

Contact: Dr. Adrian Dinescu, adrian.dinescu@imt.ro

CEO and President of the Board

Key facts about IMT

- IMT was set-up in 1993 as a R&D unit for microtechnologies (microsystem technologies). Since 1996 IMT is a National Institute for R&D in Microtechnologies (IMT Bucharest). The research was gradually extended to **micro-nanotechnologies** and to **micro-nano-biotechnologies.** About 100 people are active in R&D (61 of them have a a Ph. D in Physics, Chemistry, Electronics etc.).
- IMT was **strongly involved in European Programs** (FP 6 and FP 7), as well as in ENIAC (now ECSEL) projects (public-private partnership in nanoelectronics). A **European Centre of Excellence** in Microwave and Opto MEMS (called MIMOMEMS) was financed (2008-2011) from Framework Program 7.
- **The experimental infrastructure** was extended in 2006-2015 (15 million euro investments). Today IMT has clean rooms (class 1,000 and class 10,000) with more than 500 m^2 and a "grey area" (class 100,00) of 200 m^2 for characterization.
- Since 2009, **IMT – MINAFAB** (**IMT** center for **MI**cro- and **NA**no**FAB**rication) acts as a "open" research infrastructure for research-education and innovation. Part of IMT-MINAFAB (devoted to micro- and nanostructuring) is unique at the national level.
- The new center of **research for nanotechnologies and carbon-based nanomaterials CENASIC** (active from December 2015) is also developing new services to be added to the offer of IMT-MINAFAB.

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Barcelona, Spain

May 15 - 17, 2017

A regional pole of micro- and nanotechnologies.

- The multidisciplinary expertise of IMT researchers and the new experimental infrastructure form the basis of **IMT capability in a group of Key Enabling Technologies** (KET), strongly supported within EU. A special attention is paid to multi-KET technological platforms open for SMEs.
- The technologies available in IMT (from a list of six) are:
    - **Micro- and nanoelectronics;**
    - **Micro- and nanophotonics;**
    - **Nanotechnologies**
    - **Advanced materials**
- The last two technologies benefit from the investment in the new research centre CENASIC.
- These technologies, available within the service center IMT-MINAFAB, are the most important asset of IMT in a project of **partnership with companies in knowledge transfer** just started in 2016 (details below). The most required applications are in the field of **security**, but **space** and **ICT** are also considered.
- IMT-MINAFAB infrastructure is part of the **"Danubian" network in micro- and nanotechnologies**, coordinated by **Karlruhe Institute of Technology**, Karlruhe, Germany (details below).
- IMT is open for partnerships in developing and using micro- and nanotechnologies.

Main research fields:

- micro and nanoelectronic devices
- micro and nanophotonics
- micro and nanodevices for medical applications (BIOMEMS)
- micro-electro-mechanical systems (MEMS) including microtraductors, micro and nanofluidics
- advanced materials and nanotechnologies

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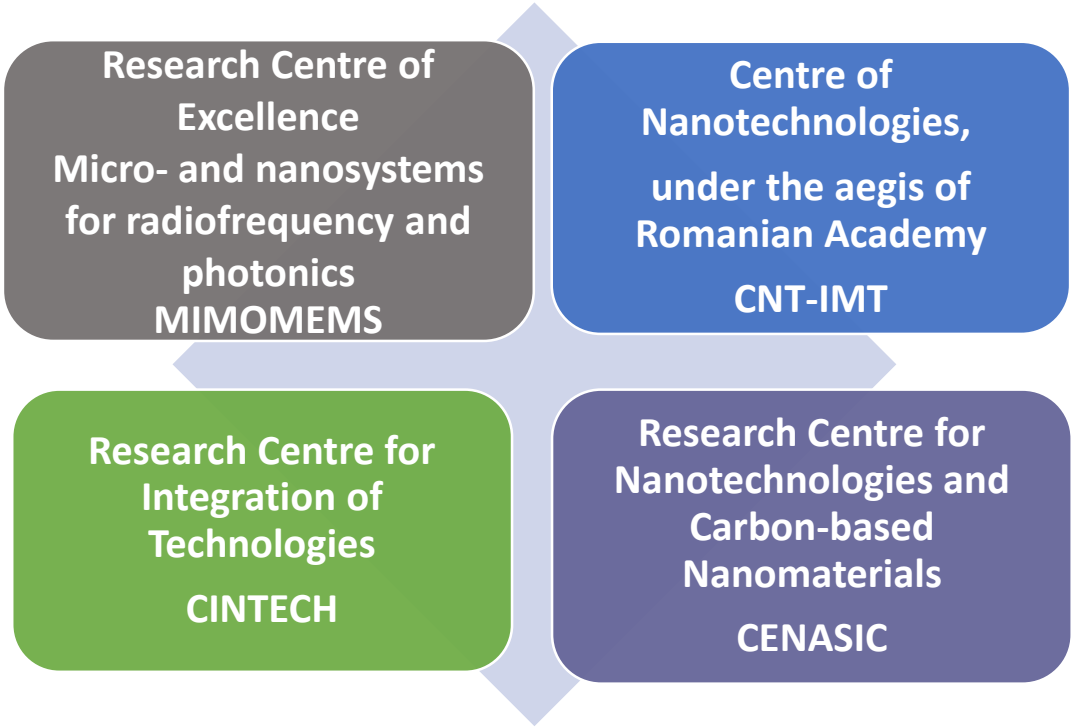
Barcelona, Spain

May 15 - 17, 2017

Department for scientific and technological research

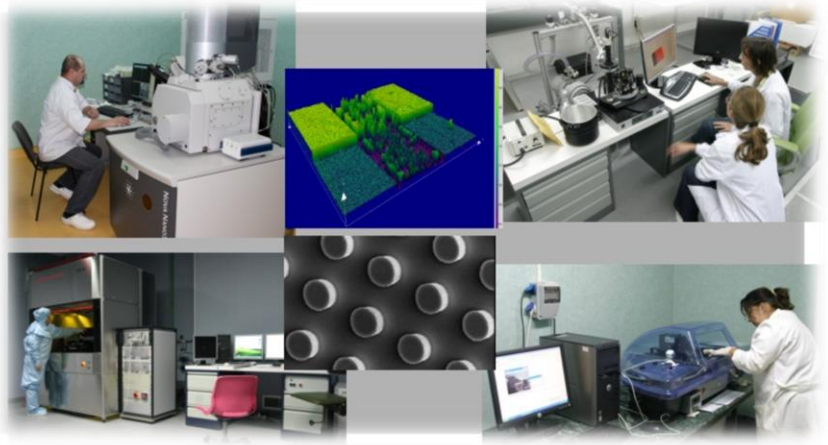


Services offer:

IMT centre for MIcro- and NAnoFABrication (IMT-MINAFAB)

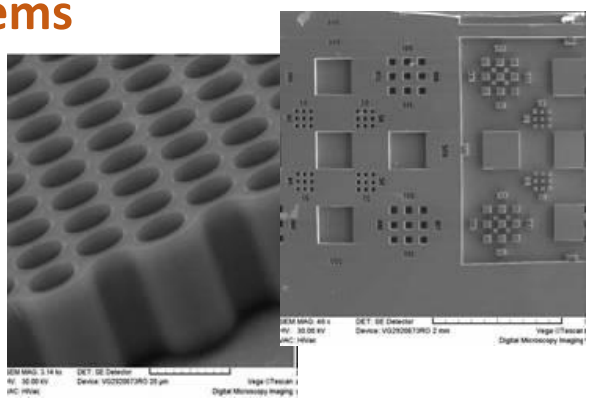
www.imt.ro/MINAFAB

• X-ray diffraction characterization for thin films; • Electrochemical investigations; • DNA microarray slide, Protein microarray slide; • DNA/protein microarray slide analysis; • Electrochemical analyses; ultra-high resolution field emission SEM imaging • Studies of mechanical properties of materials on small scales or near surfaces with high spatial resolution; • Scanning Probe Microscopy characterization; • Confocal, AFM, Near field scanning optical microscopy, Raman spectroscopy and imaging; • Technological processes in inert atmosphere; • RAMAN Spectroscopy; • Spectroscopic Ellipsometry



Facility for micro-nanostructuring of devices and systems

• Technological services for micro-nano devices and systems; • Masks fabrications; • Isotropic silicon etching; Chopping gas method (Bosch process) for anisotropic silicon etching; Cryogenic method for anisotropic silicon etching; • Dry etching of Si, SiO2, Si3N4; Polymer etching; Surface modification in plasma; • Nano-scale patterning of various substrates, electron beam induced deposition and etching.



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Barcelona, Spain

May 15 - 17, 2017

Services offer:

CENASIC - Research Centre for Integrated Systems Nanotechnologies and Carbon Based Nanomaterials

- Epitaxial growth of nitride compounds on various substrates;
- Growth of graphene / carbon nanotubes;
- Deposition of oxide ultra-thin films using ALD technology;
- Thin layer deposition using RF magnetron sputtering;
- Wet oxidation (Hydrox);
- Boron diffusion; Phosphorous diffusion;
- Thermal annealing;
- FT-IR investigations under vacuum conditions, FT-Raman;
- High performance computing: Numerical modeling/simulation for: Multiphysics; Quantum mechanics; Molecular dynamics

Plasma Enhanced Chemical Vapor Deposition (PECVD) - Nanofab 1000/ Oxford Instruments Plasma Technology, Ltd./2015

Molecular Beam Epitaxy (MBE) - COMPACT 21 DZ/Riber Inc./2015

RF Magnetron Sputtering - PlasmaLab System 400/ Oxford Instruments Plasma Technology, Ltd./2015

International cooperation:

IMT projects in **HORIZON 2020:**

3CCar - Integrated Components for Complexity Control in affordable electrified cars

ECSEL, 2015-2018 (call ECSEL-2014-1) (http://www.ecsel.eu/)

Coordinator: Infineon AG, Germany

IMT role: partner. Contact person: Dr. Gabriel Moagar-Poladian (gabriel.moagar@imt.ro)

Website: http://www.3ccar.eu/

SelectX - Crossbar of Microelectromechanical Selectors and Non-Volatile Memory Devices for Neuromorphic Computing

Marie Skłodowska-Curie Actions - Individual Fellowship, 2016 - 2018

Coordinator ("Supervisor"): Dr. Alexandru Muller (alexandru.muller@imt.ro)

Researcher: Dr. Gina Adam (gina.adam@imt.ro)

Website: http://www.imt.ro/selectX/

IMT projects in **M-era.Net**:

PiezoMEMS- Piezoelectric MEMS for efficient energy harvesting

M-ERA.NET, 2015-2018 (M-ERA.NET Transnational Call 2013) (https://www.m-era.net)

IMT role: coordinator, Contact person: Dr. Carmen Aura Moldovan (carmen.moldovan@imt.ro)

Project Topic: Materials for Sustainable and Affordable Low Carbon Energy Technologies

Other partners from Romania: "Ilie Murgulescu" Institute of Physical Chemistry; Romelgen SRL

PhotoNanoP - High photoconductive oxide films functionalized with GeSi nanoparticles for environmental applications

M-ERA.NET, 2015-2018 (M-ERA.NET Transnational Call 2014) (https://www.m-era.net)

IMT role: partner, Contact person: Dr. Adrian Dinescu (adrian.dinescu@imt.ro)

Project Topic: Functional Materials Focusing on Sensors

Other partners from Romania: Project Coordinator: National Institute of Materials Physics; OPTOELECTRONICA-2001 S.A.

ESA (European Space Agency) projects

- **Microwave filters based on GaN/Si SAW resonators, operating at frequencies above 5GHz**

ESA Contract No. 4000115202/15/NL/Cbi, 2015-2017
Contact person: Dr. Alexandru Muller (alexandru.muller@imt.ro)

- **0-level encapsulation of reliable MEMS switch structures for RF applications**

ESA Contract No. 4000110819/14/NL/CBi, 2014-2016; Prime Contractor: IMT Bucharest

Technical objectives:

- **design and manufacturing of MEMS switch structures for K-band to W-band (20-110GHz)**
- **the development of the encapsulation method of MEMS switch structures**

Contact person: Dr. Dan Vasilache (dan.vasilache@imt.ro)

- **PROBA-3 Coronagraph System**

FQ/3-13899/13/NL/GLC; Prime Contractor: Centre Spatial de Liège (www.csl.ulg.ac.be3)
Subcontractor for OPSE: IMT Bucharest; Supplier ROMAERO (www.romaero.com)
IMT-Bucharest responsible partner for "Occulter Position Sensor Emitters Heads"
Contact person: Dr. Eng. Ileana Cernica (ileana.cernica@imt.ro)

MANUNET project

ROBOGRIP - Microgrippers as end-effectors with integrated sensors for microrobotic applications

Coordinator: IMT Bucharest, Romania; Contact person Dr. Rodica Voicu (rodica.voicu@imt.ro); EU partner: Robotics Special Applications S.L (Roboticssa), Spain
Project web site: http://www.imt.ro/robogrip/

Transferring knowledge to enterprises

A project of 3 million of euro (2016-2021) financing knowledge transfer from IMT in the benefit of enterprises.

The budget is financing a wide spectrum of activities, from consultancy and services to R&D subcontracts requested by companies and R&D carried out with companies.

The research should be conducted in the (sub) domains of **microsensors, photonic and millimetric wave components**, respectively.

The scientific and technologic offer is related to the expertise and experimental infrastructure of IMT in a few Key Enabling Technologies (KET), more specifically **micro-and nanoelectronics**, **micro-and nanophotonics** and **nanotechnologies**.

This project is financed by Competitiveness programme, part of structural funding. The priority of smart specialization is related to the domain “STD, space and security”, more specifically to the sub-domain “security”. This project is in its initial stage. Approximately **25 Romanian enterprises** expressed their interest for this project.

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Barcelona, Spain

May 15 - 17, 2017

Events:

IEEE International Semiconductor Conference - CAS 2017

Sinaia, Romania, 11 - 14 October 2017

http://www.imt.ro/cas

TOPICS:

- Nanoscience and Nanoengineering
- Micro- and Nanophotonics and Optoelectronics
- Microwave and Millimeter Wave Circuits and Systems
- Microsensors and Microsystems
- Modelling
- Semiconductor Devices
- Integrated Circuits

Anniversary edition
40 years

Deadline for submission of contributed (regular) papers: **May 25th, 2017**

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Barcelona, Spain

May 15 - 17, 2017

The Danube Nano Micro Facility Network (DNMF_net)

A network of open access nano and micro fabrication and characterisation facilities

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Barcelona, Spain

May 15 - 17, 2017

Expected start date: 1st of June 2017

Period: 2 years

DNMF-net Partners:

- Karlsruhe Institute of Technology (KIT), Germany - Karlsruhe Nano Micro Facility (KNMF) - *coordinator*
- CEITEC Nano, Central European Institute of Technology, Czech Republic
- Budapest University of Technology and Economics, Department of Electron Devices (BME-EET), Hungary
- IMT-MINAFAB, National Institute for Microtechnologies IMT Bucharest, Romania
- National Center for Materials Study and Testing (NCMST), Republic of Moldova

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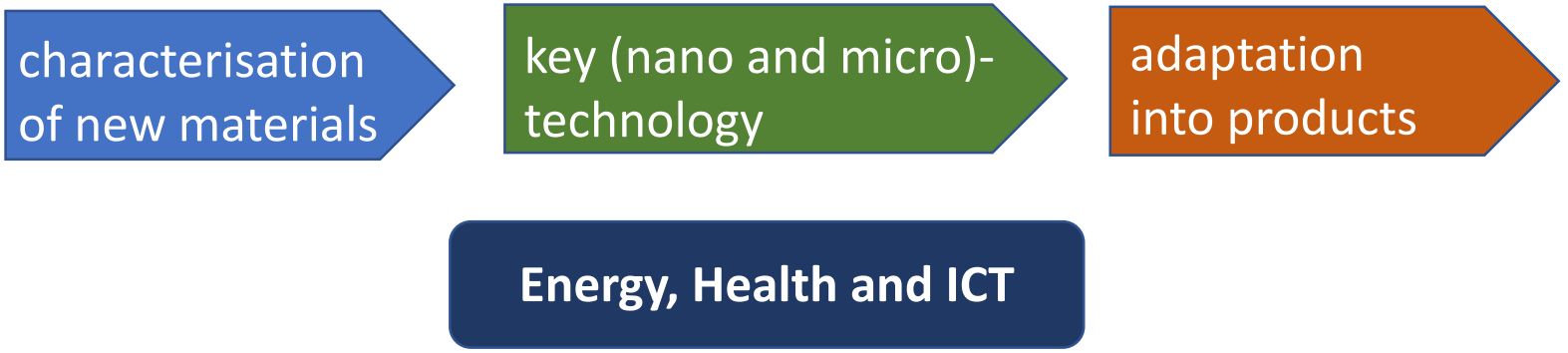
Barcelona, Spain

May 15 - 17, 2017

DNMF-net Objectives:

- **Integrate existing nano micro facilities into a sustainable network**
- Generate **new scientific and technical solutions**, crossfertilisation of skills
- **Align the offer of services with industry needs**
- Interact with regional clusters to **facilitate the uptake of scientific advances by SME's**
- Achieve sufficient integration of the Danube Nano Micro Facility Network

Address the whole value chain:



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Barcelona, Spain

May 15 - 17, 2017

R&D NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICPE – CA

313 Splaiul Unirii sector 3 Bucharest - 3, RO - 030138
ROMANIA

http://www.icpe-ca.ro/

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Barcelona, Spain

May 15 - 17, 2017

Areas of expertise:

- Fundamental and applicative research in the field of electrical engineering
- Technical assistance and consultancy in the field of electrical engineering; Information, documentation and personnel training in the field of electrical engineering
- Technology transfer.

Main R&D directions:

- Advanced Materials: functional / multifunctional, crystalline and nanostructured materials and composites
- New sources of energy (wind energy, solar energy, fuel cells, biogas, hydro-energy, hydrogen storage): conversion, saving and recovery
- Micro-Electromechanical technologies and systems: nonconventional electrical engineering

Services offer:

Technical assistance, supply of scientific and technological services to companies and to any beneficiaries which are interested in testing laboratories:

- Lab. of Characterization and Testing of Electrical Materials and Products;
- Lab. of Electromagnetic Compatibility;
- Lab. of Evaluation of Thermal Behavior of Products and Materials by Thermal Analysis;
- Lab. of Testing for Micro and Nano-Electromechanics

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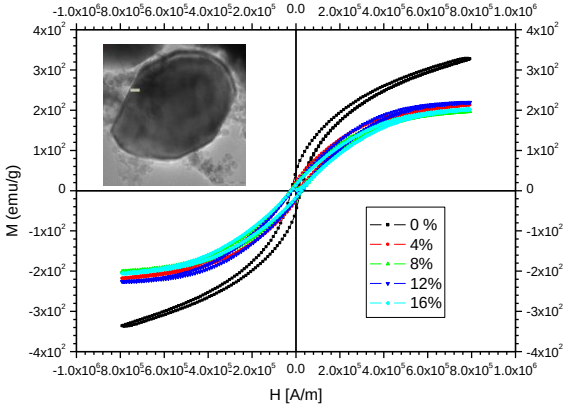
Barcelona, Spain

May 15 - 17, 2017

Recent research results and applications:

STAR project: "Magnets made by nanocomposites materials used in high speed electric motors manufacturing"

FeCo nanopowders, electrically insulated, for high frequency applications ($FeCo/Al_2O_3$ core-shell nanoparticles) Physical characteristics: saturation magnetization: 100 - 200 emu/g; coercivity: 14,35 kA/m; resistivity: after sintering, of about 10^{14} Ω·m.



Hysteresis loops of $FeCo/Al_2O_3$ with different amounts of Al_2O_3 precursor salt and HR-TEM image of $FeCo/Al_2O_3$ nanopowders

Advantages: ▲increasing of the saturation magnetization, due to the FeCo FeCo particles;▲ improvement of the resistivity, due to the presence of Al_2O_3 layer;▲ decreasing of the magnetic losses;▲ improvement of the mechanical strength for the bulk sized components, compared with the currently available FeSi alloys, used as metallic punched sheets for the building of magnetic cores.

Rings, rotor si stack from 4 sintered rotors

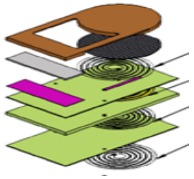
Industrial cooperation:
transferred to ROSEAL Odorheiu Secuiesc company.

Contact person: *Dr. Mirela Maria CODESCU (email: mirela.codescu@icpe-ca.ro)*

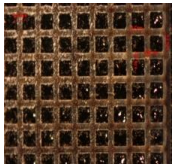
PNII project: "Electromagnetic and electrodynamic actuators manufactured through LIGA technology"

Industrial cooperation: transferred to
Apel Laser Co.

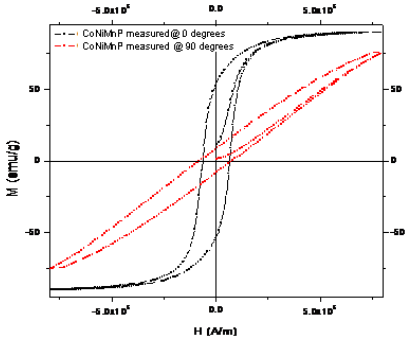
The current trend of miniaturization and reducing consumption of raw materials and energy is subject to the development of micromechanics processing facilities.In this regard, INCDIE ICPE-CA develops microtechnologies for microelectromechanical systems, processing and control procedures in the field of micro and high precision manufacture.



Electromagnetic microactuator



Electroplated CoNiMnP permanent magnets in SU8 pattern, optical microscopy, x 50



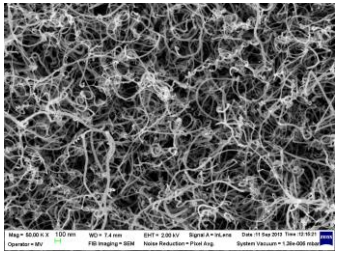
Hysteresis loops anisotropic CoNiMnP thick layers

Contact person: *Dr. Cristinel ILIE (email: cristinel.ilie@icpe-ca.ro)*

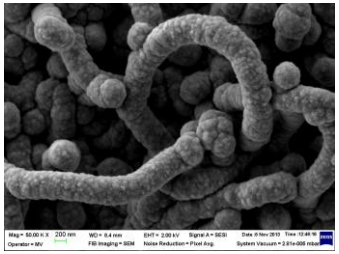
International cooperation:

MNT ERA NET project CarPolCap ("Mini-supercapacitors technology, based on hybrid CNT/CNF - electroactive polymer networks") 2012 - 2015

The supercapacitor based on hybrid electroactive polymer–carbon nanostructures consist of a positive electrode (electrochemically deposited polypyrrole on CVD grown carbon nanotubes), a negative electrod (CVD grown carbon nanotubes), an electrolyte containing specific adds and a separator membrane.



Negative electrod – CNTs based material



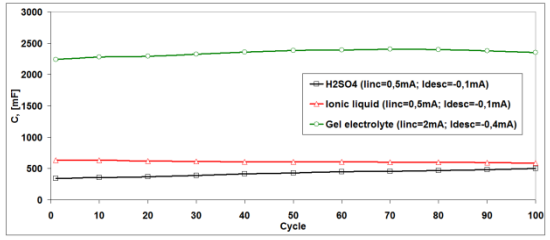
Positive electrod -polypyrrole deposited by cyclic voltammetry on CNTs

General specifications of supercapacitor based on hybrid electroactive polymer - CNT nanostructures

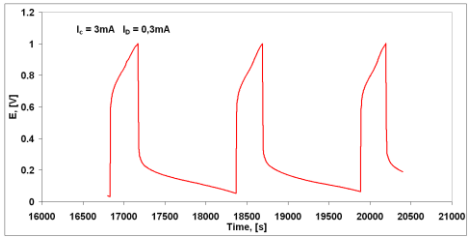
Voltage: 0 – 1 V;
Specific capacity: 50 – 150 mF/cm^2;
Total capacity: 500 – 2500 mF;
Frequency: 10 – 100 mHz;
Dissipation factor: <1.

Electrochemical parameters obtained by circular regression from *Nyquist plot*

R_s, Ω*cm^2	R_p, Ω*cm^2	C_{dl}, µF/cm^2
589,9	490,8	64850
6,34	565,6	4,44



Evolution of capacity for different electrolytes



Selection of charge – discharge curves

Applications:
Common electronic appliance, alternative energy sources, such as electric motors and on chip applications.

Contact person: *Dr. Adela BARA (email: adela.bara@icpe-ca.ro)*

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May 15 - 17, 2017

National Institute of Research and Development in Mechatronics and Measurement Technique INCDMTM Bucharest

Sos. Pantelimon, Nr. 6-8, Sector 2
Bucharest, Romania

http://www.incdmtm.ro

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Barcelona, Spain

May 15 - 17, 2017

Areas of expertise:

INCDMTM, a quasi - governmental organization, established by the national law for promoting R&D activities, has become a **National Technological Pole of Competitiveness and Excellence in Romania** in the field of the fundamental and industrial researches; technological developments; technical and economic regulations, with national or regional applicability and elaboration of development strategies for national and European **Precision Mechanics, Mechatronics and Cyber-MixMechatronics, Integronics, Adaptronics and Intelligent Measurement Technique industries**.

Services offer:

» Mechatronic and Cyber-MixMechatronic systems
» intelligent measurement technique, automatic and computerized electronic control
» equipment and integronic, adaptronic, mechatronic devices for multi-parameter integrated control
» non-electric physical quantities control
» innovative technologies
» tribotechnology
» intelligent mechatronic, integronic and adaptronic biomedical equipment
» intelligent robotic systems
» methodologies, standards, testing and certification
» links with industry; » technology transfer; » development and sustainability strategies, etc.

23rd World Smart Systems & Micromachine Summit 2017

Barcelona, Spain

May 15 - 17, 2017

Recent research results and applications:

INCDMTM has a lot of research results that have industrial and medical applications like:

- computer-aided intelligent complex measuring and integrated control equipment (e.g. MECHATRONIC EQUIPMENT FOR MULTIPARAMETRIC MEASUREMENT OF THE INNER AND OUTER RINGS OF BALL AND ROLLER BEARINGS; MECHATRONIC SYSTEM FOR MEASURING THE ROLLING ROLING PROFILE OF THE RAILWAY WHEELS IN ORDER TO OPTIMIZE THE SHEAPING/ RESHAPING ON CNC MACHINE TOOLS, etc.);
- Quality control equipment (e.g. SPECIALIZED EQUIPMENT FOR CALIBRATION IN-LINE APPLIANCES FOR TESTING PHYSICAL PARAMETERS OF WATER QUALITY; LEVEL INDICATOR WITH HALL CELLS, etc.);
- Biomedical devices and systems (e.g. SELECTIVE LASER SINTERED COMPONENTS USED IN BIOMEDICAL RESEARCH WITH DIRECT APPLICABILITY ON SELECTED PATIENTS, etc.);

Industrial cooperation:

INCDMTM has a good cooperation with industrial partners, active in the domain of **processing and machinery industry**, but especially with those from **the automotive domain**.

INCDMTM had transferred and implemented in the industrial environment many intelligent mechatronic systems and equipment, having high-tech level and being unique in Romania.

In 2017, for the automotive industry, **INCDMTM realized, transferred and implemented three high-tech intelligent mechatronic equipment and systems for dimensional and tightness control** and has another one in the course of delivery.

International cooperation:

INCDMTM had many international collaborations with EU universities, R&D institutes and SMEs in common R&D&I projects under the EU Programmes: FP7, Interreg IV C, etc.
Also, it is very active in partnerships for projects' proposals for different EU Programmes like: H2020, Interreg Europe, Danube Transnational Programme, etc.

23rd World Smart Systems & Micromachine Summit 2017

Barcelona, Spain

May 15 - 17, 2017

Other activities / events:

INCDMTM is a member of: • Romanian Chamber of Commerce and Industry, Bucharest - CCIB; • General Engineers' Association in Romania - AGIR; • Romanian Society of Mechatronics - SROMECA; • Association of the Romanian Patronage in Precision Mechanics, Optics and Mechatronics Industry - APROMECA; • Patronal Confederation from Romanian Industry – CONPIROM; • Innovative Strategic Cluster for the smart specialization field of Mechatronics – MECHATREC, etc.

Besides the R&D Laboratories, INCDMTM has: • Relay Centre for Technological Transfer and Consultancy CRTTC–INCDMTM; • Centre for Evaluation of Professional Competences in Mechatronics CE–MECATRON; • Centre for Professional Training in Mechatronics CF–MECATRON.

INCDMTM is coordinated by the Ministry of Research and Innovation – MCI and in 2013 has been the subject of an international evaluation process and received the highest qualification: A+.

Contact person: Prof. Univ. Dr. H. C. EurEng, PhD. Eng. Gheorghe GHEORGHE – INCDMTM General Manager
E-mail: incdmtm@incdmtm.ro; geocefin@yahoo.com; tel: +40212523068; fax: +40212523437; M: +40730014073

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ROMQUARTZ S.A.

126 A Erou Iancu Nicolae Str., et. 5, 077190, Voluntari-Ilfov, Romania

www.minatech.ro/romquartz

Recent research results and applications:

SH-SAW sensor fabrication on $LiTaO_3$ for mass detection in liquid media

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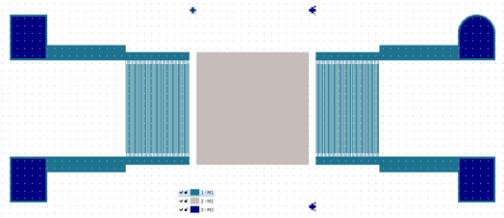
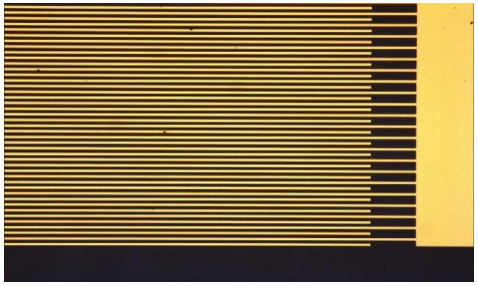
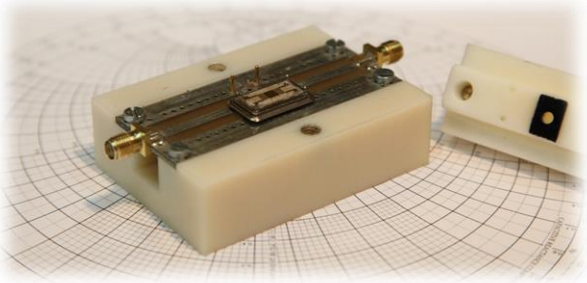
SH-SAW microfabrication



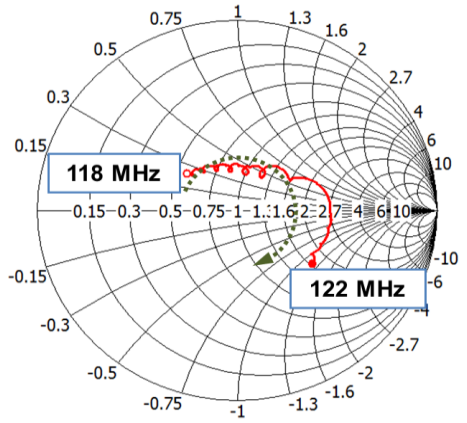
Device Layout (CleWin)



IDT optical image

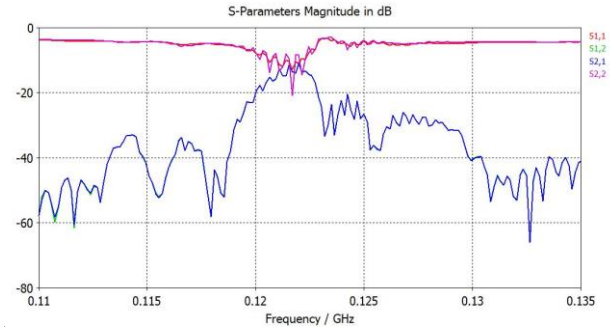


Packaging



Input impedance -behavior fairly similar to a transmission line (dotted green)

Electrical characterization



Resonant frequency: 122 MHz

SH-SAW sensor fabrication on $LiTaO_3$ for mass detection in liquid media

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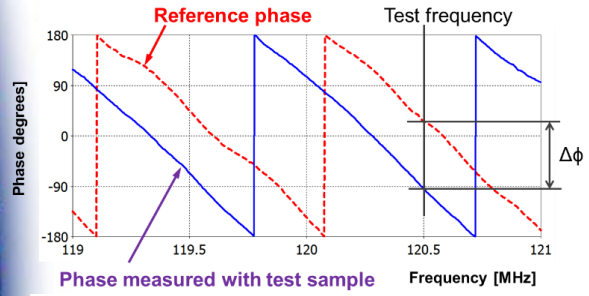
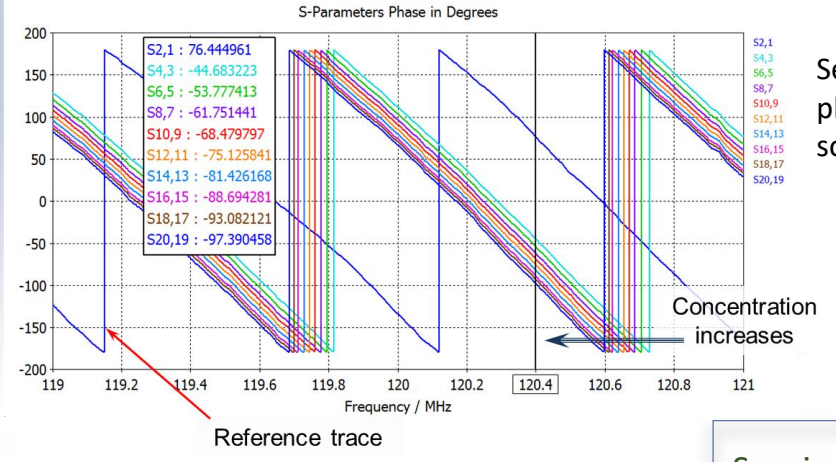
Phase shift calculation

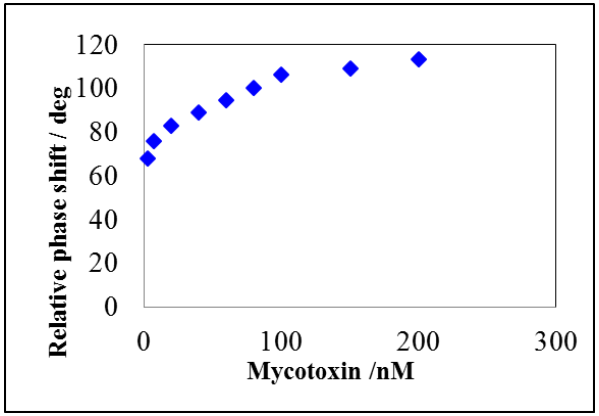


Phase response: suitable for mass and surface stress/strain sensing



Set of experimental phase characteristics vs. solution's concentration

Sensor's chemical response



Detection of mycotoxin's concentration

Detection of high molecular weight targets analyte, direct in liquid samples, using label-free immuno-interactions.

Sensing platforms integrating biomimic systems for rapid screening of undesirable substances in food (SAFETYFOOD), Contract No. 107/2012, Coordinator: University of Bucharest, Po. ROMQUARTZ S.A - IMT- Bucharest cooperation

Contact: *Drd. Angela Baracu, angela.baracu@imt.ro*

Ing. Monica Nedelcu, romquartz@minatech.ro

Bulgaria

Nanotechnology Companies

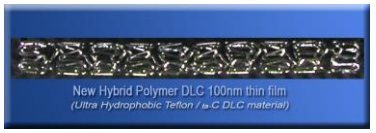
Multicoats

- established in 2003 as a joint Bulgarian/German start-up company

• ***Applied scientific research***: laser based nano coating technologies; medical implants, Drug Delivery Systems, Nano Medicine; Sensors and Biosensors; Special Utility Lasers, Measuring tools and peripherals

DLC coated SS 316 LVM Stent

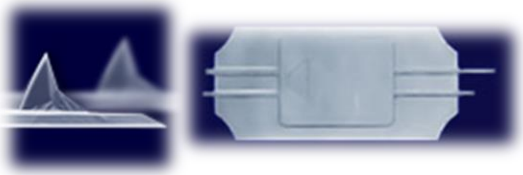
• ***Manufacturing*** (at request only): Complete modules for nano depositions; products and devices based on ultraThin, Thin Films and nano Coatings; complete Laser systems; Sensor devices; medical implants (Stents), Drug Delivery Systems' components



• ***Assembling***: Complete Production Lines for medical devices and coatings

Innovative Solutions Bulgaria Ltd.

BudgetSensors® is a registered trade mark of Innovative Solutions Bulgaria Ltd. It acquired in 2011 Bulgaria's largest MEMS fab. The company is specialised in a variety of Atomic force microscopes (AFM) probes.



All-in-One probes

Smartcom

Developing new technologies in the design and production of microchips

Intensive research on **Electrical Filters**
- design of high stable, high accuracy filters based on Film Bulk Acoustic Resonators (FBAR)

MICROELECTROMECHANICAL systems design, modeling and characterization

- partnership with Technical University of Sofia and Sofia University

NANOTECH GROUP LTD.

- founded in 2012, in the city of Plovdiv, Bulgaria

- provide high quality service in the application of hard wear-resistant coatings on cutting tools, with a focus on carbon-based nanocomposites

Nanotechnology Education and Research

Bulgarian Academy of Sciences

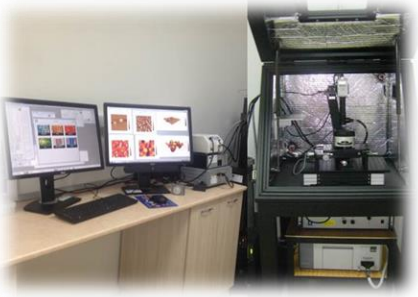
"Georgi Nadjakov" Institute of Solid State Physics

- **FUNCTIONAL MATERIALS AND NANOSTRUCTURES**
  Physics of materials and low temperatures; Kriogenni technology; Physical problems of **microelectronics**; Acoustoelectronics; Biocompatible materials
- **Nanotechnology centre**
- **NANOPHYSICS** - Photoelectrical and optical phenomena in a wide band gap semiconductors

Institute of Optical Materials and Technologies "Acad. Jordan Malinovski"

Laboratories for Electron Beam Microscopy, X-ray Analysis, Auger Analysis, Photolithography, Holographic Recording Media, Optical Characterization, Atomic force microscopy, Vacuum Deposition of Thin Layers, Pulse Lasers, Wet Deposition of Thin Layers

Electron Beam Microscopy



Atomic force microscope MFP-3D, Asylum Research, Oxford Instruments

Institute of System Engineering and Robotics (ISER) "Saint Apostle and Gospeller Mathew" of Bulgarian Academy of Sciences - established in 2010, based on joining the former Institute for Control and System Research (ICSR) and Central Laboratory for Mechatronics and Instrumentation (CLMP)

Department **"Sensors and measurement technologies in robotics and mechatronics"**:

- design, investigation and application of specialized sensors, micro- and nano-systems, intelligent sensor-information systems, actuators and interfaces;
- contactless measurement of electric current, capacity and energy for the power industry and electrical automobiles;
- antiterrorist solutions and technologies;
- education of PhD and master students and specializants in areas like sensorics, control-measurement instrumentation, atomic-force microscopy.

Division "System Engineering":

- integrated systems in the fields of the national security and defense;
- systems with complex interdependencies and limited ability for centralized management;
- distributed information systems for collecting, processing and information exchange in real time;
- systems that are potentially subject to attacks (objects of critical infrastructure) and control of dynamic systems based on intelligent technologies

University Of Sofia

- **Laboratory of Nanoparticle Science and Technology (LNST),** Faculty of Chemistry, Department of Inorganic Chemistry - develop **new nanomaterials**
- **Monte Carlo Group** - mechanical and electrical properties of defective single wall carbon nanotubes by means of classical Molecular Dynamics simulations and density functional computations (Ab Init; Quantum Esspresso; Real Space DFT)

University of Chemical Technology and Metallurgy

Faculty of Metallurgy and Material Science, Department of Metallurgy of Non-Ferrous Metals and Semiconductors Technologies:

- Materials and technologies for production of discrete and integral components for the micro-, nano- and radio-electronics, sensorics, energetics
- Pure and supra pure materials for the electronics, electrotechnics, pharmacy
- Synthesis and characterization of nanomaterials

Technical University of Sofia

Faculty of Electronic Engineering and Technologies, Microelectronics Department

"Sofia Tech Park" JSC

- founded in 2012, owned by the Ministry of Economy and the State Consolidation Company

Micro Nano Lab – MINOLab

- applied and innovative scientific research, testing, analyzing, designing and prototyping in the field of micro- and nanoelectronics, bioelectronics and nanotechnology applications

Activities:

- Early detection and correction of errors and failure analysis of micro and nanoelements, projects, modules and systems, and prototypes at chip level.
- Design at circuit- and element-level and creation of prototypes.
- Measurements of integral circuits and systems, circuit boards and devices.
- Development and testing of devices at circuit- and system-level, including embedded systems

Sofia Tech Park JSC signed in January 2017 a Memorandum of Understanding (MoU) with **IMEC**, **Belgium**, the world-leading research and innovation hub in nanoelectronics and digital technology, for collaboration on projects in the field of nanoelectronics and nanotechnology.

Sources:

- *"Nanotechnology in Bulgaria: Market Report", AZoNano*
- *Bulgarian Academy of Sciences*
- *http://www.nanowerk.com/*

Czech Republic

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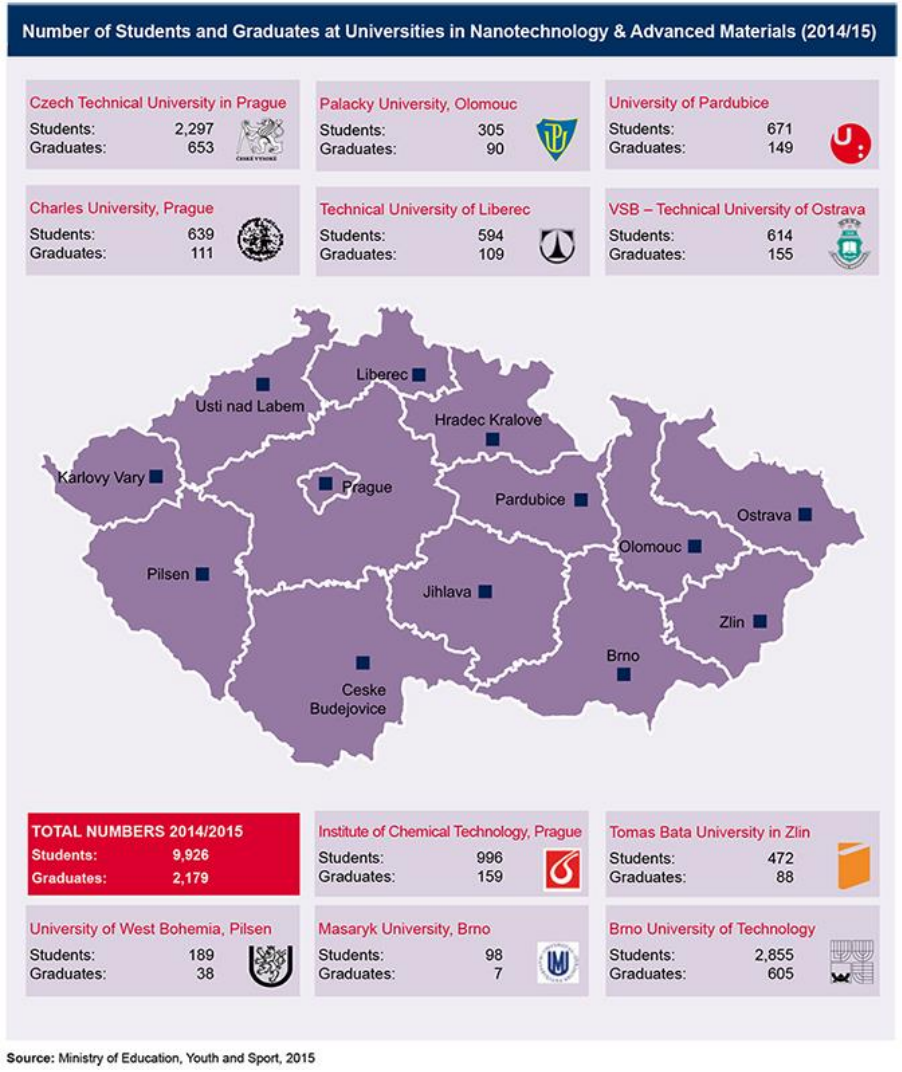
The dynamically developing nanotechnology sector is penetrating a full range of various fields: **automotive, aviation**, **textile** and **chemical industries**.

The absolute majority of domestic firms involved in nanotechnology are **companies** that need to rapidly internationalise and find business partners abroad in order to be successful: Elmarco, TESCAN ORSAY HOLDING or Contipro.

There are **more than 9,900 university students enrolled in studies programmes related to nanotechnology and advanced materials**.



New, outstanding research facilities

CEITEC - Central European Institute of Technology

A **multidisciplinary science centre** focused on **life sciences, advanced materials, nanotechnologies and microtechnologies.**

CEITEC Nano is **Czech Republic's largest cleanroom nanocentre**, acknowledged by Ministry of Youth, Sports and Education of the Czech Republic as **Large Infrastructure for Research, Experimental Development and Innovation**.

6 partnering institutions
557 researchers
7 research programmes

61 research groups
25 000 m2 of new laboratories
10 core facilities

- Nanofabrication laboratory: ISO class 5 (US 100) cleanroom of 356 m²
- Nanocharacterization laboratory: ISO class 8 (US FS 100,000) cleanroom with an area of 1,337 m²
- Structural analysis laboratory: 300 m² of ISO class 8 (US FS 100,000) cleanroom

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Institute for Nanomaterials, Advanced Technologies and Innovation, Technical University of Liberec

Research centre established in 2009.

MATERIALS RESEARCH

- Preparation and analysis of nanostructures
- Physical measurements
- Nanomaterials in natural sciences
- Nanotechnology and informatics
- Metamaterials

ENGINEERING

- Machinery design
- Vehicles and engines
- Industrial technology
- Mechatronic systems
- System integration

Regional Centre of Advanced Technologies and Materials

- Magnetic nanostructures
  - Carbon Nanostructures, Biomolecules and Simulations
    - Biologically Active Complexes and Molecular
      - Magnets Optical and Photonic Technologies
        - Nanomaterials in biomedicine
          - Nanotechnology in Analytical Chemistry
            - Environmental Nanotechnologies

High-resolution TEM

X-ray photoelectron spectroscopy (XPS) PHI 5000 VersaProbe II („XPS scanning microprobe“)

Optical development centre for nanosurfaces

Czech Nanotechnology Cluster

- build a strong group of closely cooperating nanoproduct suppliers, businesses using nanotechnologies in their products and research and educational institutes operating in this sphere
- the cluster is based in the Olomouc Region, Czech Republic

Technical University of Ostrava - Nanotechnology Centre

Departments:

- Bionanotechnology
- Inorganic Analysis
- Materials Testing
- Organic Analysis and Catalytical Processes
- Technology and Structure of Nanomaterials

Education: bachelor, master and PhD programmes in nanotechnology

Sources:
http://www.czechinvest.org/en/nanotechnology-advanced-materials
http://www.nanowerk.com/

Hungary

Nanotechnology Education and Research

Budapest University of Technology and Economics, Department of Electron Devices

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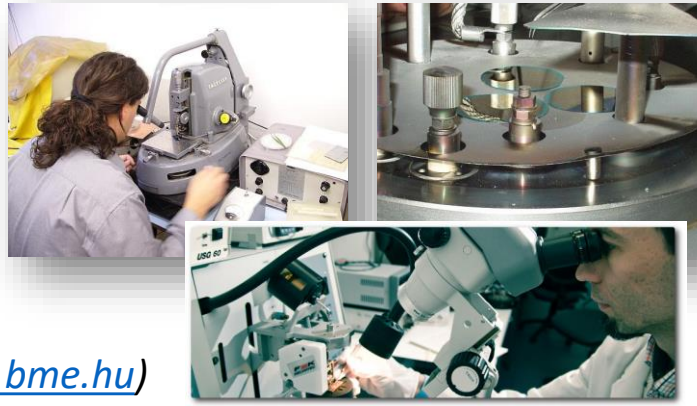
May 15 - 17, 2017

- research and education is carried out in all the fields of the theory, design, manufacturing and testing of semiconductor devices, micro- and nanoelectronics, VLSI electronics, semiconductor sensors, energy transfer systems, MEMS and systems in a package
- a special field of activity is related to the multiphysical, especially thermal, electro-thermal, thermo-optical issues in electronics, micro and nanoelectronics

R&D fields and laboratories:

- Investigation of IC thermal problems
- Characterisation of semiconductor surfaces and very thin oxides
- Optoelectronics
- Media and system informatics field



Contact: Dr. István Bársony (barsony@eet.bme.hu)
Dr. József Gyulai (gyulai@eet.bme.hu)

University of Szeged

Education, Research, Development, Innovation

Nanotechnology and materials science:

- examination of nanodispersions, self-organizing films and biocomposite materials and research of nanostructured materials.

Environmental- and nanotechnology Regional Science Centre, **Nanotechnology subprogramme**:

- develop functional materials to be used in portable highly sensitive sensors
- development of catalysts suitable for application in fuel cells, to be applied in motor vehicles in the near future.

Contact: Dr. Tibor Kovács (info@knret.u-szeged.hu)

University of Pannonia

Doctoral School of Molecular- and Nanotechnologies:
Materials engineering, MEMS and NEMS technology, functional micro- and nanoparticles, nanocomposites and nanostructured coating, development of new sensing principles, nanocatalysts, bionanotechnology, directed evolution and protein design

Contact: Head of School: Prof. Dr. Ferenc Vonderviszt (von007@almos.uni-pannon.hu)
Secretary: Zita Vereskuti (vereskuti@mik.uni-pannon.hu)

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Barcelona, Spain

May 15 - 17, 2017

Institute for Solid State Physics and Optics

Departments involved in in-depth nano-based research:

- Neutron Spectroscopy Department
- Theoretical Solid State Physics Department
- Experimental Solid State Physics Department
- Department of Complex Fluids

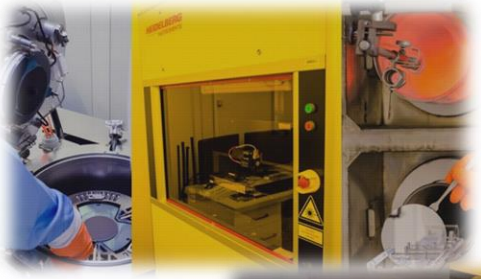
Hungarian Academy of Sciences

Institute of Technical Physics & Material Sciences, Centre for Energy Research

Departments: Thin Film Physics; Microtechnology; Nanostructures; Nanobiosensorics; Photonics; Complex Systems

MEMS Laboratory, part of Microtechnology Dept.

- Competences: **Si MEMS; NEMS; BioMEMS**
- Clean room services:
  Chemical Depositions; Cleaning; Dry Etching; High-Temperature Processes; Ion Implantation; Mask Design & Fabrication; Photolithography; e-beam lithography; Physical Depositions; Wafer Bonding; Wet Etching; Packaging and testing; Materials characterizations



Contact: Dr. Gabor Battistig, nominated PC expert for H2020 NMBP (battistig.gabor@ttk.mta.hu)

Nanotechnology companies

NANOBAKT Ltd.

- applications of nano silver (additives, Nanosept disinfectant, prosthetics)
- development and manufacturing of titanium nanotubes and nano iron

Contact: info@nanoirontechnology.com

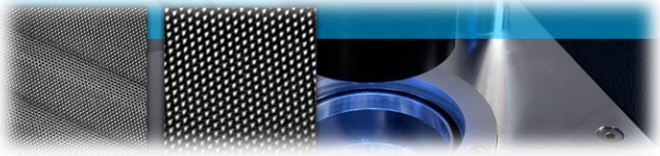
NanGenex

- a Druggability Enabling High Throughput NanoActive™ Technology Platform Company
- provides breakthrough solutions to pharmaceutical and biotech companies in order to develop new generations of NanoActive products with significant performance benefits over conventional approaches.

Contact: partnering@nangenex.com

Technoorg Linda Ltd.

- developing and manufacturing of ion technology based instruments for extended use in specimen preparation and depth profiling connected to transmission- and scanning electron microscopy



Contact: Dezső Szigethy, d.szigethy@technoorg.hu

23rd World Smart Systems & Micromachine Summit 2017

Barcelona, Spain

May 15 - 17, 2017

ThalesNano

- specializes in developing and providing microscale flow instruments for chemistry by exploiting benefits of combining microfluidics, mesofluidics and nanotechnology with flow chemistry.

Contact: Dr. Gabor Szirbik, info@thalesnano.com

GetNano Ltd.

- specializes in nano coatings distributing H2OFF® products available through so-called Nano Stops. Their automobile products guarantee safe & sound & cost-effective solutions for windshields, plastic covers, bodies and alloy wheels alike.

Sources:

- *"Nanotechnology in Hungary: Market Report", AZoNano*
- *National research, Development and Innovation Office http://nkfih.gov.hu/hungarian-innovation/environmental-and-150128*
- http://www.nanowerk.com/

Republic of Moldova

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National Center for Materials Study and Testing (NCMST)

within the Technical University of Moldova

http://www.ncmst.utm.md/

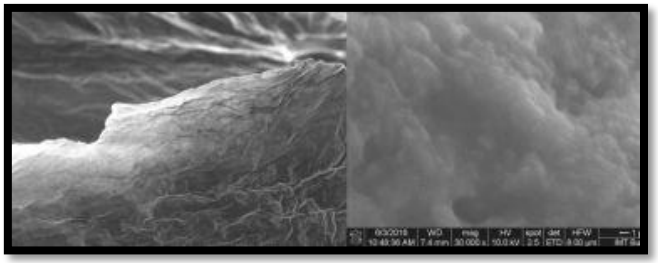
created under the financial support from US Civilian Research and Development Foundation and under the auspices of the Moldavian Research and Development Association in 2001

Research areas:

- ❑ Nanotechnologies
- ❑ Nanotemplates for nanofabrication
- ❑ Development of metamaterials for photonics and nonlinear optical applications
- ❑ Nanocomposite materials
- ❑ Gas sensors

Recent results:

Dec. 2016: **Graphene aerogel makes for ultra-lightweight pressure sensors based on graphene aerogel decorated by piezoelectric SnO2 or GaN nanocrystalline thin films**



Collaboration between **IMT Bucharest, Romania** and the **Academy of Sciences and Technical University in Chisinau**, **Republic of Moldova**

Applications: **automotive and aeronautic industries**

Contact: Prof. Ion Tighineanu (Tiginyanu), Director

ncmst@mail.utm.md, tiginyanu@yahoo.com

Ghitu Institute of Electronic Engineering and Nanotechnologies

http://nano.asm.md/

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Barcelona, Spain

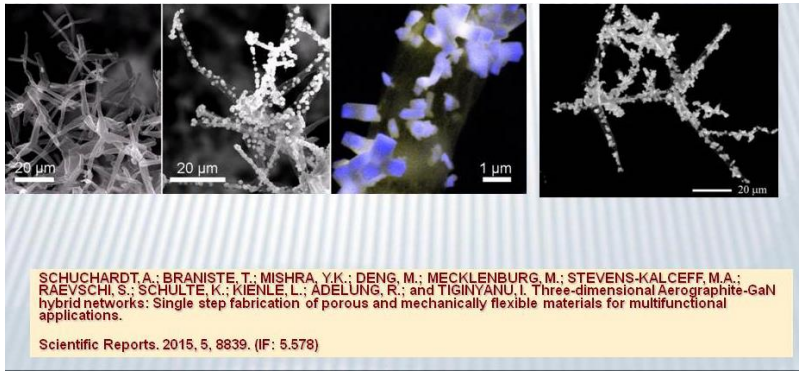
May 15 - 17, 2017

Applied researches:

- **Microtechnologies of solid state materials and structures for engineering of electronic devices and functional systems**:
- **Electronic structures, sensors, and devices for investigation of biophysical properties under nonthermal nonionizing radiation and for measurement of pressure in industrial processes**
- Design and fabrication of medical equipment and technique.

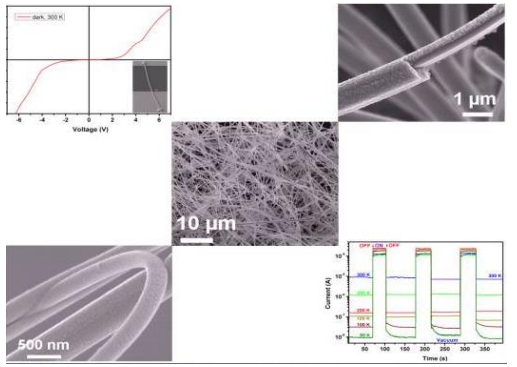
Laboratories:

- Nanotechnologies
- Electronics of Low Dimensional Structures
- Solid State Structures
- Cryogenics
- Medical Technique



SCHUCHARDT, A.; BRANISTE, T.; MISHRA, Y.K.; DENG, M.; MECKLENBURG, M.; STEVENS-KALCEFF, M.A.; RAEVSCHI, S.; SCHULTE, K.; KIENLE, L.; ADELUNG, R.; and TIGINYANU, I. Three-dimensional Aerographite-GaN hybrid networks: Single step fabrication of porous and mechanically flexible materials for multifunctional applications.

Scientific Reports. 2015, 5, 8839. (IF: 5.578)



LUPAN, O.; BRANISTE, T.; DENG, M; GHIMPU, L.; PAULOWICZ, I.; MISHRA, Y.K.; KIENLE, L.; ADELUNG, R.; TIGINYANU, I. Rapid switching and ultra-responsive nanosensors based on individual shell-core Ga2O3/GaN:Ox@SnO2 nanobelt with nanocrystalline shell in mixed phases. *Sensors and Actuators B: Chemical*. 2015, 221, 544-556. (IF: 4.097)

Contact: Prof. Anatolie Sidorenko, Director

anatoli.sidorenko@kit.edu

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ELIRI - a joint stock company

http://www.eliri.md/

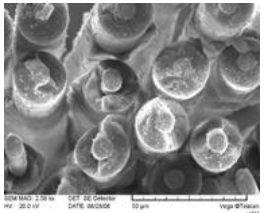
– former research institute since 1959, became a joint stock company in 1996

Scientific and technical activities

- ❑ **Hybrid and integrated microelectronics**

- hybrid technology of integrated microelectronics, on the basis of which elaborates and manufactures custom hybrid chips and functional units (up to the third degree of integration): filters, voltage regulators, amplifiers, resistance and resistance-capacitance assemblies, emitter and receivers of infrared radiation and others

- ❑ **Microwire-based products**
- ❑ **Nanocompositions**



A piece of integrated composite structures from magnetic microconductor

Contact: Marcel Varlan, General Manager
marcel.varlan@eliri.md