



## PARTNER PRESENTATION AND INTEREST IN HORIZON EUROPE PARTICIPATION

Name of the organisation	National Institute of Research and Development for Technical Physics (NIRDTP)
Country	Romania
Type of organisation	Research Institute
Short description	The <b>National Institute of Research and Development for Technical Physics</b> belongs to the network of national institutes coordinated by the Ministry of Research, Innovation and Digitalization. The mission of NIRDTP Iași is to conduct research, development, and innovation activities in the field of materials with novel structures and properties, devices, apparatus and equipments based on such materials, new preparation methods and characterisation techniques and nondestructive evaluation, electrical and magnetic separation methods, and special materials and devices with applications in engineering, medicine and biotechnology. The implementation of these research activities is based on the work conducted in the frame of national and international programs, as well as technological development contracts with Romanian and international companies.
Laboratories	1. Magnetic Materials and Devices Department (MDM) 2. Non-Destructive Testing Laboratory (NDT)
Contact person	Dr. Nicoleta LUPU, General Director
Phone	+40-232-430680
E-mail	<a href="mailto:info@phys-iasi.ro">info@phys-iasi.ro</a>

### Short description of Laboratory/Faculty Department involved

The activities developed by the MDM Department are mostly in the field of micro- and nanotechnologies, being mainly based on preparation, characterization and applications of advanced materials with specific structures and properties.

The NDT laboratory has a long and sustained record of being at the forefront in developing novel electromagnetic and ultrasound NDT technologies, for both the defense and civilian sectors.

### Expertise

The main research and development objectives of NIRDTP's Iasi are:

- preparation and characterization of advanced materials and nanomaterials with special properties and structures;
- applications based on advanced materials/nanomaterials: sensors and sensors arrays, transducers, actuators, measuring systems;
- applications based on new phenomena, including magnetic nondestructive testing methods and magnetometry.

The main scientific and technological research directions concern the development of:

- new magnetic micro/nanodimensional materials, e.g.: micro- and nanowires; nanowire arrays; micro- and nanopowders; nanocomposites and mesoporous materials; multilayer thin films;
- new bulk amorphous, nanocrystalline or nanocomposite materials, e.g.: high coercivity bulk amorphous materials, bulk amorphous and nanocomposite soft magnetic materials, new bulk shaped permanent magnets, etc.;
- new multidisciplinary applications based on novel advanced multifunctional materials prepared at NIRDTP Iași, e.g.: (i) magnetic sensors (electric and magnetic field, flowmeters, etc.); (ii) spintronic devices; (iii) sensors for (bio)medical applications; (iv) sensors and actuators based on magnetoelastic effects; (v) non-destructive control sensors, etc.

#### Involved persons. Short CV

- 1) **Dr. Nicoleta Lupu** ([nicole@phys-iasi.ro](mailto:nicole@phys-iasi.ro)) received Dipl.-Ing. in Applied Physics, M.Sc. and Ph.D. (Magna Cum Laude) in Physics from “Alexandru Ioan Cuza” University of Iași (Romania). She joined the National Institute of R&D for Technical Physics (NIRDTP) of Iași in 1997. She was the Head of Magnetic Materials and Devices Department from 2004 to 2011. She was a JSPS fellow in 2000 at the Institute for Materials Research, Tohoku University, Sendai (Japan), postdoctoral fellow at LTPCM-ENSEEG, Institut National Polytechnique de Grenoble (France) in 2002 and 2003, Institute for Materials Research (IMR), Tohoku University, Sendai (Japan) from 2003 to 2004, and Institut Laue-Langevin (ILL) and European Synchrotron Radiation Facilities (ESRF), Grenoble (France) from 2004 to 2005. She was visiting Associate Professor at L'Université du Maine, Le Mans (France) in 2006 and IMR, Tohoku University, Sendai (Japan) in 2010 and 2012, and visiting Professor at IMR, Tohoku University, Sendai (Japan) in 2015. Dr. Lupu is the General Director of NIRDTP since 2011. Dr. Lupu was PI of over 30 projects, including 4 European ones and 6 international ones. Her research focusses on magnetic and magnetoelectric materials; sensors and devices; physics and chemistry of surfaces and interfaces; nanoparticles and nanowire arrays; structurally disordered materials; hydrogen storage materials; magnetoelastic processes, including energy harvesting devices and storage and transportation of energy; magnetic sensors and actuators.
- 2) **Dr. Tibor-Adrian Ovari** ([taovari@phys-iasi.ro](mailto:taovari@phys-iasi.ro)) has an extensive experience in the investigation of wire-shaped rapidly quenched amorphous magnetic materials, starting with the amorphous glass-coated microwires, and continuing with the amorphous submicron wires and nanowires. His focus was on the practical aspects of such materials, e.g., their use as sensing elements in various types of magnetic sensors, or as magnetic domain wall conduits for magnetic logic applications. He pursued postdoctoral research at the Institute of Materials Science in Madrid (ICMM-CSIC), at Ecole Polytechnique Montreal, and at the Wolfson Centre for Magnetism Technology at Cardiff University, UK. After his return to the National Institute of Research and Development for Technical Physics in Iași, Romania, Dr. Ovari has continued to study various aspects of amorphous glass-coated microwires, such as the inter-domain wall in amorphous microwires. He was a member of the team that produced and studied for the first time ever the rapidly quenched amorphous submicron wires. These new, ultrathin cylindrical magnetic amorphous nanomaterials have become the main focus of his research activity. The mobility, pinning and displacement of domain walls in rapidly quenched nanowires have been also thoroughly investigated. The basic interactions in such materials, their overall hysteresis behavior (magnetization reversal), and their magnetic anisotropy have been of great interest as well. Some of most important advances in this field have been put together in a book chapter published in 2015: “Magnetic nanowires and submicron wires prepared by the quenching and drawing technique” in *Magnetic Nano- and Microwires: Design, Synthesis, Properties and Applications* (M. Vázquez, Ed.), Woodhead Publishing (Cambridge), pp. 199-223, 2015. More recently, Dr. Ovari has begun to investigate cylindrical nanowires with nanocrystalline structure made from amorphous precursors, alongside the micromagnetic analysis of magnetization reversal in amorphous glass-coated nanowires and the use of electrical currents to drive the

domain walls in cylindrical magnetic wires. Dr. Ovari has published over 130 papers, three book chapters, and co-authored two patents on the applications of amorphous magnetic glass-coated wires. He was the principal investigator for several projects.

- 3) **Dr. Horia Chiriac** ([hchiriac@phys-iasi.ro](mailto:hchiriac@phys-iasi.ro)) received the B.Sc. and Ph.D. degrees in physics from the Alexandru Ioan Cuza University of Iași, Romania. His research topics are production and characterization of amorphous and nanocrystalline magnetic materials as ribbons, wires, and glass-coated wires, thin films, and powders; theoretical studies on the correlation between the preparation conditions of amorphous and nanocrystalline metallic materials and their magnetic properties; theoretical models for the explanation of magnetization processes, magnetoelastic properties, and new magnetic phenomenon in amorphous and nanocrystalline magnetic materials; medical and biomedical applications of magnetic materials, such as magnetic hyperthermia, magneto-mechanical effect for cancer treatment, drug carriers, sensors for medical applications. Dr. Chiriac is senior consultant in the field of magnetic materials and their applications for research institutes and companies from Europe and North America, Director of Research at NIRDTP since 2011. He was the General Director of NIRDTP Iasi between 1989 and 2011. Published over 400 ISI papers, is co-author of 8 scientific books (5 published by international Publishing Houses) and 40 patents, from which 6 are international (USA-1, Europe-2, Canada-1), led/is leading over 50 projects and 40 partnership projects (4 FP6, 1 FP7, over 10 international projects in collaboration with companies from U.S.A. and Europe, NATO and PHARE projects and over 20 bilateral projects.
- 4) **Dr. Savin Adriana** ([asavin@phys-iasi.ro](mailto:asavin@phys-iasi.ro)) has significance experience and expertise in the development of sensors and transducers for electromagnetic nondestructive examination, modeling of the electromagnetic nondestructive examination sensors and transducers, development of metamaterials for functioning in the domain of radio and microwave frequencies. Dr. Savin performed extensive studies on new types of electromagnetic transducers for materials composites and nanocomposites and investigated the mechanical and physical properties of materials with special destinations using special transducers for non-destructive testing. She was also involved in the development of electromagnetic sensors using metamaterials for examination of metallic strip gratings and composites with carbon fibres woven, electromagnetic transducers based on 2D sensors array for determination of soil condition and detection of buried metallic objects, methods and algorithms for digital signal and image processing with applications to nondestructive evaluations, data fusion between information provided by electromagnetic nondestructive evaluation sensors and ultrasonic nondestructive evaluation sensors, design and construction of automatic equipment for eddy current nondestructive control for inspection of wires, bars and pipes, studies related to the application of electromagnetic transducer in different conventional and novel applications. Dr. Savin published over 250 papers, from which 140 ISI quoted, mostly concerning non-invasive characterization of materials using electromagnetic and ultrasound procedure, theoretical basis for the operation of eddy current transducers developed, has 7 national patents, is member of the Organizing Committee of ARoEND, Romania, full member in Council Board of Academia NDT International and represents Romania in in the NEA Steering Committee, Technical Committees and Working Groups - Subgroup on the Integrity of Metal Components and Structures & Subgroup on the Ageing of Concrete Structures.
- 5) **Dr. Firuta Borza (Barariu)** ([fborza@phys-iasi.ro](mailto:fborza@phys-iasi.ro)) graduated the Faculty of Physics, "Al. I. Cuza" University of Iasi in 1983; PhD in Physics, Electricity and Magnetism in 1999. She has 35 years experience in the preparation, using novel techniques based on rapid quenching from the melt, structural and magnetic characterization and applications of magnetic amorphous and nanocrystalline microwires, ribbons and powders and superelastic SMA microwires with 75 ISI publications, 4 patents on preparation and applications of amorphous and nanocrystalline microwires and applications. She has been involved in national and international projects (FP5, FP6, and FP7). She brought a major contribution to the development of advanced magnetic

materials both in NIRDTP Iasi (1986 -2001; 2007 –present) and Cardiff University, UK (Lecturer 2001-2007), such as amorphous and nanocrystalline microwires and thin films. She has been PhD coordinator for 2 PhD. thesis and Member of more than 15 PhD Examination commissions. She is the Innovation Manager at NIRDTP Iasi since 2020, and member of the Consultative College for Research – Development and Innovation, The specialized commission no. 7 - Commission for Innovative Technologies (2015-2020), Member of the Scientific Council of NIRDTP Iasi (2010 - present); Chair of the Ethics Commission NIRDTP Iasi (2013-present); Responsible for Intellectual Property and Innovation issues of NIRDTP Iasi. She acted as Member of the Local Committee for the organization of the conference “European Magnetic Sensors and Actuators”, July 22-24, 1996, Iasi, Romania, Vice-Chairman and Member of the Program Committee of the 5th European Conference on Magnetic Sensors and Actuators EMSA 2004, July 4-7, 2004, Cardiff, UK; Program Chair, Session Chair and Member of the Organizing Committee of the SMM 2007 - The 18th Soft Magnetic materials Conference, September 2-5, Cardiff, UK, Member of the Organizing Committee of the “International Workshop on Amorphous and Nanostructured Magnetic Materials” ANMM 2011, September 2011, Iasi, Romania, Member of the Organizing Committee of the “International Workshop on Amorphous and Nanostructured Magnetic Materials” ANMM 2015, September 21-24, 2015, Iasi, Romania. She has given 10 invited talks in international conferences and at UK Magnetics Society and Oita University, Japan.

- 6) **Dr. Sorin Corodeanu** ([scorodeanu@phys-iasi.ro](mailto:scorodeanu@phys-iasi.ro)) received the Diploma Engineering degree in Technical Physics, the M.Sc. degree in Applied Physics, and the Ph.D. degree in physics from the “Alexandru Ioan Cuza” University of Iasi, Romania, in 2003, 2005, and 2009, respectively. Since 2003, he has been with the Magnetic Materials and Devices Group, National Institute of Research and Development for Technical Physics, Iasi, Romania, where he is currently a Senior Scientific Researcher. His research topics of interest are related to preparation, characterization, and applications’ development using amorphous and nanocrystalline materials, shaped mainly as wires, glass-coated wires, and ribbons. He has extensive experience and expertise in preparation of amorphous and nanocrystalline microwires, glass-coated wires and nanowires, magnetic characterization by inductive methods and vibrating sample magnetometry, characterization of magnetic materials at low and medium frequency by magneto-impedance measurements, design and fabrication of sensor and transducer prototypes based on wire and ribbon shaped amorphous and nanocrystalline soft magnetic materials, magnetic sensors characterization, software development for data acquisition and processing electronic design for sensors.
- 7) **Dr. Gabriel Ababei** ([gababei@phys-iasi.ro](mailto:gababei@phys-iasi.ro)) has extensive experience in morphological, structural and compositional characterization by high resolution scanning/transmission electronic microscopy (SEM/TEM); preparation of magnetic materials with micro-/nanometric dimensions. design and development of set-ups based on electromagnetic shielding method for characterization of amorphous and nanostructured magnetic materials with micro-/nanometric dimensions. design and development of electromagnetic shielding material based on magnetic micro-wires, carbon nanotube, nanoparticles, nanowires, etc.
- 8) **Dr. George Stoian** ([gstoian@phys-iasi.ro](mailto:gstoian@phys-iasi.ro)) is an expert in scanning electronic microscopy (SEM) characterisation and EDS analysis, nano- and microstructure creation and/or manipulation by focused ion beam (FIB), TEM lamella preparation (more than 11 years of experience of working on SEM/FIB); Atomic Force Microscopy (AFM), Spark Plasma Sintering (SPS), BET Specific Surface Area determination, Sieverts apparatus for hydrogen storage experiments, rheometry, planetary ball milling.
- 9) **Dr. Oana-Georgiana Dragos-Panzaru** ([odragos@phys-iasi.ro](mailto:odragos@phys-iasi.ro)) has extensive expertise in nanowires, nanopowder, powder and single-crystal materials synthesis by different methods (electrochemical, co-precipitation, sol-gel, thermal, micro and nano-patterning by Electron Beam Lithography, optical lithography and laser lithography, floating zone) ; materials characterisation by optical microscopy, atomic force microscopy, current-atomic force microscopy, magnetic

force microscopy, thermo-gravimetric analysis, differential scanning calorimetry, X-ray diffraction, SQUID, impedance, electrical resistivity, and magnetoresistance measurements.

- 10) **Dr. Marian Grigoras** ([mgrigoras@phys-iasi.ro](mailto:mgrigoras@phys-iasi.ro)) has extensive experience in preparation of amorphous and nanocrystalline / nanostructured/nanocomposite, nanomaterials with soft and hard magnetic properties; experimental studies to explain the interdependence microstructure-magnetic properties of amorphous/ nanostructured magnetic materials; Development of fundamental research, applied sciences and technology, mainly in the field of magnetic nanomaterials, amorphous and nanocrystalline structures ; Magnetic characterization using PPMS and VSM techniques.
- 11) **Dr. Daniel–Dumitru Herea** ([dherea@phys-iasi.ro](mailto:dherea@phys-iasi.ro)) has significant experience and expertise in the biomedical and bioengineering field, focusing on design, preparation, characterization, functionalization and biocompatibility evaluation of inorganic nanoparticles for bio-medical applications, cell culture, synthesis of anti-tumor compounds, regenerative medicine, biosensors (experience improved at The Catalan Institute of Nanoscience and Nanotechnology (ICN2), Barcelona, Spain), bioactive substances, and magnetic nanomaterials. I have experience in normal and tumor cells culturing and characterization, dimensional analysis of organic and inorganic nanoparticles, Plasmon resonance analysis of gold nanoparticles (by spectrophotometry), analysis and interpretation of magnetic measurements. Also, I have experience in magnetic separation of blood red cells by using high-gradient magnetic separation methods, and in the treatment of cancerous cells through magnetic hyperthermia and magneto-mechanical processes, respectively.
- 12) **Dr. Daniel Gherca** ([dgherca@phys-iasi.ro](mailto:dgherca@phys-iasi.ro)) has experience and expertise on both development of innovative hierarchical 3D magnetic (electro/ photo) nanocatalysts for highly-efficient hydrogen evolution by different renewable techniques, mainly electrocatalytic and photocatalytic water splitting and in the field of pharmaceutical crystallization engineering respectively.

**If you are interested in a particular call, please indicate the Reference of the call/ Topic of interest. Potential contribution.**

--

**Have you already participated in an EU funded project? If so, provide some references.**

MOST RELEVANT PROJECTS:

- 1) **NANOSENS** - “Upgrading the Capacity of NIRDTP to Develop Sensing Applications for Biomedicine using Magnetic Nanomaterials and Nanostructured Materials”; FP7-REGPOT-2012-2013-1; Grant Agreement No. 316194 (2013-2016); EC Contribution: 2,422,076.00 €.

Aim: upgrade the research and innovation capacity of the NIRDTP Iași to the highest European level in microsensors for medical applications and biosensors based on magnetic nanoparticles and nanowires. The core activities were twinning partnerships with five European top level specialist research organisations: Sheffield Centre for Advanced Magnetic Materials and Devices within the Department of Engineering Materials, University of Sheffield (UK); Department of Materials for Information Technologies in the Instituto de Ciencia de Materiales de Madrid (ES); Instituto de Engenharia de Sistemas e Computadores para os Microsistemas e as Nanotecnologias (INESC-MN), Lisbon (PT); Nanobioelectronics & Biosensors Group in the Institut Català de Nanotecnologia, Barcelona (ES); Solid State Physics group within the Department of Physics and Astronomy, University of Glasgow (UK).

The activities increased visibility of NIRDTP Iași, society/regional responsiveness and innovation potential for the most advanced topics of microsensors and biosensors: (i) microsensors for medical

applications: acoustic microsensors based on nano- and microwires for medical applications; implantable magnetic microsensors based on nanostructured materials for medical applications; (ii) biosensors based on nanoparticles and nanowires: sensors based on nanosized detection elements for applications in nanomedicine; biosensors based on multilayered nanowires for the detection of biomolecules.

**2) VitriMetTech** - “Vitrified Metals Technologies and Applications in Devices and Chemistry”; FP7-PEOPLE-2013-ITN; Grant agreement No. 607080 - Coordinator: Universita Degli Studi di Torino, Italy (2013-2017); EC contribution: 3,465,780.12 €.

Aim: to educate a group of young researchers to implement methods for cutting edge research on new metallic glasses (e.g. Fe, Mg, Al, Ti-based), also in bulk form, and their amorphous/crystalline composites, for functional, bio-mechanical, chemical and structural micro-part applications. Transfer of results to industrial companies will boost innovation in a part of the Metal sector of the European manufacturing industry. VitriMetTech comprised five Research Projects which are designed to achieve the following objectives: (1) soft magnets with low or zero-magnetostriction for use in inductors and toroidshaped or flat transformers; (2) highly magnetostrictive alloys to exploit magneto-mechanical coupling for energy harvesting and cantilever devices; (3) bio-corrodible Mg-based bulk vitrified metals for implants free of toxic elements and with low elastic modulus; (4) nano-porous metals made from metallic glass precursors for electro- and heterogeneous catalysis, enhanced Raman spectroscopy, flexible electrodes and actuators; (5) improving the mechanical properties of vitrified metals for the above applications.

Partners: 11 of the best European academic research teams and 6 private sector companies, from Italy, France, Germany, Greece, Poland, Switzerland, Romania and United Kingdom.

**3) STREAM** - “Small Energy Harvester based on Magnetostrictive Amorphous and Nanocrystalline Materials”; MNT-ERA.NET Programme; Contract Mo. MNT-ERA NET 7-059 (2012-2014) - Coordinator: NIRDTP Iași; EC and Romanian Government contribution: 425,000 €.

Aim: to develop, optimize and commercially exploit the prototype of a novel energy harvesting device with increased power conversion efficiency and higher output power based on magnetic ribbons. The associated objective is to test and demonstrate the operation of the prototype both as an individual device and as part of an energy harvesting array of similar devices in supplying power to a wireless sensors network or to an autonomous sensor or array of autonomous sensors.

**4) MAGNESENS** - “Euroregional Advanced Research Centre for Sensors and Sensor Systems based on Magnetic Micro and NanoMaterials”; Structural Funds: SOP-IEC/A2-O.2.2.1; Contract No. 255 (2010-2013); EC and Romanian Government contribution: 4,588,235.00 €.

Aim: to establish at the NIRDTP Iași an Euroregional Advanced Research Centre for Sensors and Sensor Systems based on Magnetic Micro and Nanomaterials which will constitute a reference center in the field of sensors, unique at the national level. The MAGNESENS Centre integrates the specific R&D activities of the Materials, processes and innovative products thematic area with the aim to enhance the economic competitiveness by creating an innovative society based on knowledge, emergent in the North-East region of Romania, with positive impact in the European Research Area (ERA). The project contributed to the development and modernisation of the infrastructure for enhancing the quality and efficiency of R&D and innovation activities at NIRDTP Iasi. The Centre comprises five laboratories, two modernised and three newly created ones: (1) Laboratory for the Preparation of Thin Films and Nanostructuring (Thin Film Deposition Equipment (a); Laser Lithography System; Ultra-High Resolution Electron Beam Nanolithography Workstation (b); Clean Room facilities); (2) Electron Microscopy Laboratory (CrossBeam System - high resolution Field Emission-Scanning Electron Microscopy (FESEM), Focussed Ion Beam (FIB), gas injection system (GIS); Ultra-High Resolution Transmission Electron Microscope – UHR-TEM; facilities for samples preparation by ion polishing and FIB); (3) Laboratory for Sensors and Sensor Networks based on Microdimensional Magnetic Materials (Magnetically Shielded Room facilities); (4) Laboratory for Magnetoresistive Sensors based on Magnetic Micro- and NanoMaterials (Magnetically Shielded Room facilities).