

PARTNER PRESENTATION AND INTEREST IN HORIZON EUROPE PARTICIPATION

Name of the organisation	National Institute for R&D in Microtechnologies, IMT Bucharest
Country	Romania
Type of organisation	Research
Short description	R&D in micro-nanoelectronics, photonics, micro-nano-systems (MEMS, NEMS, MOEMS, RF-MEMS, MNBS), micro and nano-fabrication technologies and new materials
Laboratory/	Micro and Nano-Photonics Laboratory
Contact person	Dr. Dana Cristea
E-mail	dana.cristea@imt.ro

Short description of Laboratory

Mission: *Research, development and education in micro and nanophotonics*

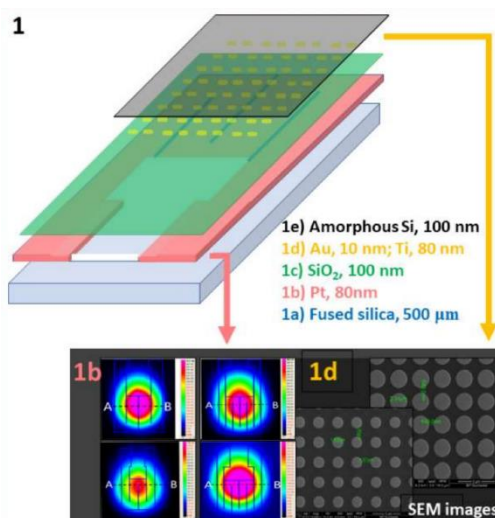
Research domains:

- **Modelling, simulation and CAD of micro and nano-photonic structures** (optoelectronic devices and photonic integrated circuits; plasmonics; OMEMS).
- **New materials for micro-nanophotonics** (hybrid nano-composites with controlled optical properties, transparent semiconducting oxides, Graphene, quantum dots) **and new processes and devices.**
- **Micro-nano photonics components** (photodetectors, photonic integrated circuits, metasurfaces, plasmonic structures, DOE, optical components);
- **Organic optoelectronics** (devices based on graphene-polymer nanocomposites)

Applications: *Optical sensors; Security elements for anti-counterfeit protection and logistic monitoring (holographic labels with extra security nanoelements, RFID elements and temperature sensor); Free space optical communications; Beam shaping; Quantum technologies.*

Expertise in the specific field of the selected call

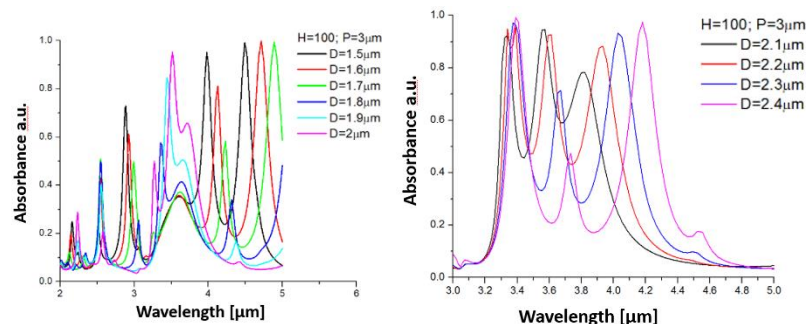
- **Compact selective IR radiation source** integration of a thermal source with broad IR radiation with the metasurface structure, obtaining a compact selective radiation source.



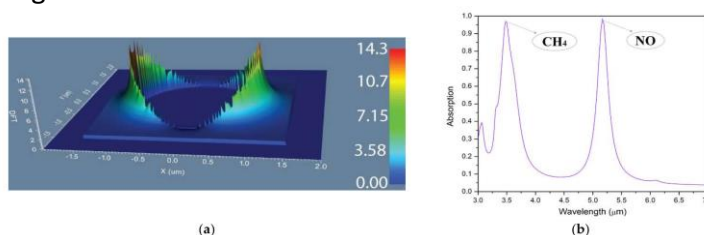
The micro-IR emitter is composed of a **metal-dielectric-metal (MDM) metasurface (Au/SiO₂/Pt)** with controlled spectral emissivity/ absorptivity achieved with geometrically tuned electromagnetic resonances, and a **broad-band IR source** (a Pt heater). To allow the integration, the Pt heater is used as a back-plane for the MDM structure. The metasurface is designed to attain almost perfect absorption on narrow IR wavelength intervals specific for the application. At equilibrium, the emissivity of the structure equals its absorptivity (Kirchhoff's law of thermal radiation), so it will radiate energy in the same narrow spectral range. The deposition of **the amorphous Si layer** on top of the metallic metamaterial the spectral characteristics of the microheater, allowing for achieving higher selectivity, better defined as maximum and narrower emission band.

(1a) substrate (fused silica), MDM structure: (1b) backplane= Pt heater (inset—thermal images obtained with an IR camera), (1c) SiO₂ insulator, (1d) metasurface based on Au nanodisks (inset—SEM image), and (1e) amorphous Si.

- The **modification of the spectral response of metasurface-based structures** can be achieved by adapting the geometrical parameters of the plasmonic micro-/nanostructures in the metasurface, e.g. the diameter of metallic nanostructures com.



The geometry of the replasmonic resonators that compose the metasurface can be adapted for a specific application- e.g. gas sensing.



Metasurface composed of gold cylindrical resonators with a 2 μm diameter placed with a period of 3 μm : (a) electromagnetic field diagram around a metallic resonator; (b) absorption spectra.

Involved persons. Short CV

PhD. Dana Cristea (senior researcher) - PhD in Optoelectronics and Material for Electronics from University Politechnica of Bucharest, head of Microphotonics Laboratory; main area of expertise: *micro-and nano-phonic devices, integrated optics, micro-optics, plasmonics, chemo-bio-sensors with optical read-out (design, processing and characterization)*; coordinator of more than 25 national and international projects (FP6, FP7, H 2020) in the area of photonic devices and sensors; coordinator of projects for technology transfer to SMEs.

PhD. Eng. Roxana Tomescu –Master Degree in Optoelectronics (2012) and a PhD in Electronics, Telecommunications and Information Technology (2015) Her main expertise is in: *design and simulations of nano-optics, metasurfaces, plasmonics, nano-antennas*, micro and nano-photonics and optoelectronic devices; *SNOM, AFM and Raman* characterizations; *technological flow* for *micro and nanofabrication*.

PhD. Catalin Parvulescu Ph.D (2015) in Electronics and Telecommunications. Expertise in *photolithography processes, processing and characterization of photosensitive films, wet etching, nanoimprint lithography processes, bonding processes, microfabrication processes for microfluidics*.

Interested in the calls and the **potential contribution**.

- HORIZON-CL4-2023-DIGITAL-EMERGING-01-51: Pervasive photonics - multi-technology integration for digital infrastructure, sensors and internet of things (Photonics partnership) (RIA)**

Co-integration of multiple photonic IC material systems or components to address new wavelengths and sensor functions– **development of light sources with a specific emission band for sensors**

- HORIZON-CL4-2023-DIGITAL-EMERGING-01-53: Versatile light sources and systems as tools for manufacturing and medical application (Photonics Partnership) (RIA)**

Sources with multi-specification / multi-application potential;

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

- MIMOMEMS**- European Centre of Excellence in Microwave, Millimeter Wave and Optical Devices, based on Micro-Electro-Mechanical Systems for Advanced Communication Systems and Sensors, REGPOT -Contract no. 202897- *design, fabrication and characterization of plasmonic nanostructures*.
- FlexPAET**- Flexible Patterning of Complex Micro Structures using Adaptive Embossing Technology, IP, NMP- algorithms for the optimization *high volume production of large-area masters micro structured surfaces for diffractive optical elements*.
- WAPITI** -Waferbonding and active passive integration technology and implementation (STREP FP 6 /IST) - *design and 3D simulation of microring resonator, all-optical wavelength converters, multifunctional devices*.