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Thesis offer:

Development of an integrated optical transducer for the detection of volatile organic compounds in the infrared environment

A 36-month thesis will start between the Foton Institute and the IEMN on the study of integrated photonic circuits based on porous silicon for the detection of volatile organic compounds in the mid-infrared field.

Beginning of the thesis: 1st September 2018
Thesis director: Joël Charrier (Lannion), ***co-supervisor:*** Yannick Coffinier (Lille)
Finding: ANR project (N ° ANR-17-CE09-0028-01)
Teams: Photonic Systems (Guided Optics & Sensors Group), Foton Institute located at the ENSSAT-Lannion and NanoBioInterfaces Group of the IEMN located in Lille
Keywords: Materials, photonics, surface functionalization, mid-infrared, technological fabrication, integrated optical circuit, optical characterization, modeling.

Subject

This thesis will be carried out within the framework of the ANR MID-VOC project, which aims to develop an innovative integrated optical sensor using spectroscopy in the mid-infrared field to detect Volatile Organic Compounds (VOCs). Indeed, the VOCs have significant absorption bands in this range of wavelengths. These sensors are made from porous silicon layers (PSi) in order to benefit from their open pores allowing for volume detection and to obtain a very low detection limit. In order to ensure selective detection of VOCs, two types of PSi functionalization will be considered: an inorganic approach, using metal oxide particles, while the second approach will use Self-Assembled organic Monolayers (SAM). Thus, the project will consist of the design, surface functionalization, technological realization and optical characterization of these sensors. This optical sensor can be used to develop breath analysis devices in point-of-care predictive medicine.

Candidate Profile

The thesis subject will implement multidisciplinary skills in surface functionalization, material physics and guided optics. A Master 2 (or engineering school) level training addressing a significant part of these areas is necessary to address this thesis topic. Skills in surface functionalization, material physics, guided optics and / or technological realization will be highly appreciated. The selected candidate will also have a taste for technology, laboratory work and clean rooms, physico-chemical and optical characterization and good teamwork skills.

Foton Institute / IEMN

The Foton Institute is a joint research unit of about 150 people associating the CNRS, the University of Rennes 1 (Enssat and IUT of Lannion) and the INSA of Rennes. The unit is

structured in six thematic areas and three teams, spread over two sites: two teams in Rennes, Opto-electronics, Hetero-epitaxy and Materials (OHM, INSA-Rennes) and Dynamics of lasers, Optics and Polarimetry (DOP, UR1); a Photonic Systems team at Lannion (Enssat). In this latest team, the Optical Guided & Sensors Group (OGC) is involved in the study of different optical materials and components for optical sensor and / or telecom applications. The specificity of the Foton Institute is to gather three teams and three platforms around common programs covering specific areas of photonics: the physical layer of telecommunications, technologies related to industrial and defense applications (optical sensors, lasers, instrumentation for photonics) and photovoltaics. Foton's themes are anchored in those of the Key Photonics (KET: Key Enabling Technology) key technology, an European priority and in the Brittany region.

The PhD student will work in the Guided Optics and Sensors group of about 25 people. This group has acquired a strong experience in photonic integrated circuits and benefits of the CCLO resources, technology platform (200 m^2 clean room, PECVD, sub-micron photolithography, ICP-RIE dry etching, Scanning Electron Microscope, etc.), equipment and optical benches adapted to integrated optics. The PhD student will thus benefit from the skills and resources for technological realization, but also for modeling aspects, for the assembly and characterization of optical integrated circuits and optical fibers.

The PhD student will also work in the IEMN's NanoBioInterfaces (NBI) group, which exploits the physical (optical and electrical) properties of metal and semiconductor nanostructures to take advantage of controlled surface chemistry to study substrate / system biomolecular interactions, biological diversity and in complex biological environments. The main projects of the NBI group in progress concern: 1) the synthesis of metallic and semiconducting nanostructures (nanoparticles and nanowires); 2) surface chemistry; 3) biosensors and 4) Lab-on-Chip type devices.

Additional information - Contact

Contact and additional information can be obtained by contacting:

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Application

All applications must be sent by email and must include the following elements:
- Motivation Letter and detailed CV
- Copy of the Master's degree or equivalent and marks from the last 2 years
- List of publications if applicable and recommendation letters (x2).

The application deadline is 01/07/2018. After the deadline, candidates will be promptly informed of their status. The selected candidates will be invited to an interview, on site (Lannion or Lille) or web seminar depending on their location.