PhD /Post doc: Implementation and characterization of a portable, robust and sensitive polymer-based photonic sensor for environmental pollutant detection

Description of LAPHIA – Cluster of excellence (IdEx)

The Cluster of excellence LAPHIA brings together teams belonging to 11 research laboratories in Bordeaux. The LAPHIA project is expected to have a long-term structuring role in both the academic and economic spheres through the production and transfer of cutting-edge knowledge in laser and photonics.

The LAPHIA project aims to create a consortium around sciences of light – optics, photonics, lasers. The Bordeaux pole in optics is already recognized as leading in several fields: high energy lasers, hot plasmas laser-matter interaction physics, material science. The industrial dynamics is really impressive in the Bordeaux and Aquitaine areas, with a rapidly growing cluster of research centers and industrial companies dealing with optical and laser technologies.

In such a favorable context, the LAPHIA project aims to federate the whole relevant academic community around coherent and innovative projects in lasers and photonics, while strengthening the links with CEA. The unique Centre of excellence structure will promote Bordeaux to among the most visible centers in Lasers and Photonics at European and international levels, resulting in a strong attractivity for students, researchers and private companies.

For more information: http://laphia.labex.u-bordeaux.fr/en/

Job statuts

Location: IMS Laboratory, University of Bordeaux, UMR CNRS 5218, 351, Cours de la Libération 33405 Talence Cedex-France
Research group: EDMiNA Team (see https://www.ims-bordeaux.fr/en/recherche/research/100-waves/edmina/90-edmina)
Start date: January 01, 2018
Duration: 12 months
Salary: Determined upon diploma and experience, typically 32 k€ (gross salary)

Description

Context and objectives:

Water quality and availability is a major socio-environmental issue with high strategic and economic importance. An increasing number of studies have now established the link between degenerative diseases, autoimmune diseases, autism, behavioural disorders and heavy ions poisoning which tends to have deleterious effects even at ultratrace levels. A growing attention is currently paid at the detection and removal of pollutants present in water and liable to threat human health and biodiversity. Monitoring these pollutants is very challenging and currently relies on expensive equipment that is not field-deployable yet. Moreover, this leads to a lack of high-resolution spatiotemporal data which is mandatory for protecting populations, applying environmental policies and understanding of pollutants cycles. The **PROSEED project** aims at the development of a dedicated polymer-based optical sensor for in-situ pollutant measurements in water. Considering industrial requirements allowing to target the development of a commercial product at short-term, an emphasis is put on a simple, portable, highly sensitive and selective water sensor concept with real-time measuring capability for ultra-trace pollutants monitoring in water.

Subject:

The postdoctoral position will aim at the development of a high-performance set-up (optical sensor with a detection limit in the µg/L range), unique in terms of rapidity/sensitivity trade-off, enabling to integrate the optical source, the transducer, the detector and a microfluidic cell in the same

package to have a transportable demonstrator of in-situ pollutant measurement. The active core of this sensor is based on an Optical Micro-Resonator (OMR) architecture including polymer-based integrated waveguides and microring combined with a microfluidic cell on a glass-substrate. The principle of detection is based on the interaction between the evanescent field of the guided light in the polymer waveguide and the analyte under test. Each part that compose this device have been successfully studied, fabricated and characterized with two recent PhDs. This project will give us the opportunity to put together all these elements allowing to obtain the final sensor operating in the IR range.
Through the collaboration between multiple partners (IMS, LPQM ENS Cachan, TECNALIA, LAAS), the objective is threefold: (a)- set up implementation and in-deep characterization of the whole detection system including microfluidics part, fibered optical source/detector and polymer-based transducer part relying on our recent collaborative realizations, (b)- provide a low-cost device that integrates the optical source, the active sensing part and the photodetector in a single and light volume package (for example a well-established "butterfly module"), (c)- start a product valorization according a benchmarking and market analysis in collaboration with **TECNALIA Research & Innovation** to make it visible from industry and allowing tangible feedbacks on the pre-processing technique for the analyte preparation.

Main activities of post-doc:

- Implementation on an optical table of an end-fire coupling set-up, using high-precision positioning stages, lensed fibers, fibered laser diode, detector and optical transducer.
- Optical characterizations of the optical sensor by varying environment parameters using microfluidic system.
- Study and development of a robust embedded solution within the butterfly package.
- Collaboration with TECNALIA partner to build a valorization approach of the final embedded device through their industrial partners' network.

Profile of applicant

This one-year post-doctoral position will combine hands-on operations addressing optoelectronic and optical characterization with accurate metrology, packaging and microfluidics to achieve an embedded miniature system with new functionality. Additional responsibilities may include work area planning, data analysis, technical presentations and reports, as well as potential manuscript for peer-reviewed journals and/or international conferences. The candidate will work in a fast-based environment as a member of a multidisciplinary team consisting of PhDs, post-docs, Associate Professors and Full Professors.

SKILLS: PhD in Photonics, Electrical/Optical Engineering, Materials Science, Physics or related fields. Candidate must have demonstrated laboratory experience in miniaturized devices or systems using integrated optics and optical instrumentation. Experience with nano- and microfabrication in a cleanroom environment would be an added-value.
Candidate must have excellent organizational, strong reporting and presentation skills as well as the ability to work both individually and as part of a team.

Supervisors/Contact

Simon JOLY*: ***Equipe "Evaluation des Dispositifs Micro et Nano Assemblés"*** **-** IMS Laboratory - University Bordeaux
Laurent BECHOU: ***Equipe "Evaluation des Dispositifs Micro et Nano Assemblés"*** **-** IMS Laboratory - University Bordeaux

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Application deadline: November 15, 2017