Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage */ internship supervisor*:

Nom / *name*: DUSSARDIER Prénom/ *first name* : Bernard

Tél : 04 92 07 67 48/ 06 32 71 66 67 Fax :

Courriel */ mail*:

Nom du Laboratoire / *laboratory name*: Laboratoire de Physique de la Matière Condensée (LPMC)

Code d'identification : UMR 7337 Organisme : Univ. Nice Sophia Antipolis et CNRS

Site Internet / *web site*: http://lpmc.unice.fr/

Adresse / *address:* Faculté des sciences / Parc Valrose / 06108 NICE CEDEX 2

Lieu du stage / *internship place*: LPMC, Nice et Fastlite, Valbonne (Sophia Antipolis)

Titre du stage / *internship title*: **In line Optical fibre sensor with nanostructured gold for Raman enhancement**

This internship aims are a contribution to the development of a new in-line sensor 'platform', based on an optical fibre sensor (OFS), sensitive to the chemical structure of an external analyte. The asymmetrical (polarization-sensitive) sensor implements the exaltation of Raman scattered light (Enhanced Raman Scattering, ERS) on a designed and engineered optical fibre. Nanoparticles (NPs) of noble metal (Au, Ag) induce a huge extinction (surface plasmon resonance, SPR), that is tunable in wavelength depending on the NPs size, shape, spatial distribution and environment. The SPR localizes the electromagnetic field of an incident wave in the vicinity of NPs. In Raman spectroscopy, an increase by up to 10^6 of the signal from molecules close to NPs allows the optical characterization of the molecule structure. When implemented as an OFS, it can be used in the remote detection of molecules in solution (well-known SERS effect) as well as in the characterization of solid materials deposited around NPs.

Several studies by partners of this consortium showed the feasibility of measuring ERS from amorphous sol gel matrices (TiO_2, SiO_2) in contact with nanostructured gold films [1,2]. These paves the way towards ERS-OFS based on silica (main material of the telecommunication fibres used in OFS). This project aims at merging several technologies to further enhance the potential of this type of OFS: specifically engineered optical fibre to give access to the evanescent field from the guide mode of a singlemode OF, direct laser writing of complex waveguides and components within the OF cladding (see annex), patterning of NPs on the fibre planar side surface, and optimized coupling of the evanescent field of the mode with the plasmon wave. As a proof of concept, the main objective is to develop a highly-sensitive remote OFS with an exalted Raman signal of molecules in liquid or solid materials, simplifying the complicated signal treatment necessary in Raman sensors.

This internship is proposed in the frame of a multi-institute collaboration. It will be devoted to the development of the 'optical platform' of the sensor head. During the internship, specialty optical fibers will be designed (using numerical tools) and fabricated (LPMC Specialty Optical Fibre fabrication facility). Exploratory test of writing waveguides in the cladding will be made in collaboration with a local startup (Fastlite [3]) on a laser writting platform. The optical characterization of the sensor platform will be performed at LPMC, as well at partners places.

Internship duration : 4 to 6 months. Key words : fibre optics, sensor, guided-wave optics.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : Oui/Yes**

Si oui, financement de thèse envisagé: bourse doctorale université

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**

Références

1 E. Nardou, D. Vouagner, A.M. Jurdyc, et al. JNCS,357 (2011) 1895-99

2 S.Degioanni, A-M. Jurdyc, A.Cheap, B.Champagnon, F.Besseuille, J.Coulm, L.Bois, D.Vouagner 118 (2015) 153103

3 http://www.fastlite.com/en/