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 : 21 Janvier 2018

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Lieu du stage / *internship place*: ICMMO-SP2M + Tematys

Titre du stage / *internship title*: **Reliable Fiber Bragg Gratings sensors for extreme environments**

Résumé / *summary* : Fiber Bragg grating (a spatial modulation of refractive index changes) sensors technology operating in extreme temperatures is a major technological breakthrough within the instrumentation for extreme environment. Its development and validation of innovation will meet the new needs of the industry by designing fiber micro-sensors that will be incorporated in particular materials and processes in the areas of engine air carriers (aeronautics, SAFRAN), space (launchers, Eurocryospace) or the advanced manufacturing (e.g. 3D laser additive manufacturing of metal and ceramics parts). Having an innovative, reliable and robust instrumentation, based on Bragg gratings in optical fibers, for measurements in high temperatures (thermal measurements and / or mechanical deformations) will be an undeniable asset for industrial programs in the short and medium words, at the forefront of technological developments (engines of the future, laser assisted 3D synthesis, high power lasers, nuclear plants, steel) and requiring characterization tools in harsh environments for qualification processes and products.

This overall project is to develop Fiber Optic sensors based on Bragg gratings capable of operating in extreme environments, especially at high temperatures (700-1500°C). Following very recent developments, this technology is a recent technological breakthrough with already many fundamental and industrial applications. These sensors are being developed to measure the temperature and strain in extreme environments. This new Fiber Bragg grating technology joins the intrinsic advantages of FBG-based metrology such as the spectral multiplexing capabilities (multiple measurement points on a single optical fiber) combined with the electromagnetic immunity and this new property resistance to extreme temperatures, which interests actors of the Aerospace (aircraft engines), Advanced Manufacturing (3D laser additive manufacturing metal parts), optics (high power laser) but also steel industry, Nuclear (instrumentation of future reactors) and Space (launchers).

To go above the limits imposed by the classical GeO_2-SiO_2 fiber glass system, (typ. 600°C) FBGs can be inscribed in SiO2-Al2O3 glasses and even in sapphire optical fibre using various approaches but particularly by femtosecond laser fabrication. However, sapphire (crystal) optical fibres are presently highly multimode having a surrounding air cladding and brittle. In this project we will work on the next generation of fibres that may overcome these problems using FBG written in alumino-silicates glasses.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: ANR, concours Ecole doctorale, CEA Saclay**

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

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