MAP-fis Essay Proposal, 2015-2016

(*please write in English*)

Supervisor

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Title

Fabrication of optical sensing devices by 3D laser micromachining

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Optics

Summary of Proposal

In recent years, three-dimensional (3D) micro-/nanofabrication techniques have attracted increasing attention, due to their promise in a wide range of applications including integrated optics, plasmonics, microbiology and microelectromechanical systems [1-3]. In particular, the high integration capability of the 3D fabrication, will enable highly innovative configurations in selected applications such as multiaxial strain optical fibre sensors for very high temperatures, or fluidics and waveguides to address high Q microresonator biosensors.

In this essay it is proposed to explore the potential of 3D microfabrication with fs-laser, in the development of new optical sensors for demanding applications. The goals are:

- Understand the femto-etching and direct writing micromachining fabrication methods;

- Assess the possibilities of design and fabrication of novel fibre optic and integrated optics sensor devices using this tool;

- Identify selected sensor configurations for future fabrication, test and optimization in the context of practical applications.

References

(*to allow students first look at topic*)

[1] W. Xiong, Y. S. Zhou, X. N. He, Y. Gao, M. Mahjouri-Samani, L. Jiang, T. Baldacchini, and Y. F. Lu, "Simultaneous additive and subtractive three-dimensional nanofabrication using integrated two-photon polymerization and multiphoton ablation," Light Sci Appl, vol. 1, p. e6, Apr. 2012.

[2] R. Osellame, G. Cerullo, and R. Ramponi, Femtosecond Laser Micromachining: Photonic and Microfluidic Devices in Transparent Materials, 1st ed., vol. 123. Springer Science & Business Media, 2012.

[3] K. Sugioka and Y. Cheng, "Femtosecond laser three-dimensional micro- and nanofabrication," Appl. Phys. Rev., vol. 1, no. 4, p. 041303, 2014.