A PhD student in photonics (m/f)

On the subject: Study of gamma and neutron radiation effects on Bragg gratings in plastic optical fibers

Project description:

Polymer optical fibers acquire a growing interest in both telecommunications and sensing. In this field, they are interesting because of their high flexibility and intrinsic biocompatibility. Among the different types of polymer optical fibers, some are photosensitive so that Bragg gratings can be manufactured inside their core.

This project aims to study and understand the spectral evolution of different polymer optical fiber Bragg gratings (POFBGs) when subjected to gamma and neutron radiation. The focus will be made a) in the development of setups to manufacture different gratings (uniform, phase-shifted, ...) in various types of POFs (PMMA, CYTOP and TOPAS), b) to use the 'design of experiments' concepts to analyze and explain the performances of these gratings under gamma and neutron radiation and c) to assess the use of polymer gratings in sensing applications for parameters such as temperature, strain, relative humidity level and gamma dosimetry.

In more detail, this project tackles 4 main tasks:

- Manufacturing of FBGs in different types of POFs using both a femtosecond laser system emitting at 400 nm and a continuous wave (CW) He-Cd laser emitting at 325 nm. The candidate fibers are poly(methyl methacrylate) (PMMA), fluoropolymer CYTOP, and cyclic olefin copolymer TOPAS also including photo-sensitive dopants. The writing performances (e.g. grating reflectivity vs laser type, UV-fluence, annealing cycles) will be studied during and after the photo-inscription process to produce stable and highly reflective gratings. After the inscription, temperature, strain and humidity sensitivity will also be investigated.
- Irradiation of both POFBGs and glued fiber areas and study of their behavior as a function of the gamma and neutron radiation dose and the dose-rate. The performances of the different fiber types and FBG writing techniques will be analyzed to understand the mechanisms responsible of the FBG spectra modifications.
- Exposure to gamma- and gamma-neutron radiation field to be performed in the RITA irradiation facility and the BR1 reactor with the online measurements of the FBGs optical spectra. (http://www.sckcen.be/en/Research/Infrastructure/BR1).
- Study of radiation-induced density and refractive index changes, radiation–induced dilatations of optical fibers samples will be quantified using high-precision length measurements. Both pristine and UV-exposed samples will be investigated.
Job description:

The work will be carried out at the University of Mons, Belgium in the Electromagnetism and Telecommunication Department, in collaboration with the SCK.CEN (Belgian Nuclear Research Center). The Electromagnetism and Telecommunication Department has strong background in optical fibre sensing and metrology while the SCK.CEN is internationally recognized in the field of radiation effects on optical fibres.

We are looking for a PhD student in photonics (duration: 48 months) whose main activities will be focussed on the production and characterization of POFBGs in response to different external stimuli (temperature, relative humidity level and gamma and neutron irradiation). The thesis will also focus on the use of theory of design of experiments to:

- minimize the number of experiments needed to fully characterize the POF sensor.
- to analyze the experimental results and in particular to:
  - better understand the interaction between radiation and POF material.
  - detect and quantify the cross correlation between the parameters (temperature and humidity, temperature and gamma flux, ...).

Starting date: the PhD can start from June 1st to August 1st 2019.

Profile description:

- Master degree in physics, electrical engineering, material sciences or equivalent.
- Technical background in photonics.
- Autonomy, good sense of organization and communication skills.
- Fluent in English.

Application procedure:

Applications, including cover letter, curriculum vitae (mentioning studies distinctions) and a copy of the university certificate, are to be sent by e-mail to prof. Patrice Mégret Patrice.megret@umons.ac.be

Submission deadline: Before June 30th 2019