POFCOM

Bragg Gratings in Plastic Optical Fibre for Communications and Sensing Applications

Plastic optical fibres are seen as an interesting solution for ultra-high capacity communication inside buildings and also for sensor applications. POFCOM intended to develop innovative solutions in POF for high speed communications and optical sensing. We have developed world's first solutions, such as the world record in writing speed of fibre Bragg gratings in POF (PFBG) or the first PFBG for the visible region.

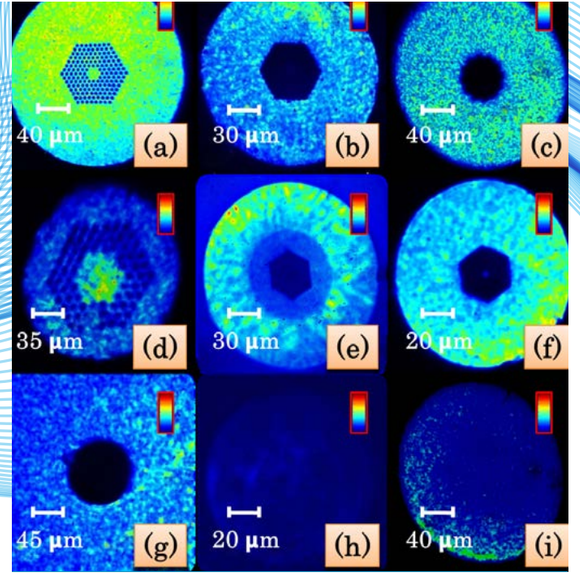


Fig. 1 Near field images of different POFs used in the project and prepared with the new end face preparation methodology developed in the project

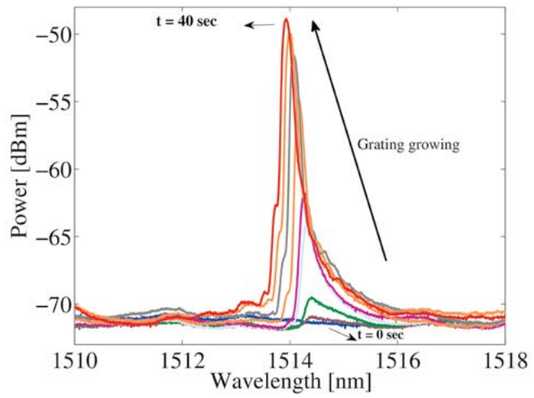
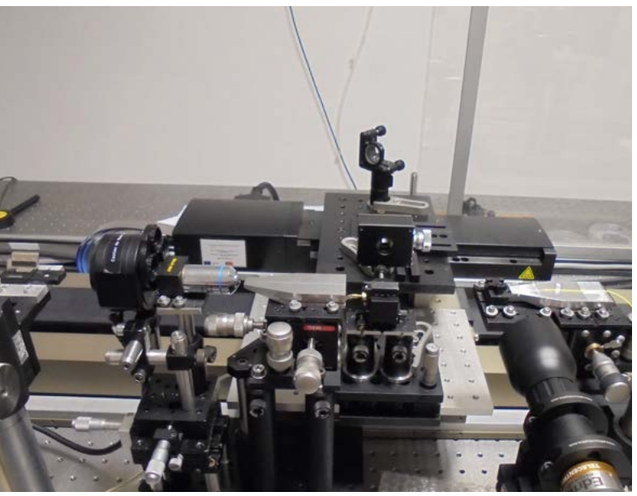


Fig. 2 Spectral evolution over time of a high quality PFBG during inscription.



Main Project Team

Rogério Nogueira	**OCP-Av**
Lúcia Bilro	OCP-Av
Ricardo Oliveira	OCP-Av
Nélia Alberto	OCP-Av
Carlos Maques	OCP-Av

Funding Agencies

FCT	**92,585€**
Start Date	01/02/2012
Ending Date	31/07/2014

Indicators

Journal Papers	12
Conference Papers	34
Patents	1
Book Chapters	3
Concluded PhD	2
Concluded MSc	1

Two Main Publications

R. Oliveira, L. Bilro, R. N. Nogueira, **Bragg gratings in a few mode microstructured polymer optical fiber in less than 30 seconds,** Optics Express, Vol. 23, No. 8, pp. 10181 - 10187, April, 201

R. Oliveira, L. Bilro, T. H. R. Marques, M. Napierala, T. Tenderenda, P. Mergo, T. Nasilowski, C. M. B. Cordeiro, R.N. Nogueira, **Bragg Gratings Inscription in Highly Birefringent Microstructured POFs,** IEEE Photonics Technology Letters, Vol. PP, No. 99, pp. 1 - 4, November, 2015

PROJECT WEBPAGE URL
https://www.it.pt/Projects/Index/1647

GENERAL MOTIVATION AND OBJECTIVES

Nowadays, the possibility of the fibre to the home (FTTH) for simultaneous transmission of different services such as internet, telephone, digital television is, in fact, actual. However, to meet the more demanding expectations of the end user, it is necessary to improve the physical infrastructure of the existing communication networks in order to obtain the best ratio between quality of service and price of implementation. So the demand for optical devices that process information at a reduced cost and are easy to install is a reality. Thus, to respond to the need of broadband technologies in the global market, with POFcom project we combine two fiber optic-based technologies to develop new techniques and new devices for the processing of information entirely in the optical domain: fibre Bragg gratings (FBG) and microstructured polymer optical fibres (mPOF) Polymer optical fibres (POF) are being pointed as a lower-cost and viable alternative to glass fibre in short-distance applications. The use of this type of fibre has several advantages, such as simpler and less expensive components, ease to handle and connect and has greater flexibility and resilience to bending, shock, and vibration. Moreover, FBG is passive and versatile device that has been used in the development of components and techniques for optical communication systems with high capacity. With this strategy we intend to reduce cost and in the same time don't compromise the spectral efficiency. This combination of FBGs and mPOF has also attracted the attention of the scientific community in sensing technology. The thermal and mechanical properties of polymeric materials open new possibilities in terms of robustness, sensitivity and operating range of sensors. These sensors can be used to monitor several physical parameters and to detect gases and liquids and are quite interesting for many applications in engineering, including structural health and environmental monitoring, medicine, petrochemical industry and to the development of smart structures.

The global aim of this project is to develop new techniques and new innovative devices based on FBG in mPOF for optical communications and sensing technologies.

CHALLENGE

The main challenges of the project were:

- Implementation of a state of the art FBG fabrication system for POF fibres
- Produce high quality PFBG in reduced time for applications in communications and sensors.
- Develop solutions for easy manipulation of PFBG, such as connection between fibres.

WORK DESCRIPTION AND ACHIEVEMENTS

POFCOM has produced the foundation for high speed communications in POF, as well as novel sensors using this type of fibre. Many of the achievements were world first and allowed the scientific community in the field to leap forward in this topic.

The main achievements were:

- World's first PFBGs in the visible spectral region (600 nm).
- World's first PFBG in a GI-POF presenting spectral properties that can be used as optical filtering in short-range.
- World's first high quality HiBi FBG in POF.

POF transmission systems or to act as a sensor.

- Novel technique for time record production of PFBGs in microstructured POF (mPOF), allowing the production of very high quality PFBGs in a few seconds.
- Novel approach to produce high quality PFBG.
- New modelling and theoretical understanding of new geometries of POF.
- A new concept to increase the capacity of optical communications in POF has been developed, based on WDM and FBG written in POF.
- A new HiBi PFBG has been developed for a polarization and wavelength processing in POFs.
- A pressure sensor, a dual sensor for refractive index and viscosity and a temperature/strain sensor have been developed.
- A new technique for end-face preparation of POF, allowing for high quality connection between POF.