

Introduction to Silicon Photonics

Eduardo S. Luca*, Paulo C. Dainese.

Abstract

The project aims to study an anular guide recorded with a Bragg grating to explore its sensing properties, such as temperature and stress, changing only geometric parameters (radius) and the core refractive index. It is proposed to develop a structure where the Bragg wavelength is insensitive to temperature changes. Therefore, simulations were made using the COMSOL software and the samples were manufactured, so the measures of the Bragg wavelength versus temperature were done and the process developed.

Key words:

Photonics, Optical Communications, Fiber Bragg Grating Sensor.

Introduction

Micro-structured photonic materials offers the potential for the propagation of light control and its interaction with matter. Understanding the origin and characteristics of the scattering processes in photonic guides is very important, both on linear and nonlinear regimes.

Results and Discussion

Before manufacturing the samples, we had to simulate the guides, using the COMSOL software. We can change geometrical parameters and refractive index in the hole to adjust the sensitivity.

In simulation, we already know the radius of the hole (the same of the available samples) and the available refractive index, so, we just need to find the ideal refractive index to each hole.

Once this was done, we went to sample preparation and then, the measurements. For measuring the reflected wavelength (Bragg wavelength) we used the experimental setup as shown in Image 1.

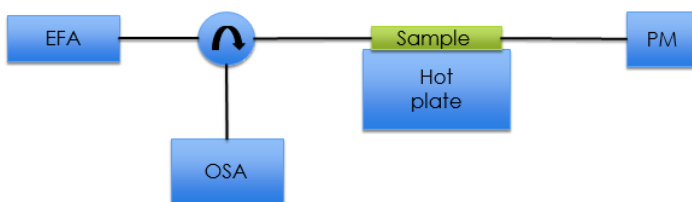
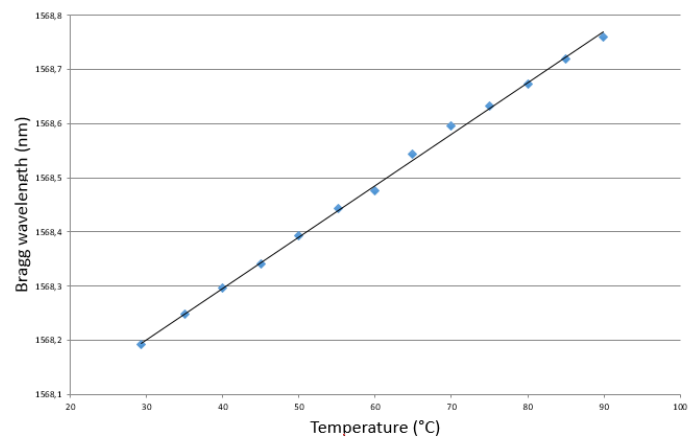


Image 1. Scheme of the experimental setup.

As shown in Image 1, we have the initial signal, coming from Erbium Fiber Amplifier, then passing through the circulator, and then through the sample. Since we are interested only in the reflected signal, we take with the Optical Spectrum Analyzer only the signal that comes backwards from the sample.

Once we propose a structure whose Bragg wavelength is insensitive to temperature changes, we need to change the temperature of the sample during the measurements, so we used the hot-plate below it.

With the simulations and the experimental setup done, we measured the Bragg wavelength as a function of the temperature in the guide, specifically on the Bragg grating region.



Conclusions

The sample used to plot the graph shown in Image 2 is hollow, so its not filled with the correct liquid, not with the correct refractive index. We developed ways to insert the liquid with the right refractive index in the hole, so we can show that for those cases the Bragg wavelength do not change with the temperature.

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