REFRACTOMETRIC FIBER OPTIC OPTRODES FABRICATED BY PHOTOPOLIMERIZATION

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Fiber optic interferometers in different configurations have been developed for physical, chemical and biosensing applications. High resolution, simplicity, immunity to electromagnetic interference and low cost are some of the advantages of these devices [1]. Most solutions, however, involve complex fabrication methods like chemical etching, fiber polishing and multistep coating processes.

In this work a simple fabrication method is proposed for fast production of chemically sensitive interferometric optrodes at the fiber tip. Intrinsic Fabry-Perot FP cavity sensors are developed by cleaving a standard single mode fiber (SMF28) and dipping the flat end tip into a photopolymer solution. This results in the formation of a polymer drop at the fiber tip. The light of a violet laser (405 nm) is then coupled into the distal fiber end and guided towards the polymer drop. A fast photo-polymerization and self-guiding process takes place creating a waveguide at the fiber tip, matching the fiber modal profile (figure 1). Excess polymer is then rinsed with ethanol [2]. Control of the polymer refractive index and chemical properties then enables the rapid fabrication of chemically sensitive FP sensor for different analytes. A study on the impact of fabrication parameter in the FP tip properties will be discussed. Also preliminary results demonstrating interferometric pH measurements with the photopolymer tip will be shown (figure 2) where both wavelength and fringe visibility are modulated by the acidity of a sample solution. Such label free approach paves the way for multipoint, multi-analyte sensing systems using standard telecom optoelectronics.

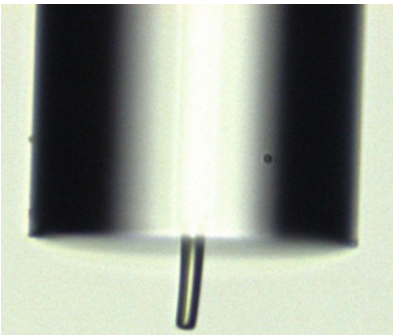

Figure 1 – Polymer tip.

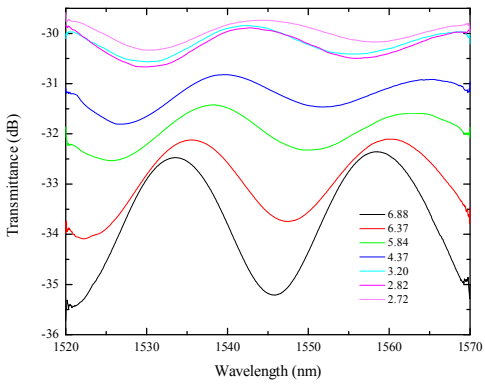

Figure 2 – Spectral response of the FP cavity to pH.

The support of FCT is acknowledged Project Aquamonitor. n.º FCOMP-01-0124-FEDER-013911 (Ref[a]. FCT PTDC/AAC-AMB/112424/2009 and scholarship (SFRH / BD / 68924 / 2010).

[1] H.Y. Choi et al. Miniature fiber-optic high temperature sensor based on a hybrid structured Fabry-Perot interferometer, Optics Letters, 33 (2008) 2455-2457.
[2] O. Soppera, S. Jradi, D.J. Lougnot, Photopolymerization with microscale resolution: Influence of the physico-chemical and photonic parameters, J Polym Sci Pol Chem, 46 (2008) 3783-3794.