DNA DETECTION BASED ON FUNCTIONALIZED HOLLOW CORE FIBERS

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The recent advent of hollow-core photonic crystal fibers (HC-PCFs) provides a unique opportunity to enhance sensing for different fields of applications [1]. HC-PCF comprises an air-core surrounded by a cladding consisting of a periodic array of air-holes in silica. The cladding forbids light in a range of frequencies to propagate while guiding it within the air-core in a well-confined good-quality mode over very long distances. This makes them very attractive hosts for enhanced interactions between light and matter in applications that range from gas-based nonlinear optics [2] to chemical and biological sensors [3, 4]. In the present work we have considered two kinds of fibers: an HC-1060 and a microstructured Bragg fiber, both provided by NKT Photonics. After their characterization, the fibers were functionalized using Peptide Nucleic Acid (PNA) probe, an oligonucleotide (ON) mimic that is well suited for specific DNA target sequences detection. Such functionalization has led to a significant frequency shift of transmission spectra, suggesting the possibility to realize sensing for biological applications.

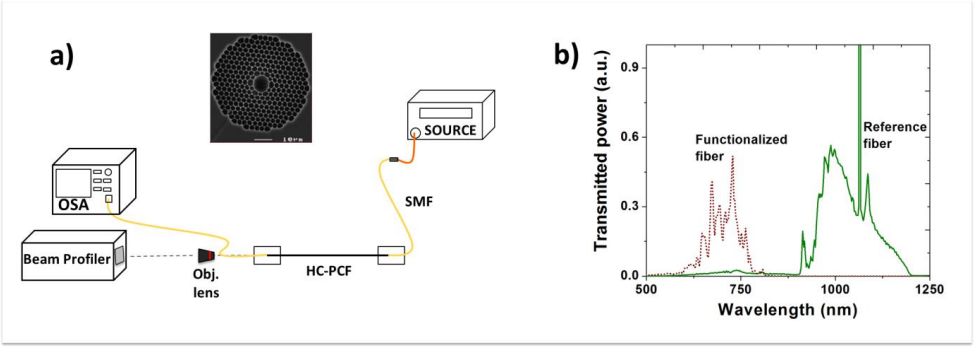

Fig. 1 a) Experimental setup for the acquisition of transmission spectra and beam profile of the HC-PCFs. At the top, cross section of the HC-1060 with its beam profile. b) Transmission spectra of the HC-PCF using a SC source, before and after functionalization.

The experimental setup is shown in Fig. 1a. A supercontinuum source (SC) used as a broadband light source was coupled to an SMF-28 which in turn was butt-coupled to the HC-PCF under investigation. Two different pathways of the setup made it possible to study the beam profile at the end

of the fibers, and the spectral response using the Optical Spectrum Analyzer (OSA). In Fig. 1, the section of the fiber of the HC-1060 is shown, while Fig 1b shows the spectrum in transmission before and after the functionalization. The change of refractive index due to the functionalization of the internal channels of the fiber has caused a shift in the spectrum of the two HC fibers studied. For instance, the spectral shift of the peak of the functionalized HC-1060 was observed to be of around 390 nm; this suggests a high sensitivity in the process of hybridization with the complementary strands of DNA.
Similar spectral modulations were observed for the Bragg fiber. Unlike the work done in the past [4, 5], using the HC fibers does not have require fiber gratings, resulting in a more simple and direct approach.

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