PHOTONIC PLATFORM BASED ON FUNCTIONALIZED MICROSTRUCTURED OPTICAL FIBER FOR DNA DETECTION

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Microstructured Optical Fibers (MOFs), also called Photonic Crystal Fibers (PCFs), are characterized by a pattern of air holes running along the entire length of the fiber. Since their discovery, they have represented a versatile photonic platform for many sensing applications. In fact the surface of the capillaries running along their length can be functionalized to perform selective sensing experiments [1], by infiltrating small biological samples inside the holes. In the present work a DNA sensing platform based on a Peptide Nucleic Acid - functionalized MOFs gratings has been demonstrated. Two different microstructured optical fibers have been considered. The first one was a grape-fruit geometry MOF having 5 holes of 20.8 μm diameter, forming an outer core of 16.1 μm, which includes a 3.5%wt Ge doped socket of diameter 8.5 μm. The second fiber was a Large Mode Area (LMA-10) MOF, having the hexagonal holes arrangement typical of such fibers. The inner surface of both MOFs, where a strong Bragg grating was previously inscribed, has been functionalized using PNA probes, OligoNucleotides mimic that are well suited for specific DNA target sequences detection. The hybrid sensing systems were tested for optical DNA detection of targets of relevance in biomedical application, using the cystic fibrosis gene mutation, and food-analysis, using the genomic DNA from genetic modified organism soy flour. After the solutions of DNA molecules has been infiltrated inside the fibers capillaries and hybridization has occurred, differently from our previous work [2], oligonucleotide-functionalized gold nanoparticles were infiltrated and used to form a sandwich-like system to achieve signal amplification. Spectral measurements of the reflected signal reveal a clear wavelength shift of the reflected modes when the infiltrated complementary DNA matches with the PNA probes placed on the inner fiber surface. Measurements have also been made using the mismatched DNA solution containing a single nucleotide polymorphism, showing no significant changes in the reflected spectrum. Several experiments have been carried out demonstrating the reproducibility of the results and the high selectivity of the sensors, showing the simplicity and the potential of this approach.

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