بسمه تعالی

سخنرانی علمی

Photonic Crystal Slab Nanostructure Biosensors

Abstract: Photonic crystals are widely used to guide and control photons in small volumes and are well suited for large scale optical integration. A photonic crystal slab (PCS) is defined by a periodic two-dimensional (2D) refractive index (RI) contrast in a high-RI slab layer (e.g. a hole lattice). In addition to conventional in-plane guided modes, PCS structures support guided mode resonances (GMRs) which arise from the coupling of external radiation and internal guided modes. This straightforward light-coupling scheme gives rise to narrow Fano resonance lineshapes which are well suited for label-free sensing in microfluidic environments. Capture agent/target binding changes the local RI, causing the GMRs' spectral locations to shift. This shift can be used to determine the number of binding events that have occurred.

We report a direct detection limit measurement of $\Delta n = (6\pm1)\times10^{-6}$ [RIU], in a two-dimensional (2D) photonic crystal slab (PCS) bio-sensor. The detection limit was quantified by resonance spectral shift and precise control of a split-flow of two liquids through real-time measurements. We demonstrate a split mesa PCS for self-referencing and temperature insensitive measurements. Using a novel multi PCS architecture we propose a technique for parallel multi-analyte studies and for improved detection accuracy in a single measurement. Our SiNx based 2D PCS design integrated with a microfluidic channel is suitable for label-free analyte detection in optofluidic bio-sensing applications. These sensors represent a low-cost, CMOS compatible, large-area sensitive solution for optofluidic bio-sensing.

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