UNIVERSITI TEKNOLOGI MARA

PHYSICAL PARAMETRIC STUDIES OF PHOTONIC CRYSTAL CAVITY AFFECTING THE PERFORMANCES OF SENSOR APPLICATIONS

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ABSTRACT

In this work, a small size of PC slab high sensitivity, and high accuracy sensor for measuring the performance of sensor application was realized in variation of sensing material such as cryptophane E, sugar-water solution and phosphate buffered saline (PBS) infiltrated photonic crystal cavity (PhCC)_ by combining selective absorption characteristic of sensing material to gas, liquid and protein sensor. The parametric studies has been done by increased the refractive index (RI) of the different sensing material, increase the number of defected holes of PhCC and increase the radii of defected holes of the PhCC. The RI of different sensing material that infiltrated in defected holes of PhCC will induce a shift of resonant wavelength and allowing the precision absorption characteristic in different sensor application. In order to demonstrate the parametric studies based on 2D silicon PhCC, we used the finite difference time domain (FDTD) method to observe the performance of PhCC sensors. The simulation results of PhC microcavity for gas sensing show the RI sensitivity of 48.2 nm/RIU, a quality factor of 2551 and transmission of 0.3330. Liquid sensing simulation results shows the RI sensitivity of 46.3 nm/RIU, a quality factor of 1874 and transmission of 0.5690. In protein sensing results show, the RI sensitivity of 114.4 nm/RIU, quality factor of 1659 and transmission of 0.3814. The advantage of high sensitivity and high quality factor of the PhC microcavity which is, it can be used in other sensing material as well, and protein showed highest RI sensitivity value of 114.4 nm/RIU. The design has been realized in silicon photonic crystal structure. The whole design and simulation process is done by using the OptiFDTD software.

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