# PHOTONIC CRYSTALS ARRAY APPLIED TO GLUCOSE SENSOR

Xin Zhao[1,*], Bo Gao[1], Zhi Mei Yang[1] , Yao Ma[1], Ming Min Huang[1], Li Lai[1] and Min Gong[1]

College of Physical Science and Technology, Sichuan University, Chengdu, China

* Email: zhaoxin1234@scu.edu.cn; Tel.: +86-028-85412287

The current medical measurement of human blood glucose concentration is invasive. In order to relieve the suffering of patient and improve the efficiency, a non-invasive optical glucose sensor is required. Based on these advantages, this paper designs a filter based on basic two-dimensional Photonic Crystals [1-5] structure by using different array structure. Based on Rsoft simulation software, the dimensional photonic crystal models are built. By changing the lattice structure and the depth of the apertures, the power transmission of the structure is analyzed.

Compared with invasive glucose sensor, optical noninvasive glucose sensor can reduce the pain of frequent sampling. However, the optical testing of glucose concentration is still influenced by the noise from body fluid and organic structure. According to this situation, the Photonic Crystals of multi-period array is proposed. Photonic crystals can enhanced the intensity of the light selectively in the form of increasing the characteristic peak value which can read out the glucose concentration. By comparison and comprehensive analysis, the effective high-precision optical signal can be chosen from the noise. The wavelength of the infrared light source is from 5 to 15μm. The minimum size of the fabrication processing is 0.5μm which ensures the higher precision without increasing the costs. The project will provide new point about the non-invasive optical glucose sensor by the way of multiple characteristic peak comprehensive analysis.

There has been a growing interest in the study of Photonic Crystals because of their unique abilities to control light propagation [6-8]. Recently, significant progress has been made in the fabrication and characterization of Photonic Crystals [9-10], and towards the development of Photonic Crystals applications in the fields of photonic circuits. In these cases, the photonic band structure mainly depends on the lattice constant and refractive index that varies in response to the design changes.

The structure of the two Photonic Crystals are shown in Fig. 1 and Fig. 2. The first structure is designed as Fig. 1 shown. The surface structure is aperture arrays with a diameter of 5μm and lattice constant of 10μm. The depth of the aperture array in the Photonic Crystal is 2μm. The structure of the lattice structure is square. The second surface structure is aperture arrays with a diameter of 5μm and lattice constant of 8μm. The structure of the lattice structure is equal triangle as shown in Fig. 2. The relationship between the transmission power and the wavelength of the input light is shown in Fig. 3 and Fig. 4. The SEM image of the equal triangle lattice Photonic Crystal is shown in Fig. 5. The surface structure is aperture arrays with a diameter of 5μm and lattice constant of 8μm. The depth of the aperture is 2μm.

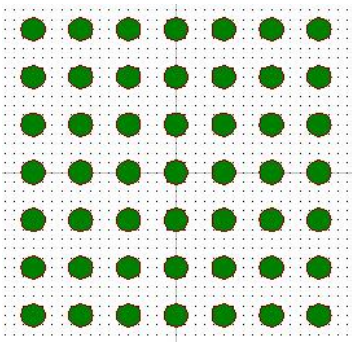

*Fig.1 Schematic of the Photonic Crystal with the square lattice.*

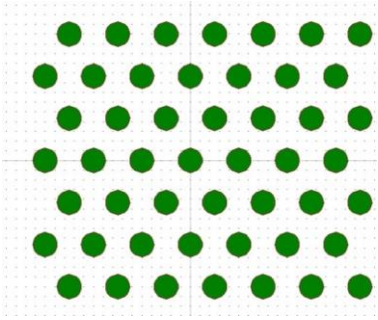

*Fig.2 Schematic of the Photonic Crystal with the triangle lattice.*

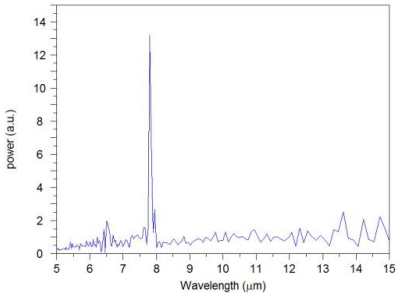


*Fig. 3 The power transmission of the Photonic Crystal structures when the lattice structure is square, the depth of the the aperture is 2 μm.*

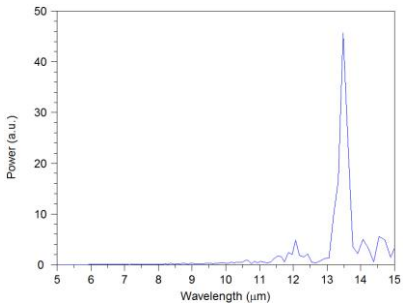


*Fig. 4 The power transmission of the Photonic Crystal structures when the lattice structure is equal triangle, the depth of the aperture is 0.5 μm.*

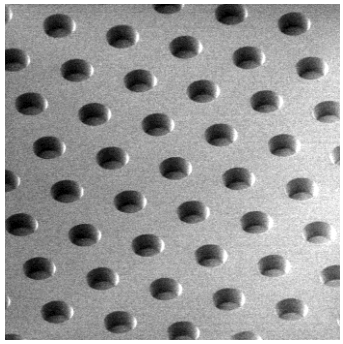

*Fig. 5.The SEM image of the equal triangle lattice Photonic Crystal.*

**REFERENCES:**


[1] P. Gargini, J. Glaze, and O. Williams, "The SIA's 1997 National technology roadmap for semiconductors: SIA road map preview," Solid State Tech, vol. 4. pp. 73-76, 1998.

[2] E.M. Purcell, "Spontaneous transition probabilities in radio-frequency spectroscopy,".Phys.Rev,vol.69.pp. 681-684, 1946.

[3] K.M. Ho, C.T. Chan, and C.M. Soukoulsi, "Existence of a photonic gap in periodic structure," Phys.Rev.Lett, vol. 65. pp. 3152, 1990.

[4] E. Yablonovith, T.J. Gmitter and R.D. Meade, "Donor and acceptor modes in photonic band structure," Phys.Rev.Lett, vol. 67. pp. 3380-3383, 1991.

[5] T.M. Monro "Holey optical fibers：an efficient modal mode," . J Lightwave Technology, vol. 17. pp. 1093-1102, 1999.

[6] K. Goodarzi, and A. Mir, "Design and analysis of an all-optical demultiplexer based on photonic crystals," Infrared Phys.Technol, vol. 68. pp 193-196, 2015.

[7] S.P. Li, etal. "A tunable terahertz photonic crystal narrow-band filter," IEEE Photon Technol.Lett, vol. 27.pp 752-754, 2015.

[8] H. Sekoguchi, Y. Takahashi, T. Asano, and S. Noda, "Photonic crystal nanocavity with a Q-factor of ~9 million," Opt.Express, vol. 22. pp 916-924, 2014.

[9] D. Cassagne, C. Jouanin, and D. Bertho. "Hexagonal photonic-band-gap sturctures," Phys. Rev, vol. 53. pp. 7314-7142, 1996.

[10] M. Hok, C.T. Chan, and C. M. Soukoulis. "Existence of a photonic gap in periodic dielectric structures," Phys. Rev. Lett, vol. 65. pp 3152-3155, 1990.