# Supporting Information

# Factors influencingRecognition Capability of Photonic Crystal Sensors with Inverse Opal Structure

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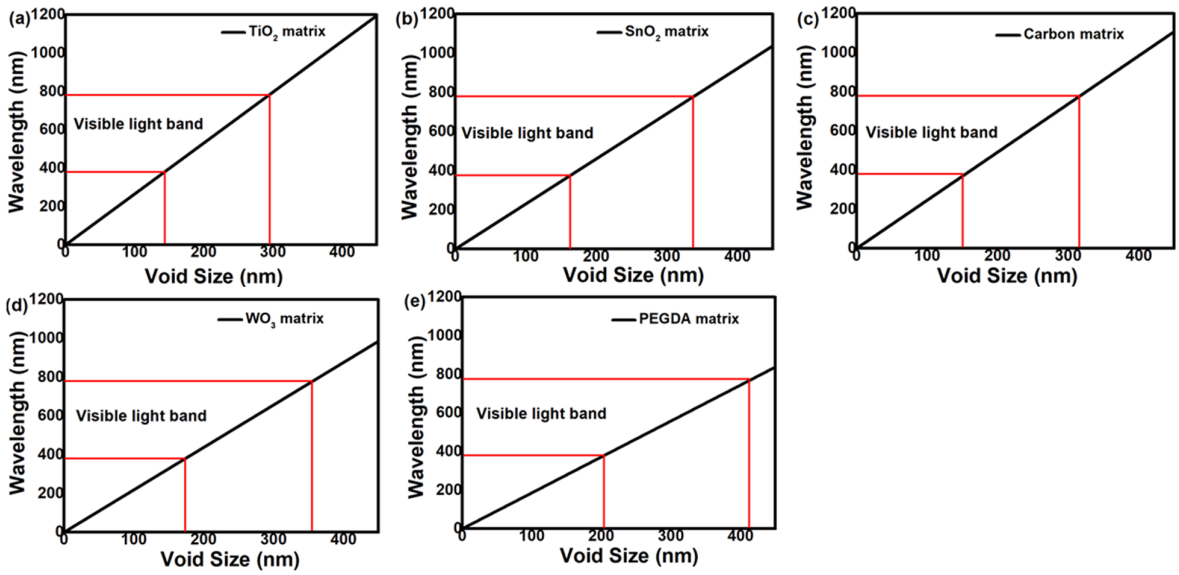


Figure S1 Relations between central reflection wavelength ($\lambda_{IO}$) and void sizes (D) of the IO structure systems, where the systems were composed of (a) $TiO_2$ matrix, (b) $SnO_2$ matrix, (c) Carbon matrix, (d) $WO_3$ matrix, (e) PEGDA matrix.

Table S1 The range of central reflection wavelengths and void sizes of the IO structures composited of different matrixes

| Matrixes | The range of central reflection wavelengths (nm) | The range of the void size (nm) |
|---|---|---|
| $TiO_2$ | 380-780 | 143-295 |
| $SnO_2$ | 380-780 | 164-338 |
| Carbon | 380-780 | 150-316 |
| $WO_3$ | 380-780 | 173-356 |
| PEGDA | 380-780 | 204-412 |

The Equations that describe the wavelength response range of PC sensors constructed by different matrixes have been shown below.

$$\Delta\lambda_{TiO_2}=1.633D*\left(\left(0.74*n_s^2+1.909\right)^{1/2}-1.628\right) \qquad (Eq.\ S1)$$

$$\Delta\lambda_{SnO_2}=1.633D*\left(\left(0.74*n_s^2+1.258\right)^{1/2}-1.414\right) \qquad (Eq.\ S2)$$

$$\Delta\lambda_{carbon}=1.633D*\left(\left(0.74*n_s^2+1.535\right)^{1/2}-1.508\right) \qquad (Eq.\ S3)$$

$$\Delta\lambda_{WO_3}=1.633D*\left(\left(0.74*n_s^2+1.061\right)^{1/2}-1.341\right) \qquad (Eq.\ S4)$$

$$\Delta\lambda_{PEGDA}=1.633D*\left(\left(0.74*n_s^2+0.562\right)^{1/2}-1.141\right) \qquad (Eq.\ S5)$$

Where $\Delta\lambda_{TiO2}$, $\Delta\lambda_{SnO2}$, $\Delta\lambda_{carbon}$, $\Delta\lambda_{WO3}$, $\Delta\lambda_{PEGDA}$ are the wavelength response range of IO structured PC sensor with $TiO_2$, $SnO_2$, carbon, $WO_3$, PEGDA matrix, respectively. $D$ means the void sizes in these IO structures, $n_s$ represents the refractive index of external substances.

The Equations that express the wavelength range contrast ($\Delta\lambda$) caused by two external substances in the IO structure composited of other matrixes have been given in Equation S6-Equation S10.

$$\Delta\lambda_{TiO_2\text{-contrast}}=1.633D*\left(\left(0.74*n_{S1}^2+1.909\right)^{1/2}-\left(0.74*n_{S2}^2+1.909\right)^{1/2}\right) \qquad (Eq.S6)$$

$$\Delta\lambda_{sno_2\text{-contrast}}=1.633D*\left(\left(0.74*n_{S1}^2+1.258\right)^{1/2}-\left(0.74*n_{S2}^2+1.258\right)^{1/2}\right) \qquad (Eq.S7)$$

$$\Delta\lambda_{carbon\text{-contrast}}=1.633D*\left(\left(0.74*n_{S1}^2+1.535\right)^{1/2}-\left(0.74*n_{S2}^2+1.535\right)^{1/2}\right) \qquad (Eq.S8)$$

$$\Delta\lambda_{WO_3\text{-contrast}}=1.633D*\left(\left(0.74*n_{S1}^2+1.061\right)^{1/2}-\left(0.74*n_{S2}^2+1.061\right)^{1/2}\right) \qquad (Eq.S9)$$

$$\Delta\lambda_{PEGDA-\text{contrast}}=1.633D*\left(\left(0.74*n_{S1}^2+0.562\right)^{1/2}-\left(0.74*n_{S2}^2+0.562\right)^{1/2}\right) \qquad (Eq.S10)$$

Where$\Delta\lambda_{TiO2\text{-}contrast}$, $\Delta\lambda_{SnO2\text{-}contrast}$, $\Delta\lambda_{carbon\text{-}contrast}$, $\Delta\lambda_{WO3\text{-}contrast}$, $\Delta\lambda_{PEGDA\text{-}contrast}$ means the wavelength range contrast of the PC sensors response to external substance 1 and substance 2, where the PC sensors are composited of $TiO_2$, $SnO_2$, carbon, $WO_3$, PEGDA matrix, respectively. D means the void sizes in these IO structures, $n_{S1}$ and $n_{S2}$ represents the refractive index of external substance 1 and substance 2.

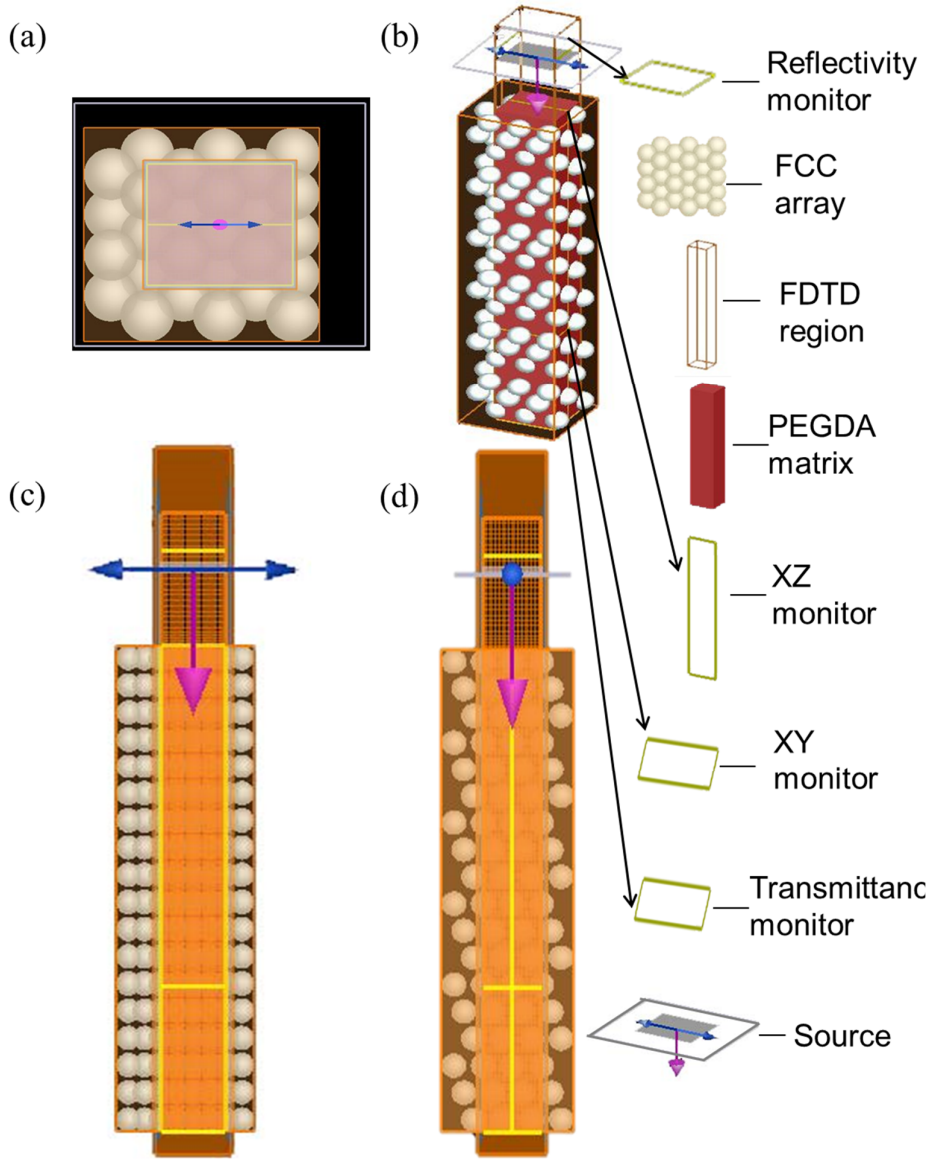


Figure S2 Simulation model of PC sensors composited of PEGDA matrix and the voids with a closed-packed face-centered cubic structure. where the void ratio is 30%. (a) Top view; (b) Three-dimensional diagram; (c) Main view; (d) Left view