

Electronic Supplementary Information

Fluoral-p infiltrated SiO₂ inverse opal photonic crystals as fluorescent film sensors for detecting formaldehyde vapor

Yuqi Zhang,^a Lidan Mu,^a Ru Zhou,^a Pei Li,^b Jiaqi Liu,^a Loujun Gao,^a Liping Heng^{*b} and Lei Jiang^b

^a College of Chemistry & Chemical Engineering, Shaanxi Key Laboratory of Chemical Reaction Engineering, Yan'an University, Yan'an, Shaanxi 716000, P. R. China.

^b School of Chemistry and Environment, Beihang University, 100191, P. R. China.

*E-mail: henglp@iccas.ac.cn Fax: (+86) 10-82627566

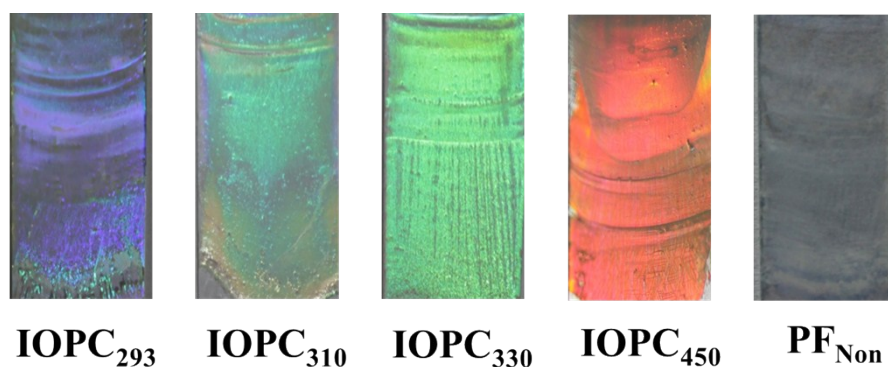


Fig. S1 Photographs of SiO₂ inverse opals IOPC₂₉₃, IOPC₃₁₀, IOPC₃₃₀, IOPC₄₅₀, and the non-periodic SiO₂ porous film PF_{Non}. The photos were obtained from a digital camera (Canon 600D).

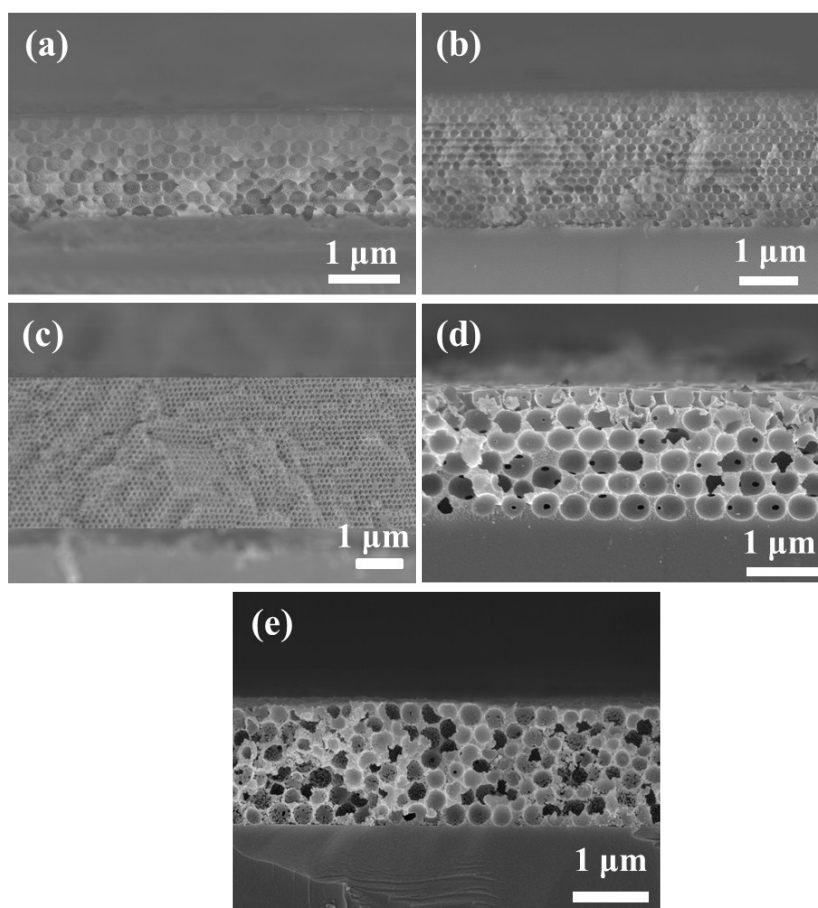


Fig. S2 The cross-sectional SEM images of SiO₂ IOPC₂₉₃ (a), IOPC₃₁₀ (b), IOPC₃₃₀ (c), IOPC₄₅₀ (d), and non-periodic SiO₂ porous film (e).

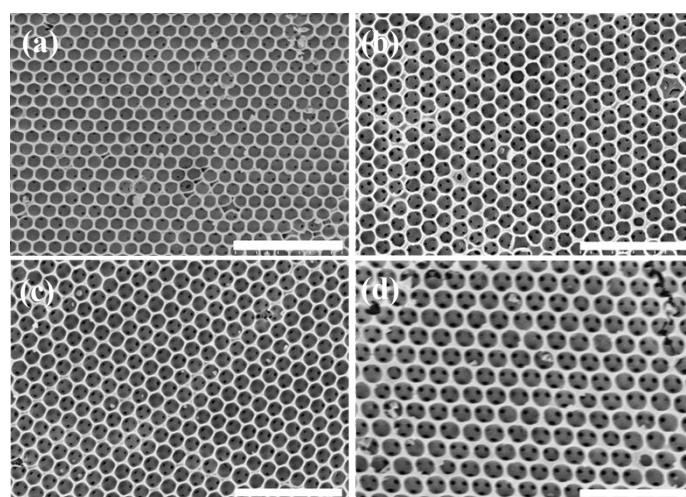


Fig. S3 SEM images of Fluoral-p infiltrated SiO₂ IOPC films fabricated from PS microspheres with diameters of (a) 293, (b) 310, (c) 330, (d) 450 nm, respectively.

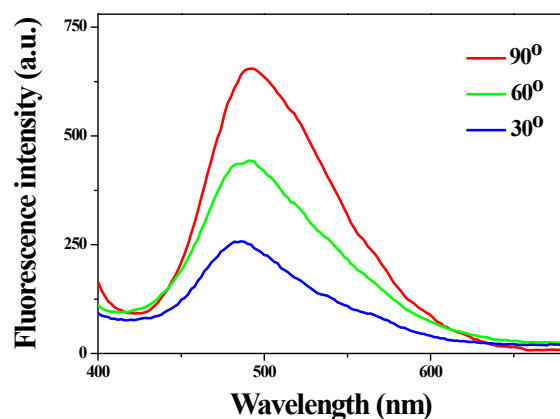


Fig. S4 The in situ fluorescence spectra of F-SiO₂ IOPC₃₃₀ recorded at different angle between the incident light and (111) plane of PCs when the concentration of formaldehyde vapor is 12.8 mg/m³.

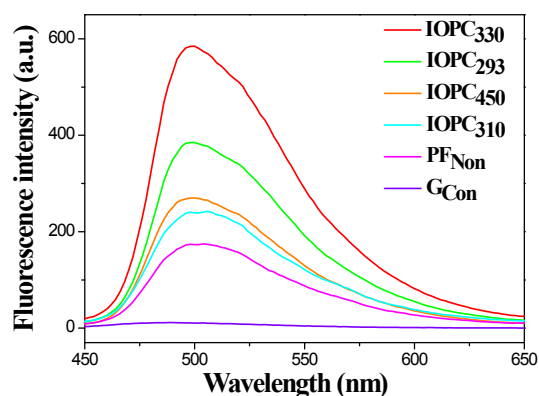


Fig. S5 The fluorescence spectra of different F-SiO₂ IOPC sensors, the non-periodic SiO₂ porous film (PF_{Non}) and the control sample (G_{con}) exposed to FA vapor for 320 s at the concentration of 12.8 mg/m³ ($\lambda_{\text{ex}} = 360$ nm).

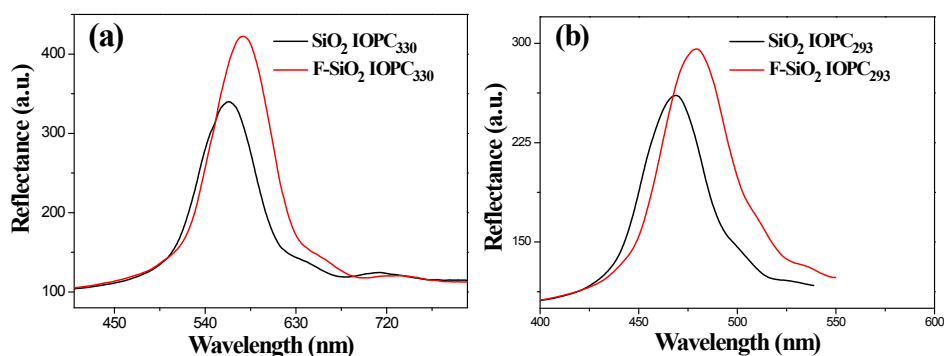


Fig. S6 The reflectance spectra of SiO_2 IOPC₃₃₀ (a) and SiO_2 IOPC₂₉₃ (b) before (black line) and after (red line) infiltrating Fluoral-p molecules. There is a little shift in the reflectance spectra after Fluoral-p molecules infiltrated into the SiO_2 IOPC because small quantities of Fluoral-p may induce tiny variation in the effective refractive index of PC. Red shifts of 14 nm and 10 nm in the stopband for SiO_2 IOPC₃₃₀ and SiO_2 IOPC₂₉₃ can be observed.

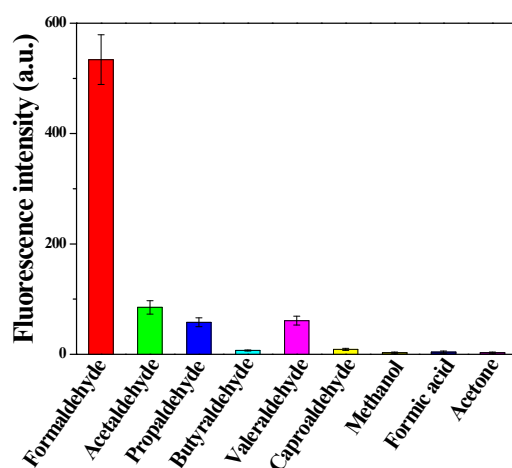


Fig. S7 The fluorescence intensity at the wavelength of ~ 495 nm when the F-SiO_2 IOPC₃₃₀ sensor was exposed to the different aldehydes and other volatile organic compounds (VOCs) at concentration of 12.8 mg/m^3 . There is remarkably strong fluorescence in the environment of formaldehyde vapor, while there are very weak or even no fluorescence in the vapors of other aldehydes and VOCs, which demonstrated that the as-prepared sensor is excellently selective to formaldehyde.