

## Novel Polymer-based Thermoresponsive Photonic Crystal Sensors with Broad Wavelength Shifts

Lu Li,<sup>\*a,d</sup> Jingjing Xu<sup>a</sup>, Xin Lyu<sup>a</sup>, Zhanfang Liu<sup>\*b</sup>, Zihe Song<sup>a</sup> and Juan Wei<sup>\*c</sup>

<sup>a</sup>Key Laboratory of Auxiliary Chemistry and Technology for Chemical Industry, Ministry of Education, Shaanxi University of Science and Technology, Xi'an 710021, China.

<sup>b</sup>Institute of Forensic Science, Ministry of Public Security, Beijing 100038, China.

<sup>c</sup>Department of Chemistry, National University of Singapore, 3 Science Drive 3, 117543, Singapore.

<sup>d</sup>Shaanxi Collaborative Innovation Center of Industrial Auxiliary Chemistry and Technology, Shaanxi University of Science and Technology, Xi'an 710021, China.

### Preparation of VF-IOPPCs

VF-IOPPCs were prepared according to our previous work (Li et al. 2016). In this paper, monodispersed silica particles with a diameter of about 260 nm were used. In the typical preparation process, the prepolymer was made by methacrylic acid (MAA, 5 mmol), vinyl ferrocene (1.5 mmol), EGDMA (0.1 mmol), and 2-Hydroxy-2-methylpropiophenone (10  $\mu$ L), which were sufficiently mixed in anhydrous ethanol (0.5 mL). Then the prepolymer was degassed with nitrogen for 20 min to remove the dissolved oxygen. The solution was infiltrated into the photonic crystal templates which were covered with PMMA slides. After the removal of excess precursors on the slides, photopolymerization was performed under a UV light at 365 nm for 3 h. VF-IOPPCs were obtained after the films were immersed in 3% HF solution, and then washed to neutral with deionized water. Finally, VF-IOPPCs were immersed in deionized water still they reached a swelling equilibrium.

### Temperature response of VF-IOPPCs

The prepared VF-IOPPCs were immersed in hydrogen peroxide solution to reach swelling equilibrium at different temperatures, and their reflection and color were recorded in the same time.

### Characterization

The VF-IOPPCs were characterized by scanning electron microscope (SEM, HITACHI, Regulus 8100). The reflections were measured by an optical fiber spectrometer (FLAME-T-VIS-NIR, Ocean Insight). These spectra were taken with light impinging perpendicular to VF-IOPPCs and the diameter of collection spots were about 1.5 mm. The color changes of VF-IOPPCs were recorded by a common digital camera.

### Reference

Li, L., Long, Y., Gao, J.M., Song, K., Yang, G., 2016. *Nanoscale* 8(8), 4458-4462.

