Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Reflection and Transmission Two-Way Structural Colors

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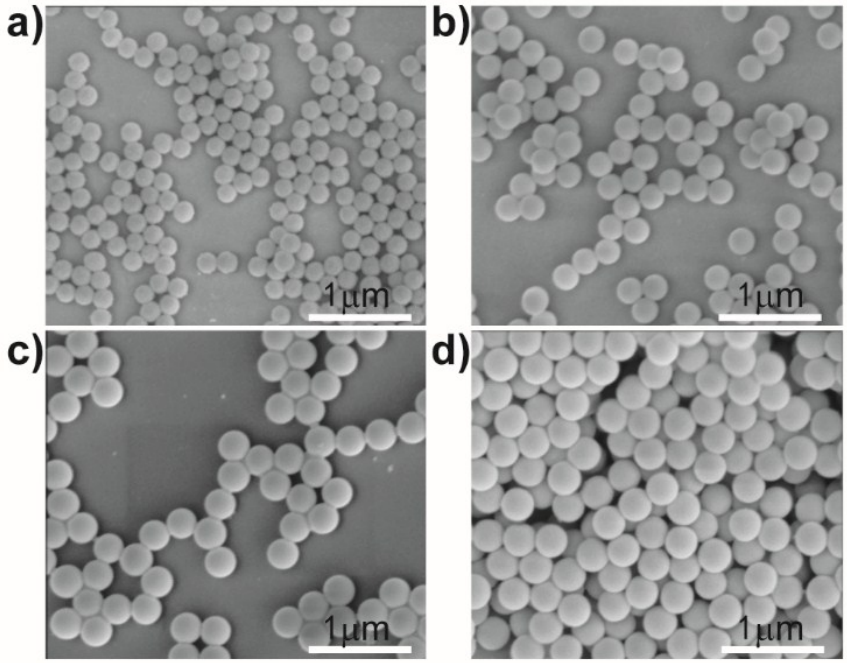

Figure S1. The SEM images of SiO_2 spheres with diameter of a) 180 nm, b) 250 nm, c) 295 nm, and d) 330 nm.

According to Bragg's law and Snell's law, the photonic stop bands of FCC structured PCs can be theoretically calculated as

$$\lambda = 2\sqrt{2/3}\ (\mathrm{D})\ \ (\sqrt{n^2 - sin^2\theta}) \tag{1}$$

$$n^2 = 0.74 \times n_0^2 + 0.26 \times n_c^2 \tag{2}$$

Where λ is the wavelength of reflection peak; θ is the incident angle, equal to the detection angle; D is the diameter of the latex particles; n is the effective refractive index; n_0= 1.45 and n_c = 1.0 are the refractive index of silica and the air, respectively.

We can predict the diameter of silica spheres with needed structural color through the Bragg's law of diffraction. So we can convert the formula into another form like

$$D = \lambda / \left[1.63 \times \sqrt{1.82 - \sin^2\theta}\right] \tag{3}$$

First, let's assume that the incident angle (θ) is 5, and the wavelength position of the band gap (λ) was used to determine the diameter (D) of the silica spheres we needed according to Equation (3). The results are shown in the table S1.

Table S1. Diameter of the silica microsphere we used

λ (nm)	θ (°)	Theoretical D (nm)	Practical D (nm）
640	5	291	295
540	5	246	250

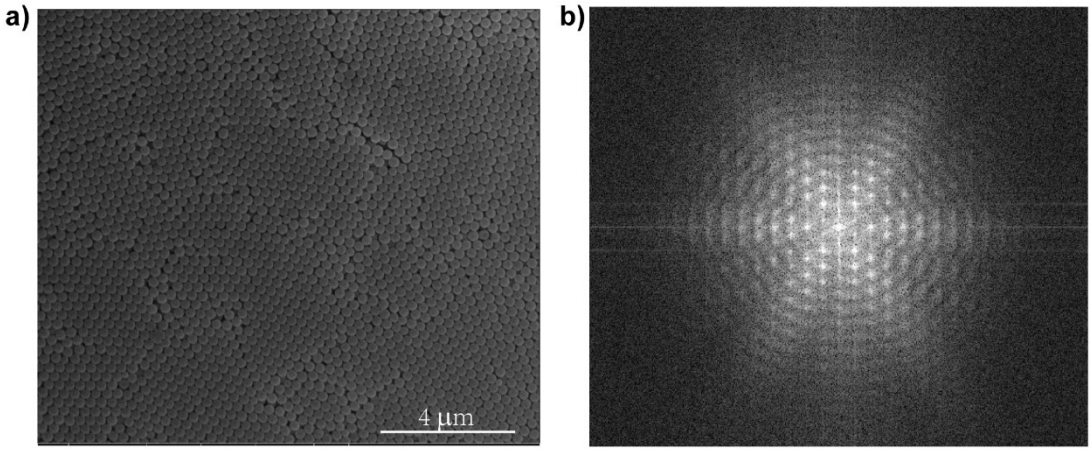

Figure S2. a) Typical SEM images of the PC assembled by 295 nm SiO_2 microspheres. b) 2D Fourier transform graph.

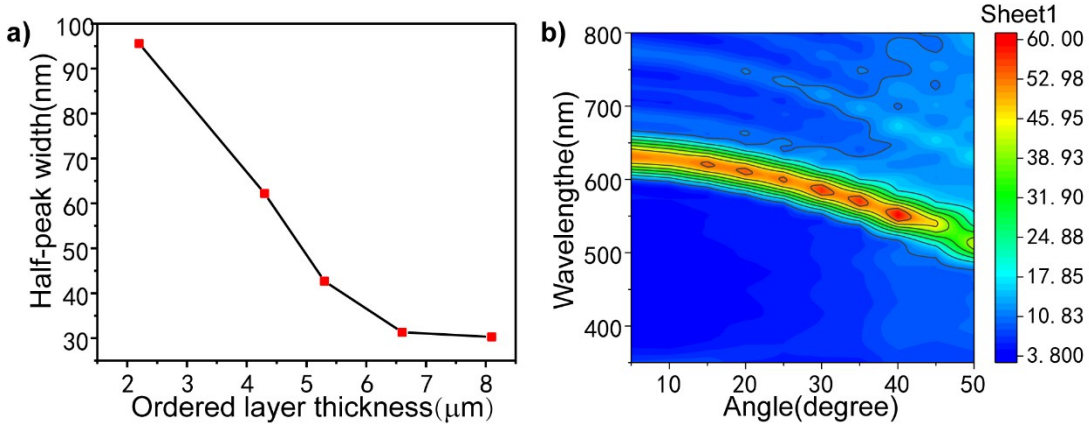

Figure S3. a) The narrowing trend of half-peak widths of different ordered layer thicknesses. b) Reflection spectrum of ordered layers assembled with 295 nm SiO_2.

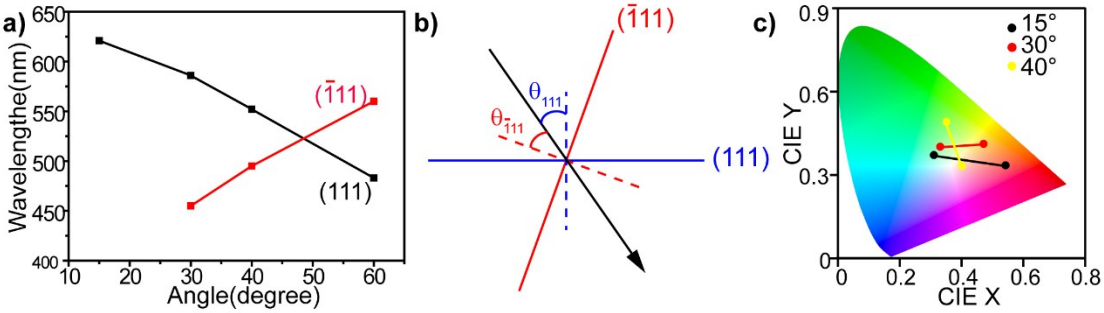

Figure S4. a) The position of the transmission peak of the two crystal planes (111, $\bar{1}11$) as the angle changes. b) Schematic diagram of the angle between the $\bar{1}11$ plane and the 111 plane. c) Complementary structure color of reflection and transmission in CIE chromaticity diagram.

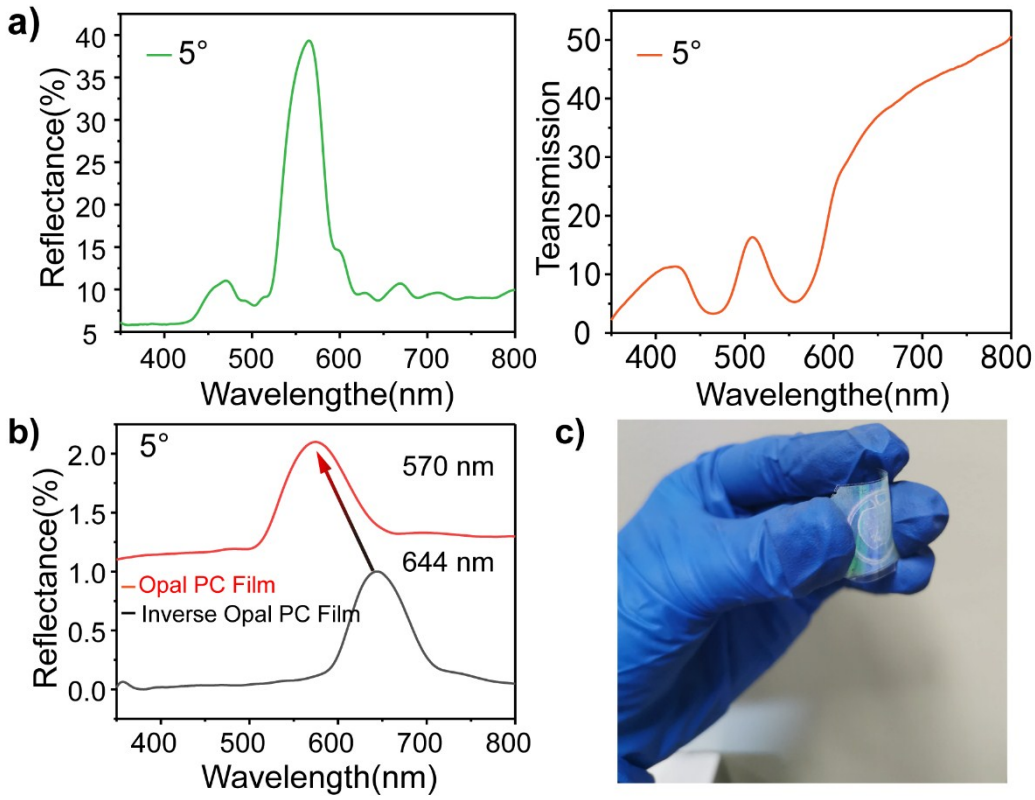

Figure S5. a) Reflection and transmission spectra of the pattern parts. b) Reflection spectrum of opal and inverse opal structures assembled by 295 nm SiO_2 microspheres at an incident angle of 5 Degrees. c) A digital photo of soft inverse opal PC film.