Supplementary information for:

Photorefractive Photonic Crystals Fabricated by PMMA and 5CB Based Materials Using Three-dimensional Colloidal Crystals

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The position of photonic stop band can be estimated by using a modified version of Bragg's law:

$$\lambda = 2d\sqrt{n_{eff}^2 - sin\theta^2} \quad \text{(S1)}$$

Where λ is the wavelength of the photonic stop band, n_{eff} is the effective refractive index of the sample, θ is the incident angle which is 20 degree in this measurement, d is the lattice constant. As our samples belong to FCC symmetry, the relationship between d and interval space of the spheres D is calculated as: $d=(2/3)^{0.5}D$.

The effective refractive index of the PDLC 277 can be estimated by using effective media theory via the following relation:

$$n_{eff}^2 = n_{silica}^2 f_{silica} + n_{PDLC}^2 f_{PDLC} + n_{air}^2(1 - f_{silica} - f_{PDLC}) \quad \text{(S2)}$$

Where n_{silica} and n_{PDLC} are the refractive index of silica microspheres and PDLC material, f_{silica} is volume fractions of silica microspheres, taken as 72% for a face-centered cubic structure (Little lower than the theoretical maximal value because exists of the defects). As we consider the situation at the highest field intensity (2.75 $V\mu m^{-1}$), all 5CB molecules are assumed in parallel arrangements and the refractive index for ordinary ray of 5CB, 1.532[1] is applied. Therefore, the refractive index of PDLC fabricated by 40% PMMA and 60% 5CB with external voltage at 2.75$V\mu m^{-1}$ can also be estimated by using effective media theory. The infilling volume ratio of PDLC in the silica colloidal crystal can be calculated as 0.1742. The calculated relationship between n_{silica}, n_{PDLC} and external potentials are shown in Figure 3 inset, which are both prominently decreased with the increase of the field intensity.

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[1] A. Mazzulla, F. Ciuchi, J. R. Sambles, Physical Review E 2001, 64, 021708.