Supplementary Material (ESI) for Chemical Communications

Supporting Information for

Colour Modification Action of an Upconversion Photonic Crystal

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Synthesis of $NaYF_4$:Yb,Er nanoparticles: $NaYF_4$:Yb,Er nanoparticles were synthesized according to the previously described method.[S1] The $NaYF_4$:Yb,Er nanoparticles were purified by centrifugation after the addition of ethanol as the flocculent, and redispersed in nonpolar solvents.

Converting Hydrophobic $NaYF_4$:Yb,Er nanoparticles into Hydrophilic Ones: The as-prepared $NaYF_4$:Yb,Er nanoparticles (0.5 mmol) were dissolved in hexane (50 mL) and stirred at −78 °C. Then resulting solution was reacted with a continuous steam of ozone (1.2 L/h) for 30 min. The color of the nanoparticles solution was changed from colorless to blue after the reaction. Then oxygen steam substituted the ozone until the color of the solution changed back to colorless, in order to wipe off the extra ozone dissolved in the solution. Subsequently, for the post treatment, a mixture of CH_3COOH and CH_3SCH_3 were added to the solution, for the modification of the nanoparticles with –COOH. And the resulting mixture was concentrated under vacuum, washed twice with deionized water or acetone, and redispersed in 10 ml water.[S2]

Preparation of Silica Sol Precursor: 2 mL of above $NaYF_4$:Yb,Er water colloid solution was mixed with 3 mL of TEOS, 1.5 mL of ethanol, and 0.5 mL of HCl, and then left to stir at room temperature to get a clear sol.

Preparation of 3D Colloidal Crystals: Colloidal crystal was assembled on a smooth cellulose acetate filter membrane with 450 nm pores. The as-prepared colloidal dispersion was carefully poured onto the membrane and kept at 30°C under static conditions, allowing the water to evaporate in air. After 12 h, an iridescent thin film was formed. The membrane with the colloidal crystal films on the upper surface was placed on a Büchner funnel for further use.

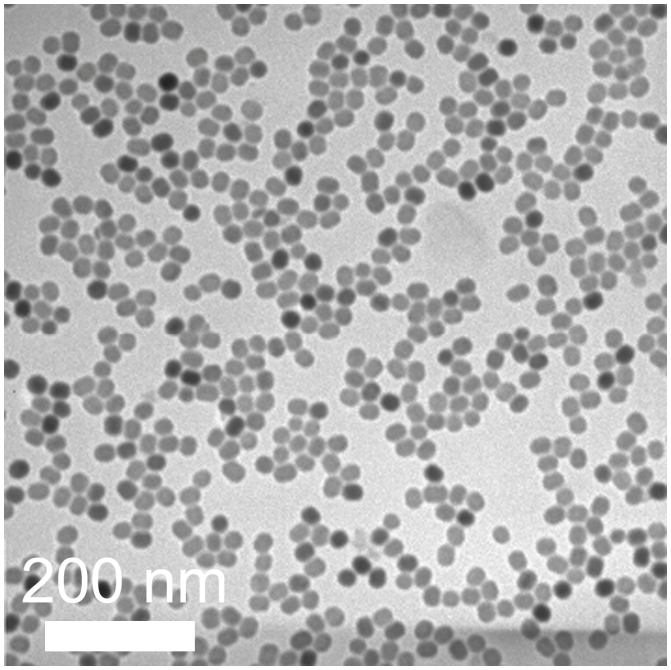

Fig. S1 TEM image of the $NaYF_4$:Yb,Er nanoparticles redispersed in water.

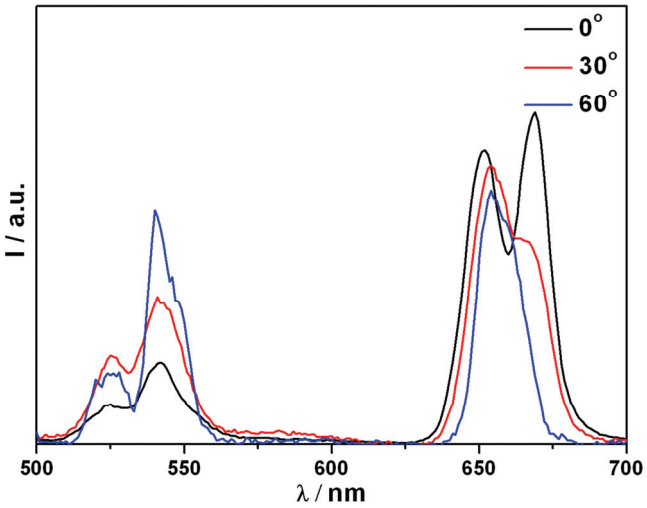

Fig. S2 The emission spectra of PC1 at different incident angles with respect to the surface normal.

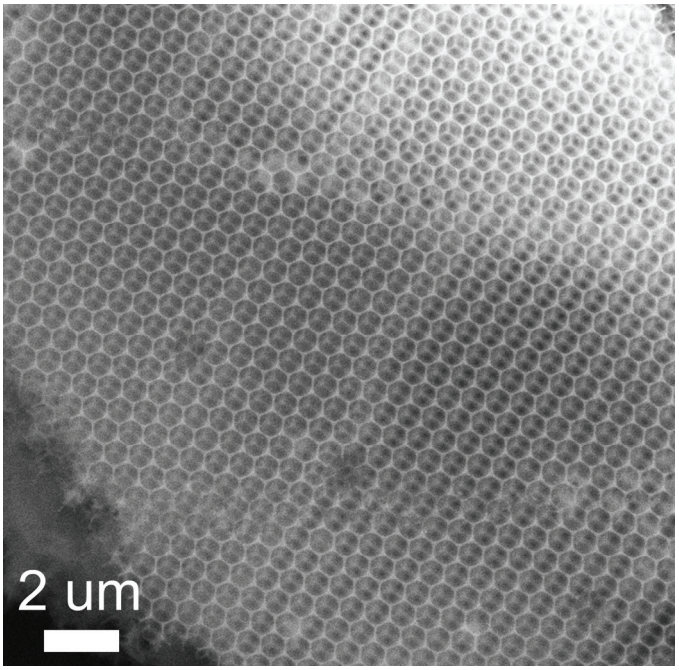

Fig. S3 SEM image of the reference sample PC2.

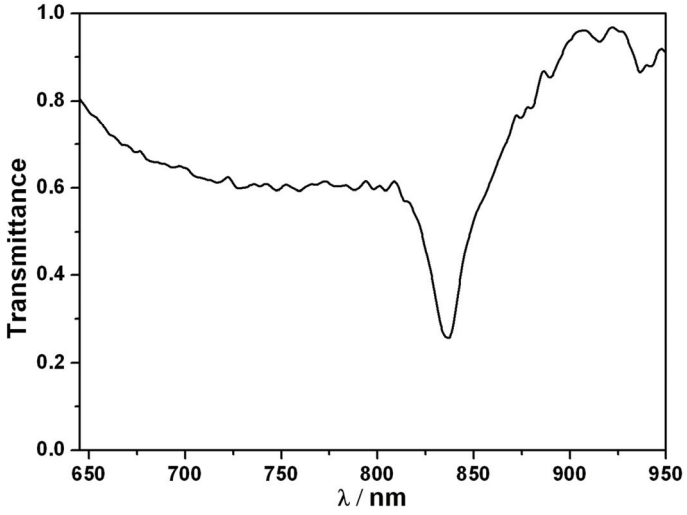

Fig. S4 The transmission spectra of the reference sample PC2.

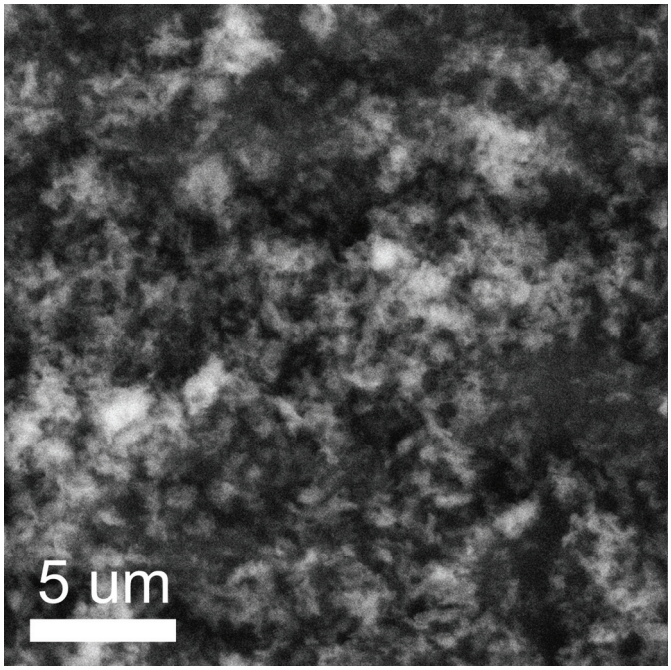

Fig. S5 SEM image of the crushed sample of PC1

Supporting References:

[S1] H. X. Mai, Y. W. Zhang, R. Si, Z. G. Yan, L. D. Sun, L. P. You and C. H. Yan, *J. Am. Chem. Soc.* 2006, **128**, 6426.

[S2] H. P. Zhou and C. H. Yan *unpublished*.