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Communication

Rapid Coating of Ultraviolet Shielding Colloidal Crystals

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Abstract: A facile spray coating preparation of ultraviolet (UV) shielding Poly(methyl methacrylate) (PMMA) based colloidal photonic crystal (PC) films was presented, where the UV radiation was physically resisted by the periodic structure. The specific wavelength within the UV regime could be tuned as required by varying the size of the monodispersed PMMA colloids. Such crystal coatings could be rapidly prepared in optical glasses with controllable thickness of ~5 μm, which could simultaneously resist UV-254 with the efficiency of 77.43%. The monochromaticity of the crystal coatings ensures their potential in UV shielding materials of direct physical skin contact type.

Keywords: colloidal crystal; photonic crystal; UV shielding; coating; self-assembly

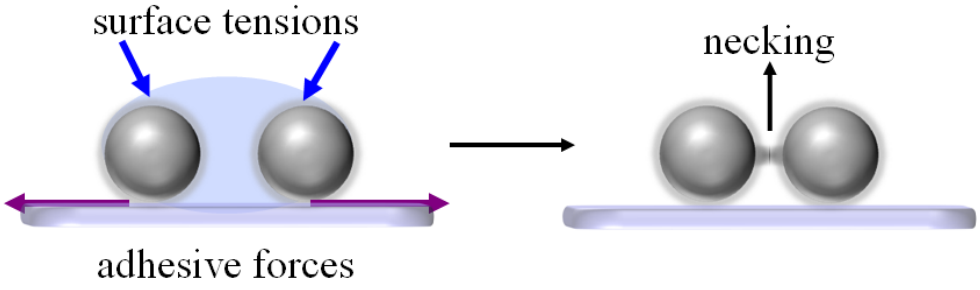

Figure S1. Schematic representation of the motion of PMMA colloids during self-assembling.

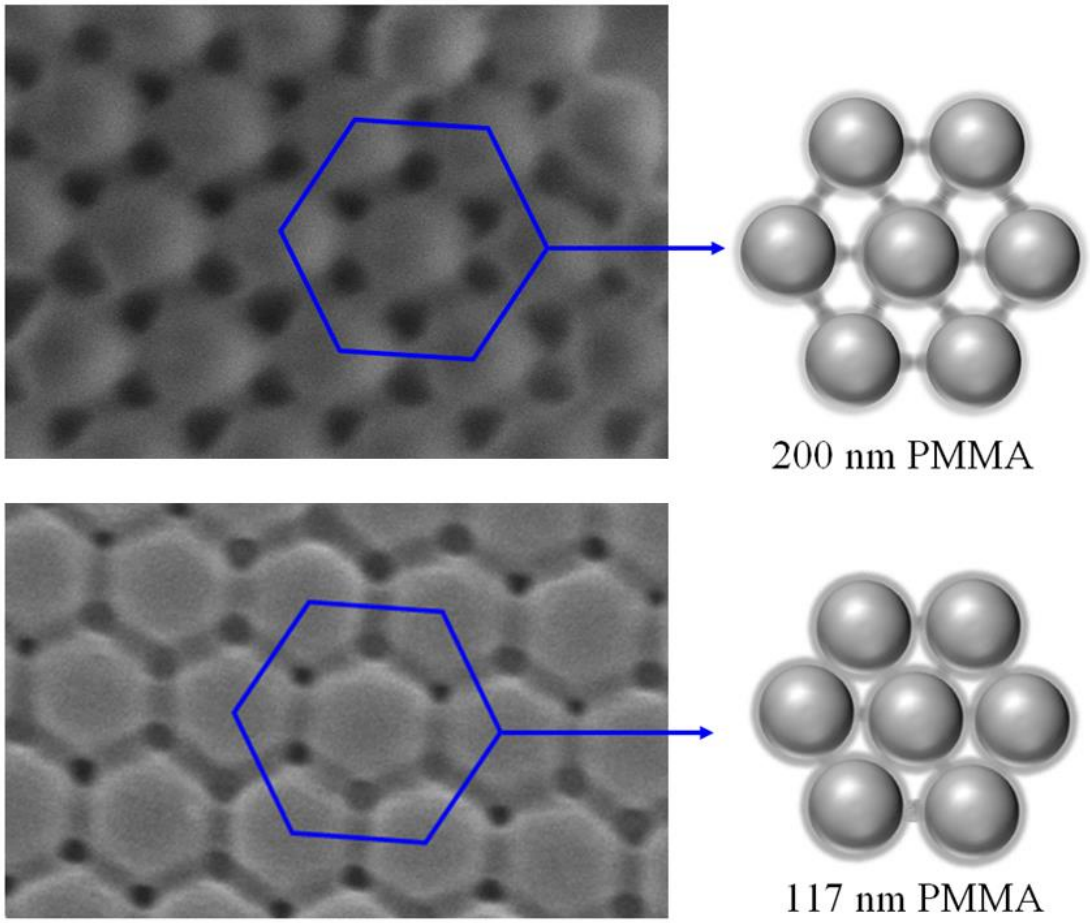

Figure S2. Stacking comparison of CC with different thickness: upper is a 2-layer assembly of 200-nm PMMA and lower is a 52-layer assembly of 117-nm PMMA. Note that the cubic units were normalized for better comparison.

Table S1. Calculated data according to Fabry-Pérot fringes.

p	λ_p (nm)	*K*	*T* (nm)	Error of *T* (%)	*L*	Error of *L* (%)
1	376.5	0.9729	5140	3	54	3
2	366.5	1.9512	5125	3	54	3
3	357.0	2.9314	5117	3	54	3
4	348.0	3.9094	5116	3	54	3
5	339.5	4.8806	5122	3	54	3
6	331.5	5.8403	5137	3	54	3
7	322.0	7.0417	4970	0	52	0
8	314.0	8.1099	4932	1	52	1
9	306.0	9.2339	4873	2	51	2
10	298.5	10.3424	4834	3	51	3
11	291.0	11.5080	4779	4	50	4
12	283.0	12.8195	4680	6	49	6

Although the error may raise as the interference fringes of p_{10} to p_{12} are incomplete, after being removed as error data, the film thickness was recalculated to be 5059 ± 186 nm and the number of stacking layers is 52 ± 2, which are still consistent with the above results.

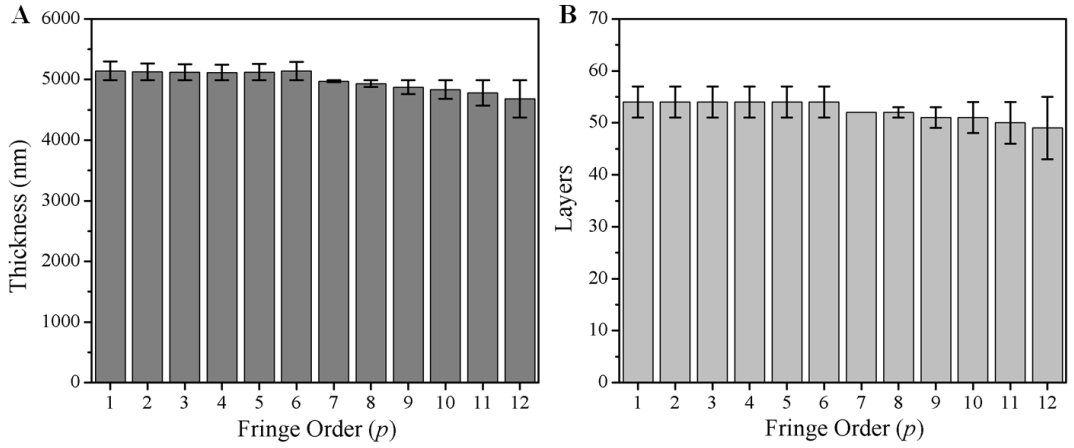

Figure S3. Thickness (*T*) and layers (*L*) analysis of spray coated 117-nm PMMA CC.

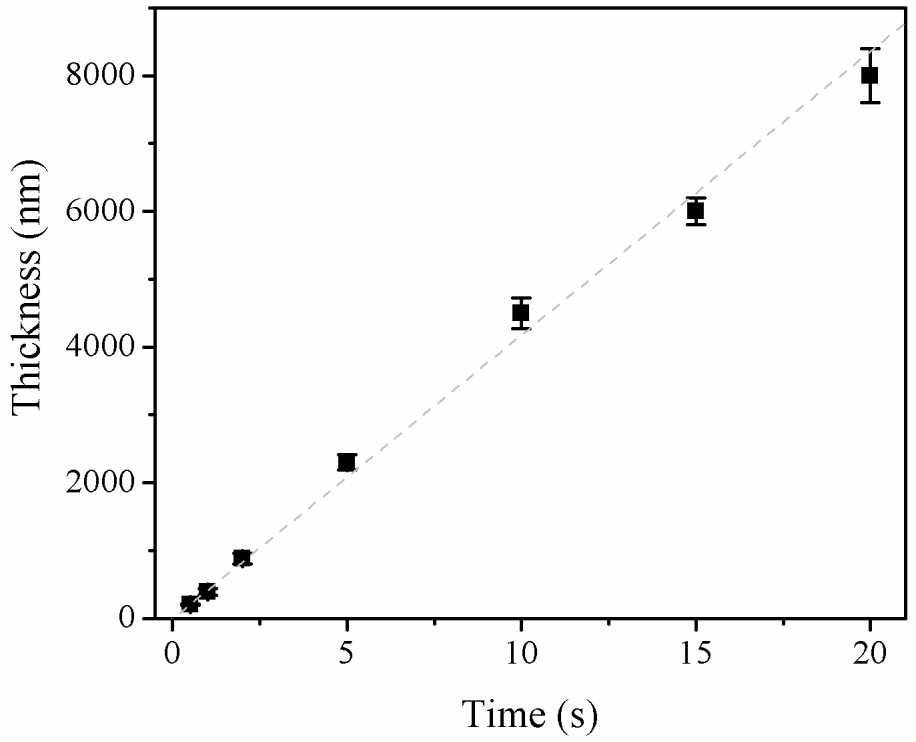

Figure S4. Time dependence of the PMMA crystal thickness during spray process. The thickness of the crystal showed time-related linear growth ($R^2 = 0.99776$).

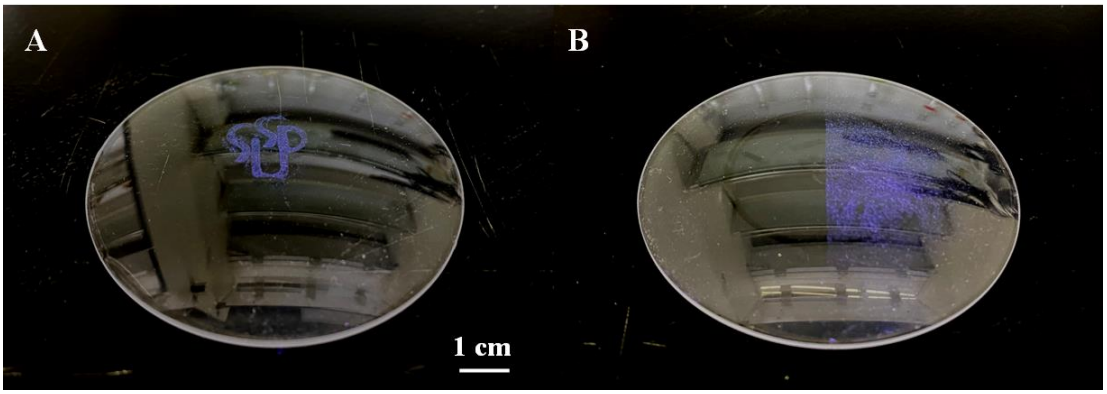

Figure S5. 200-nm PMMA crystal coated on the optical glasses using spray process: (A) "SSPU" pattern coated used a mask and (B) comparison of uncoated (left) and coated (right) surface of the glass. The CCs diffract the light with wavelength of ~456.5 nm and showed bright structural color of purple. For UV shielding coatings, the CCs assembled with smaller PMMA colloids are transparent.