

Supporting Information

Water-Induced Reversible Phase Transformation between Cesium Lead Halide Perovskite Nanocrystals Enabling Fluorescent Anti-Counterfeiting

Haiyan Zhao,^a Tianyu Lin,^a Shuchen Shi,^a Wenhai Bai,^a Tongtong Xuan,^{*ab}
Tianliang Zhou,^{ab} and Rong-Jun Xie^{*abc}

^aFujian Key Laboratory of Materials Genome, College of Materials, Xiamen University, No. 422, Siming South Road, Xiamen 361005, China

^bShenzhen Research Institute of Xiamen University, No. 19, Gaoxin South Fourth Road, Nanshan District, Shenzhen 518000, China

^cState Key Laboratory of Physical Chemistry of Solid Surface, Xiamen 361005, China

Email: ttxuan@xmu.edu.cn (Xuan T.T.); rjxie@xmu.edu.cn (Xie R.-J.)

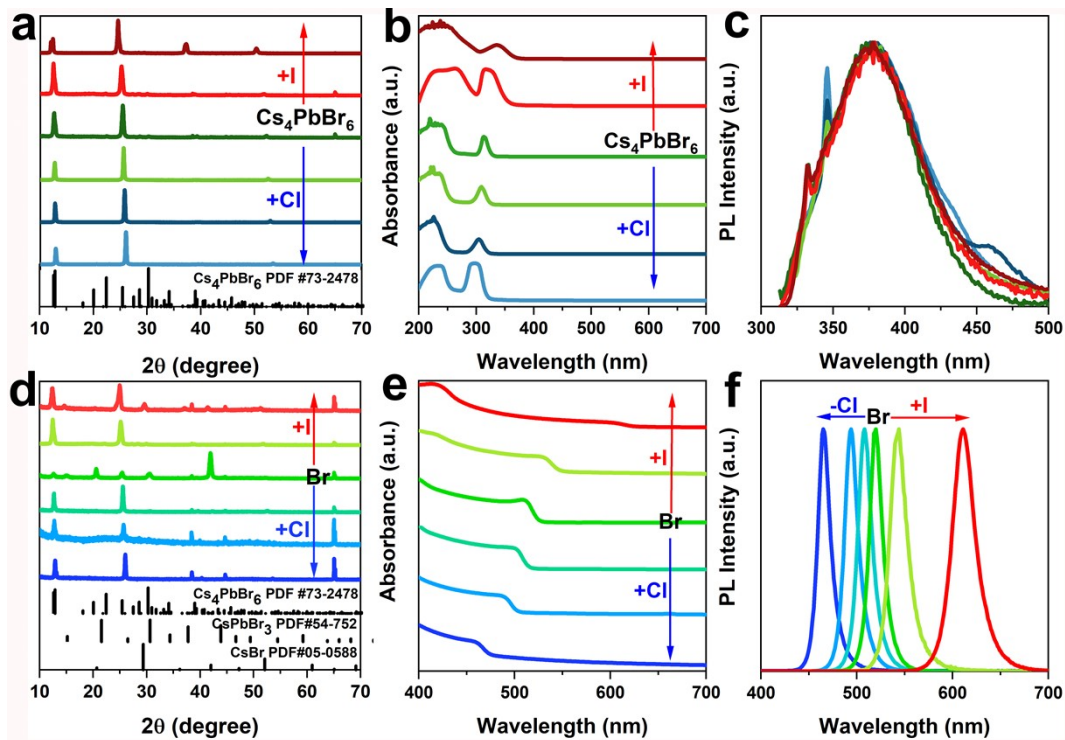


Fig. S1 (a) XRD patterns, (b) absorption spectra, and (c) PL spectra of the Cs_4PbX_6 films with different halide compositions. The detailed formulas of the synthesized Cs_4PbX_6 NCs are $\text{Cs}_4\text{PbCl}_{3.6}\text{Br}_{2.4}$, $\text{Cs}_4\text{PbCl}_{2.4}\text{Br}_{3.6}$, $\text{Cs}_4\text{PbCl}_{1.2}\text{Br}_{4.8}$, Cs_4PbBr_6 , $\text{Cs}_4\text{PbBr}_{3.6}\text{I}_{2.4}$, and $\text{Cs}_4\text{PbBr}_{2.4}\text{I}_{3.6}$ from bottom to top. (d) XRD patterns, (e) absorption spectra, and (f) PL spectra of the $\text{CsPbX}_3/\text{Cs}_4\text{PbX}_6$ films.

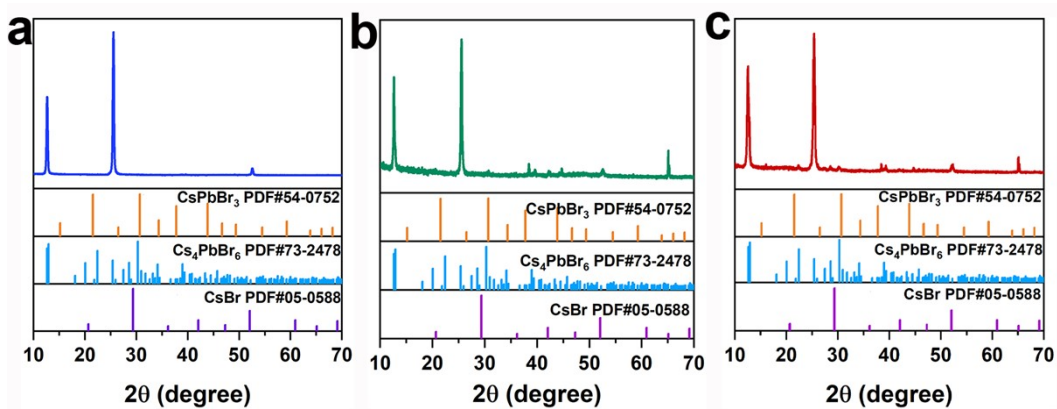


Fig. S2 XRD pattern of Cs_4PbBr_6 NC films: (a) before treatment, (b) after water vapor treatment, and (c) after vacuum drying.

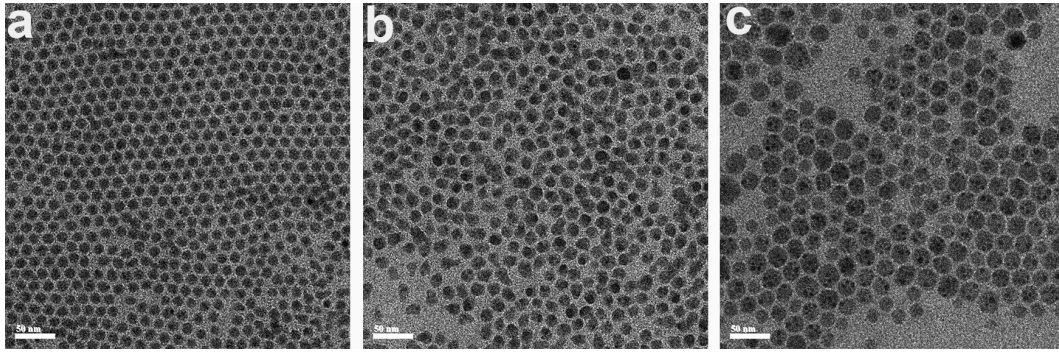


Fig. S3 TEM images of Cs_4PbBr_6 NCs: (a) before treatment, (b) after water vapor treatment, and (c) after vacuum drying.

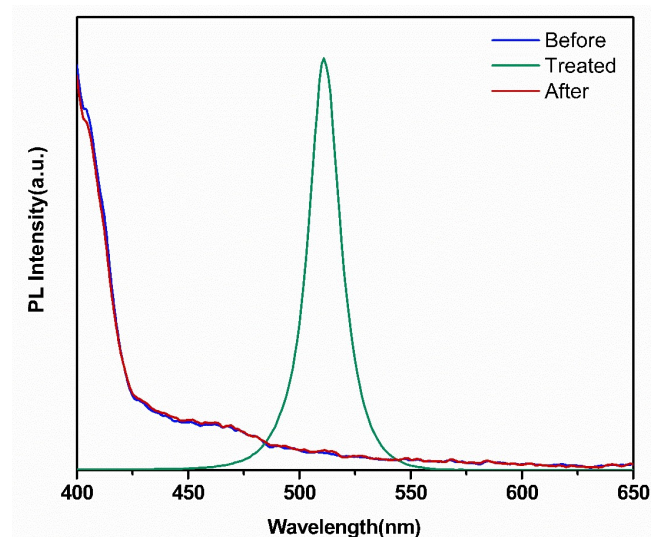


Fig. S4 Photoluminescence spectra of the Cs_4PbBr_6 NC film based on the logo of Xiamen University under 365 nm excitation: (a) before treatment, (b) water vapor treatment, and (c) vacuum drying.

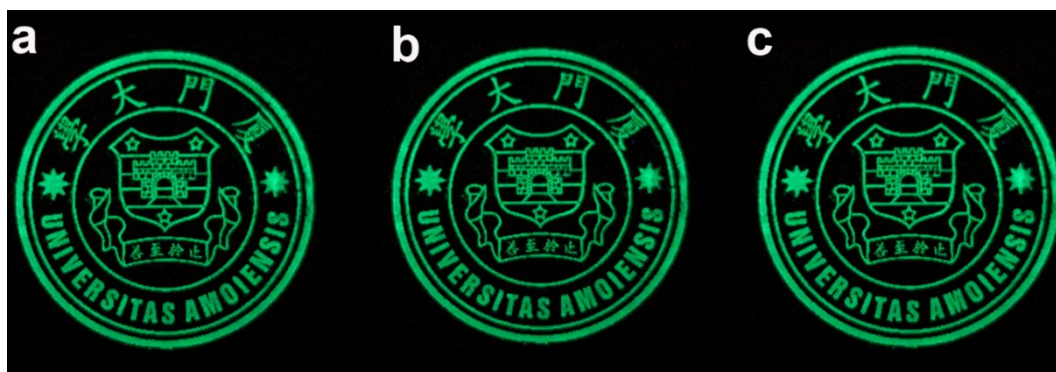


Fig. S5 Photographs of the logo of Xiamen University under 365 nm UV light after (a) 1, (b) 10, and (c) 20 consecutive switching cycles.



Fig. S6 Original patterns for printing: (a) logo of Xiamen University, (b) QR codes from en.xmu.edu.cn.

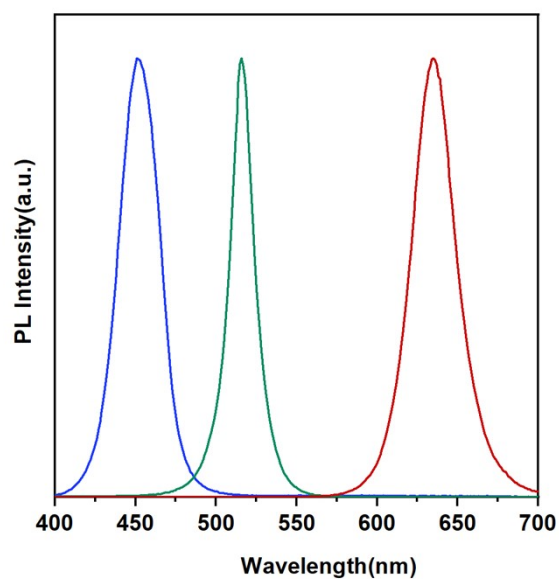


Fig. S7 Emission spectra of $\text{Cs}_4\text{PbCl}_{3.6}\text{Br}_{2.4}$, Cs_4PbBr_6 , and $\text{Cs}_4\text{PbBr}_{3.6}\text{I}_{2.4}$ NCs films based on logos of Xiamen University after being treated with water vapor.

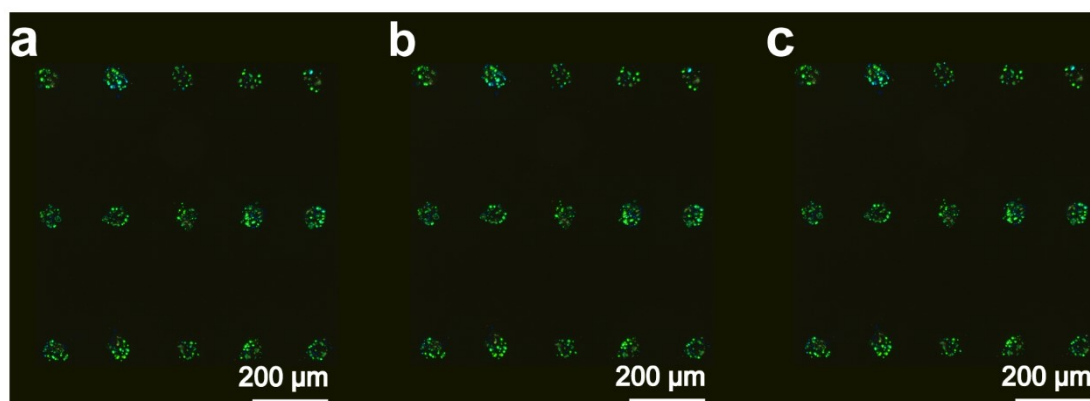


Fig. S8 Fluorescence microscope photographs of the Cs_4PbBr_6 NC-based patterns under 365 nm UV light after (a) 1, (b) 10, and (c) 20 consecutive switching cycles.

Table S1. Summary of the average thickness of each perovskite pixels

Perovskite Films	The Average Thickness of Each Pixels (μm)				
Cs_4PbBr_6 NCs	0.2401	0.1162	0.1159	0.1212	0.1211
	0.2744	0.2903	0.3167	0.1893	0.1677
$\text{CsPbBr}_3/\text{Cs}_4\text{PbBr}_6$ NCs	0.0869	0.00971	0.0969	0.0943	0.1694
	0.2450	0.2620	0.3432	0.1426	0.2512