Supporting Information

Enhanced Photothermal Stability of In-situ Grown $FAPbBr_3$ Nanocrystals in Polyvinylidene Fluoride by Incorporation of Cd^{2+} Ions

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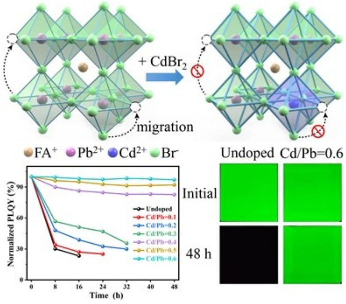

We reported the enhanced photothermal stability of in-situ grown $FAPbBr_3$ perovskite nanocrystals in polyvinylidene fluoride by incorporation of Cd^{2+} ions, which with potential applications in backlight devices.

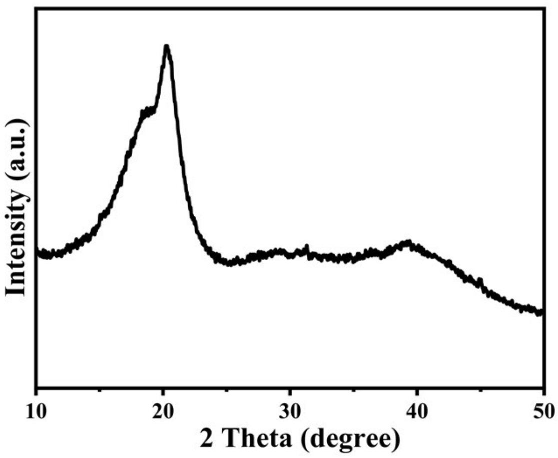

Fig. S1 XRD patterns of pure PVDF film.

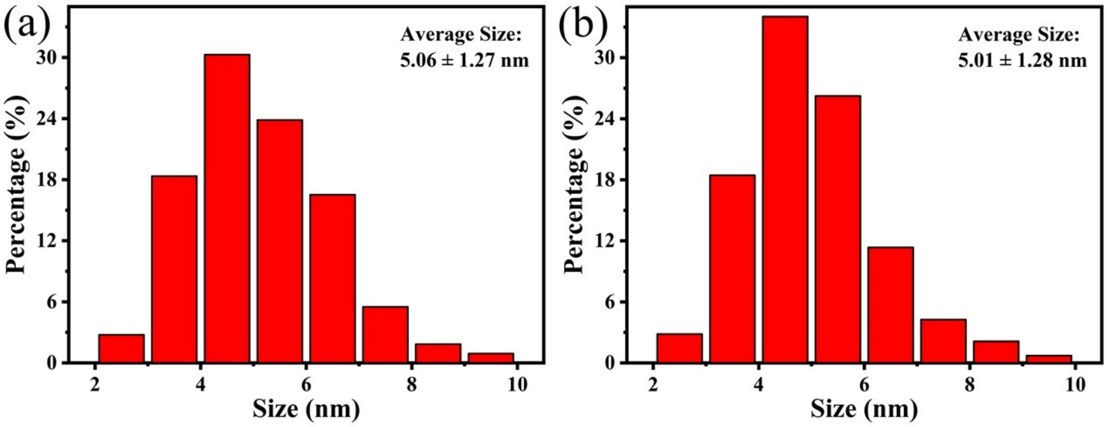

Fig. S2 Grain size distribution histograms of undoped $FAPbBr_3$ PNCs (a) and Cd^{2+}-doped $FAPbBr_3$ (Cd/Pb = 0.6) PNCs (b).

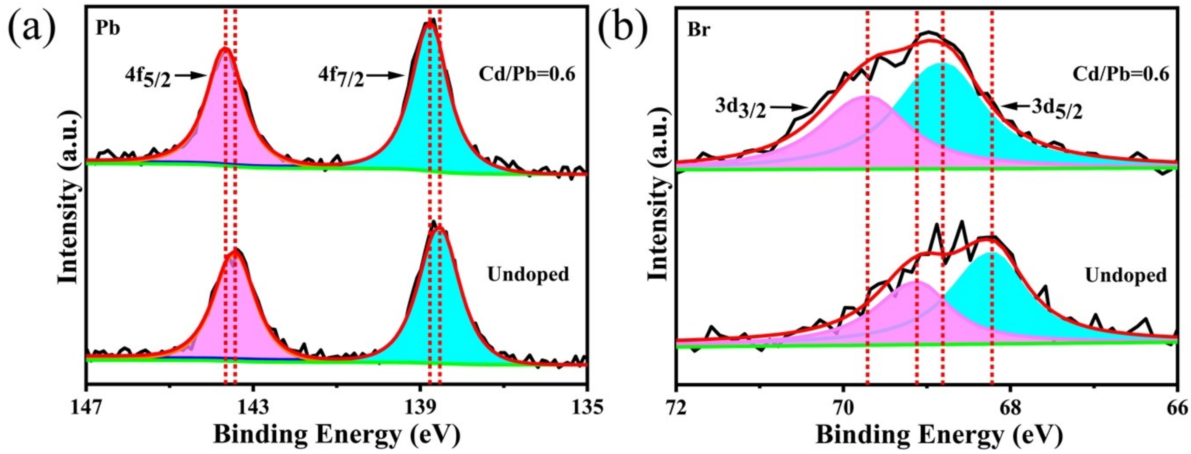

Fig. S3 XPS spectra of Pb 4f (a) and Br 3d (b) in purified undoped $FAPbBr_3$ and Cd^{2+}-doped $FAPbBr_3$ (Cd/Pb = 0.6) PNCs.

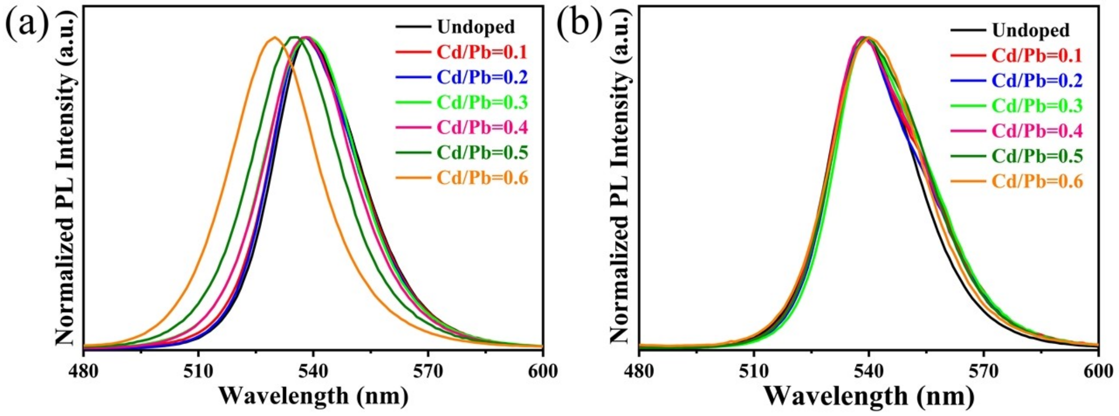

Fig. S4 Normalized PL spectra of Cd^{2+}-doped (Cd/Pb varied from 0.1 to 0.6) and undoped $FAPbBr_3$@PVDF films before (a) and after (b) annealing at 393 K for half an hour.

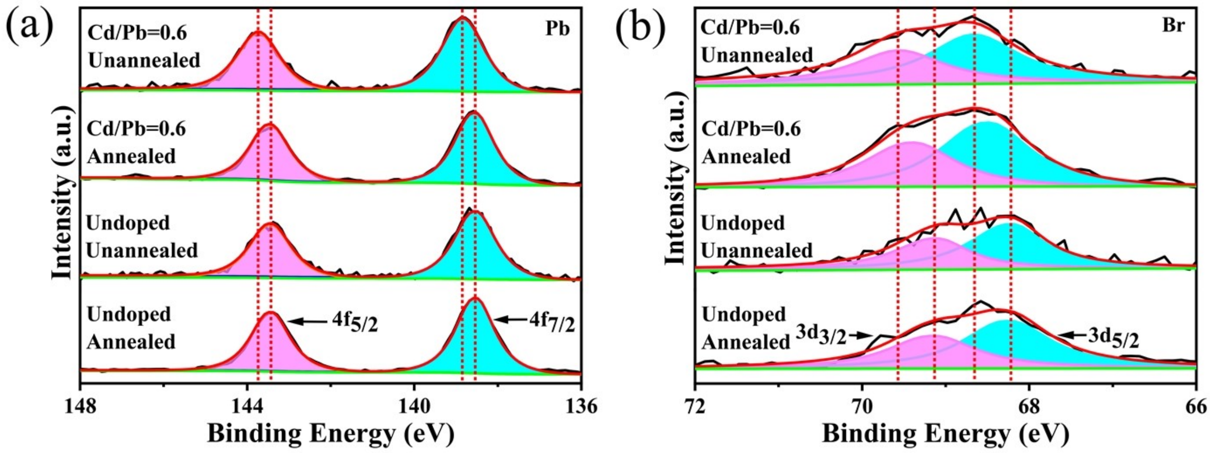

Fig. S5 XPS spectra of Pb 4f (a) and Br 3d (b) of purified undoped $FAPbBr_3$ PNCs and Cd^{2+}-doped $FAPbBr_3$ (Cd/Pb = 0.6) PNCs before and after annealing at 393 K for half an hour.

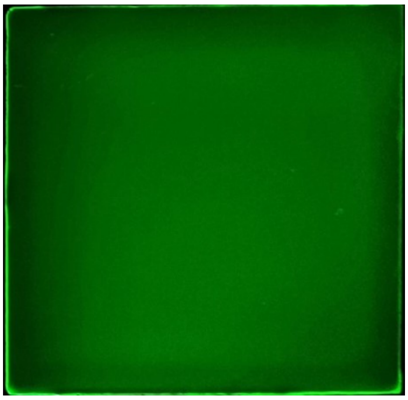

Fig. S6 The digital photograph of Cd^{2+}-doped $FAPbBr_3$@PVDF (Cd/Pb = 0.7) film, under UV irradiation at 365 nm.

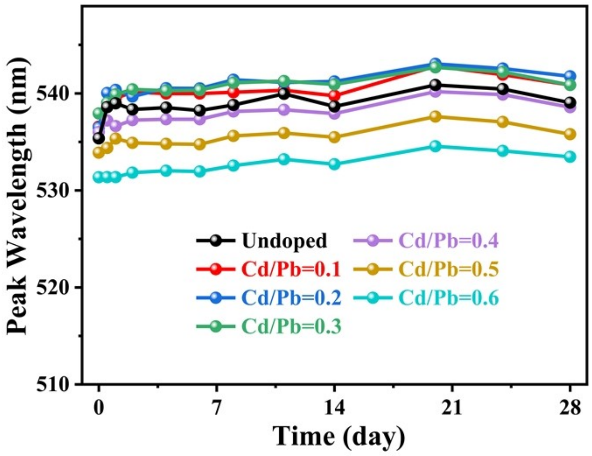

Fig. S7 PL peak wavelength evolution after different periods in an oven at 333 K of Cd^{2+}-doped (Cd/Pb varied from 0.1 to 0.6) and undoped $FAPbBr_3$@PVDF films.

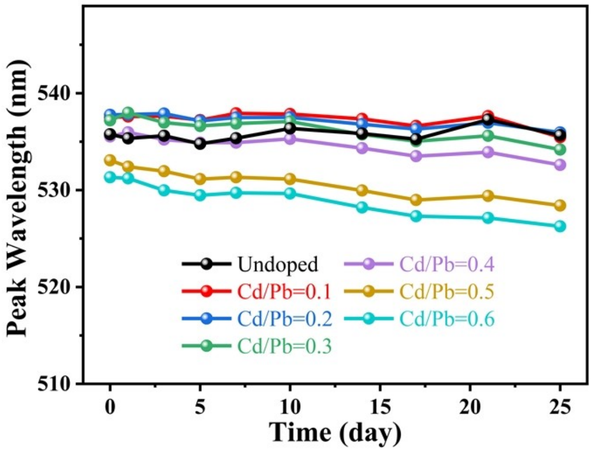

Fig. S8 PL peak wavelength evolution after different periods under continuous blue-light irradiation (460 nm, 13 mW/cm^2 at film surface) of Cd^{2+}-doped (Cd/Pb varied from 0.1 to 0.6) and undoped $FAPbBr_3$@PVDF films.

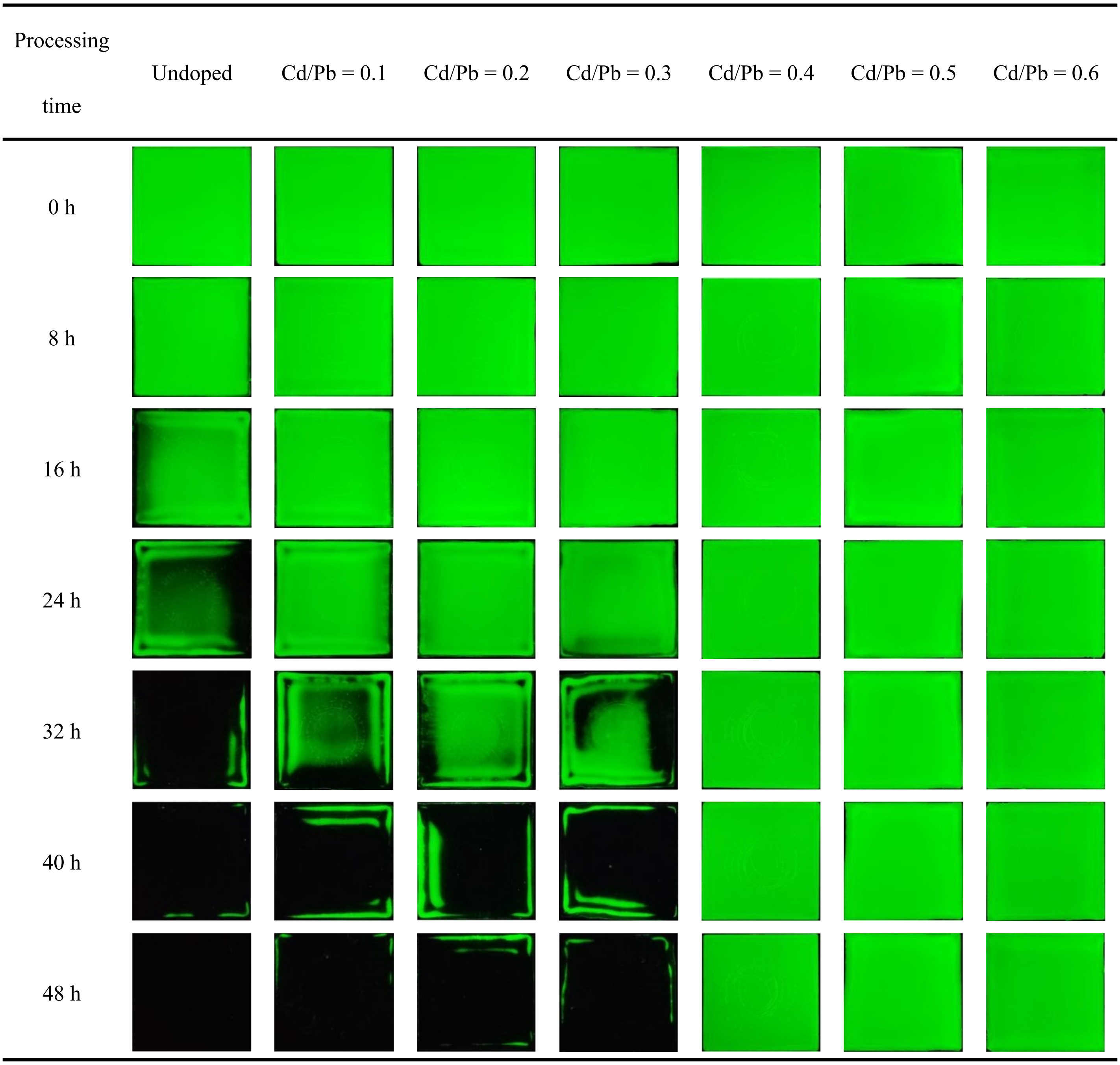

Fig. S9 The digital photographs under UV irradiation at 365 nm of Cd^{2+}-doped (Cd/Pb varied from 0.1 to 0.6) and undoped $FAPbBr_3$@PVDF films treated in the environment of 333 K and blue-light (460 nm, 13 mW/cm^2) irradiation for different time.

Table S1. The binding energy of Pb 4f and Br 3d in Cd^{2+}-doped (Cd/Pb varied from 0.1 to 0.6) and undoped $FAPbBr_3$@PVDF films.

sample	Binding Energy (eV)		Binding Energy (eV)	
	$Br^- 3d_{5/2}$	$Br^- 3d_{3/2}$	$Pb^{2+} 4f_{7/2}$	$Pb^{2+} 4f_{5/2}$
Cd/Pb = 0.6	68.69	69.66	138.79	143.69
Cd/Pb = 0.5	68.64	69.65	138.73	143.63
Cd/Pb = 0.4	68.58	69.60	138.62	143.49
Cd/Pb = 0.3	68.48	69.46	138.61	143.47
Cd/Pb = 0.2	68.35	69.35	138.54	143.41
Cd/Pb = 0.1	68.28	69.26	138.53	143.40
Undoped	68.15	69.13	138.48	143.35

Table S2. Comparison of stability parameters of halide perovskites

Perovskite	Treatment	Emission peak (nm)	PLQY (%)	Photostability	Thermostability	Ref.
$CsPbBr_3$	Integrated with mesoporous silica nanoparticles.	519		80% (96 h, 365 nm, 6 W)		1
$CsPbBr_3$	Silica-coated	519	87	80% (168 h, 365 nm, 16 W)	85% (293 K heat up to 393 K)	2
$CsPbBr_3$	Encapsulated in Dimethicone	522		55% (2 h, UV)	56% (273 K heat up to 353 K),	3
$CsPbBr_3$	Encapsulate with a poly-diphenylvinylphosphine-styrene copolymer	518	90	64% (142 h, 365 nm)		4
$CsPbBr_3$	Surface treatment using ammonium hexafluorosilicate		84	93% (53 h, 450 nm, 175 mW/cm^2)	90% (293 K heat up to 353 K)	5
$CsPbBr_3$	Anchoring on BN nanosheets	523	71	95% (96 h, 365 nm)	50% (303 K heat up to 373 K),	6
$CsPbBr_3$	Assembled on natural mineral halloysite nanotubes	526	56	82% (144 h, 365 nm)	60% (298 K heat up to 393 K)	7
$CsPbBr_3$	N-alkylmonoamine ligands	515	96	80% (1 h, 450 nm, 9.3 mW/mm^2)		8
$CsPbBr_3$ /$CsPb_2Br_5$	Coordinated with partially hydrolyzed poly (methyl methacrylate) and polyethylenimine	520	75	60% (120 h, 365 nm, 2W)		9
$CsPbCl_3$	Mn^{2+}-doped	396, 587	54	40% (1 h, 2000 W)		10
$CsPbCl_3$	Zn^{2+}-doped	409	88	46% (70 h, 365 nm, 6W)	47% (273 K heat up to 413 K)	11
$CsPbCl_3$	Cd^{2+}-doped	406	98	60% (260 h, 365 nm, 8W)		12
$CsPbCl_3$	Cd^{2+}-doped and $CdCl_2$ surface passivation	381	60	83% (168 h, 330 nm, 8 W)	54% (3 h, 358 K)	13
$CsPb(Br/Cl)_3$	Cu^{2+}-doped	455	80		75% (annealing at 523K)	14
$CsPbBr_3$	Cu^{2+}-doped	506	95		50% (annealing at 523K)	
$CsPbBr_3$	Sn^{2+}-doped	512	82		93% (105 min, 353K)	15
$FAPbBr_3$	Cd^{2+}-doped	530	75	96% (360 h, 460 nm, 13 mW/cm^2)	99% (0.5 h, 363K) 97% (48 h, 333 K and blue-light irradiation)	This work

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