Supporting Information

Transition metal halides derived phase transition from Cs_4PbCl_6 to $CsPb_xM_{1-x}X_3$ for bright white light-emitting diodes

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Table S1. Photoluminescence quantum yield of MX_2 salt treated Cs_4PbCl_6 samples.

Sample	PLQY (%)
Cs_4PbCl_6+$ZnCl_2$	74.2
Cs_4PbCl_6+$ZnBr_2$	88.1
Cs_4PbCl_6+$MnCl_2$	56.8
Zn:$CsPbCl_3$	13.9
$CsPbCl_3$	2.3
$CsPbBr_3$	50.2

Table S2. Atomic ratio of $ZnCl_2$ treated Cs_4PbCl_6 NCs from XPS analysis

Sample	Cs	Pb	Zn	Cl
$CsPb_xZn_{1-x}Cl_3$	1.79	1.58	0.26	10.15

Table S3. Lifetime parameters and PLQYs of samples.

Sample	τ_{ave} (ns)	PLQYs (%)	Γ_{rad} (μs^{-1})	$\Gamma_{non\text{-}rad}$ (μs^{-1})
Cs_4PbCl_6+$ZnCl_2$ 10 uL	20.5	52.6	20.7	23.1
Cs_4PbCl_6+$ZnCl_2$ 30 uL	23.4	56.8	24.2	18.4
Cs_4PbCl_6+$ZnCl_2$ 50 uL	25.1	64.1	25.5	14.3
Cs_4PbCl_6+$ZnCl_2$ 80 uL	26.5	70.3	26.5	11.2
Cs_4PbCl_6+$ZnCl_2$ 110 uL	27.7	74.2	26.8	9.3
Cs_4PbCl_6+$ZnBr_2$ 10 uL	5.2	8.3	15.9	17.6
Cs_4PbCl_6+$ZnBr_2$ 30 uL	5.4	10.2	18.8	16.6
Cs_4PbCl_6+$ZnBr_2$ 50 uL	6.2	15.5	25.1	13.6
Cs_4PbCl_6+$ZnBr_2$ 80 uL	16.5	78.5	47.5	13.0
Cs_4PbCl_6+$ZnBr_2$ 110 uL	21.3	88.1	41.4	5.6
Cs_4PbCl_6+$MnCl_2$ 10 uL	7.4	13.2	17.8	117.3
Cs_4PbCl_6+$MnCl_2$ 30 uL	9.4	18.8	20.0	86.3
Cs_4PbCl_6+$MnCl_2$ 50 uL	10.9	25.6	23.4	68.2
Cs_4PbCl_6+$MnCl_2$ 80 uL	13.5	35.5	26.4	48.8
Cs_4PbCl_6+$MnCl_2$ 110 uL	16.9	56.8	33.6	25.6

The radiative and non-radiative recombination rates were estimated as follows:

$$\Gamma_{rad} = PLQYs/\tau_{ave} \qquad (1)$$

$$\Gamma_{non\text{-}rad} = (1\text{-}PLQYs)/\tau_{ave} \qquad (2)$$
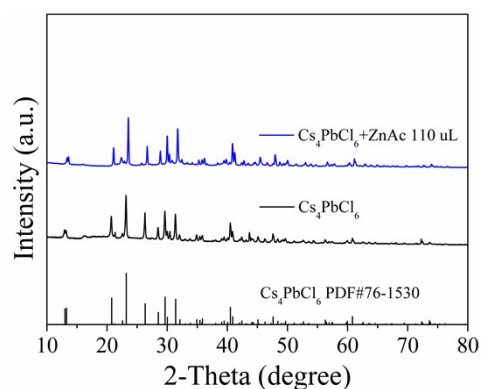
Fig. S1 XRD patterns of ZnAc/hexane solution treated Cs_4PbCl_6 NCs.
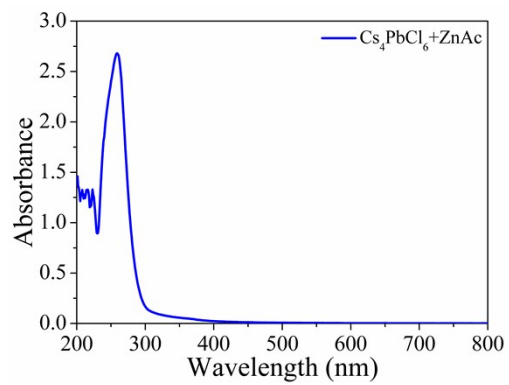
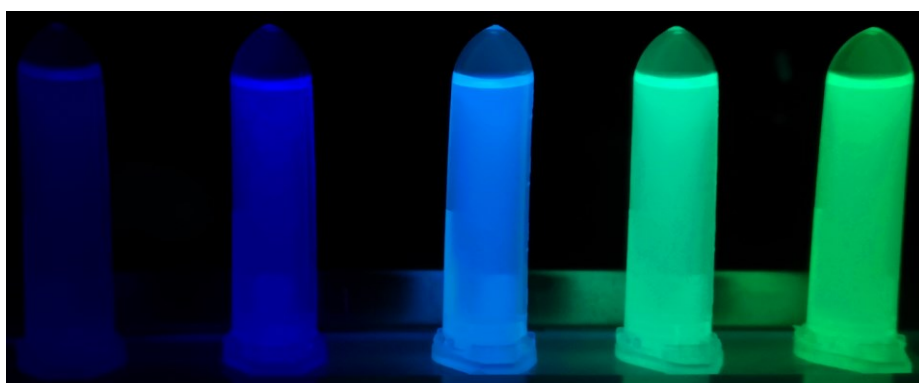**Fig. S2** Absorption spectra of ZnAc/hexane solution treated Cs_4PbCl_6.

Fig. S3 Photograph of the ZnBr/hexane solution treated Cs_4PbCl_6 under an irradiation of a 365 nm UV lamp.