Supporting Information

Two-phase anion exchange synthesis: multiple passivation for highly efficient and stable $CsPbCl_3$ nanocrystals

Wenzhen Lv,[#a] Mingchuan Xu,[#a] Lei Ge,[a] Xun Zhu,[a] Junxian Hong,[a] Wei Huang,[ab] and Runfeng Chen[a]*

[a] *Key Laboratory for Organic Electronics and Information Displays & Jiangsu Key Laboratory for Biosensors, Institute of Advanced Materials (IAM), Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), Nanjing University of Posts and Telecommunications (NUPT), Nanjing, 210023,China.*

[b] *Shanxi Institute of Flexible Electronics (SIFE), Northwestern Polytechnical University (NPU), Xi'an 710072 China.*

Tab S1. Optical properties of TAE-$CsPb(Br,I)_3$ NCs via the TAE reaction.

Time（min）	Fwhm (nm)	PL Peak (nm)	PLQYs (%)
0	18.4	515	65.82
0.2	29.8	576	68.31
1	31.5	623	72.93
5	32.8	678	79.45
10	33.7	690	84.60

Tab S2. PL decay parameters of HI-$CsPbCl_3$ NCs and TAE-$CsPbCl_3$ NCs.

Sample	PLQY(%)	T_1/ns(a_1)	T_2/ns(a_2)	$<t>^a$/ns	K_r^a/ns^{-1}	K_{nr}^a/ns^{-1}	K_r/ K_{nr}
HI-$CsPbCl_3$	6±2	1.94(0.32)	14.57 (0.68)	10.53	0.0057	0.0893	0.064
TAE-$CsPbCl_3$	95±2	3.50(0.84)	7.07 (0.16)	4.07	0.2339	0.0118	19.82

NCs	

Tab S3. The elemental composition of AE-$CsPbCl_3$ and TAE-$CsPbCl_3$ NCs calculated from XPS data.

Sample	Cs	Pb	Cl	Cd
AE-$CsPbCl_3$	20.31	34.79	44.90	--
TAE-$CsPbCl_3$ NCs	18.83	12.19	60.31	8.67

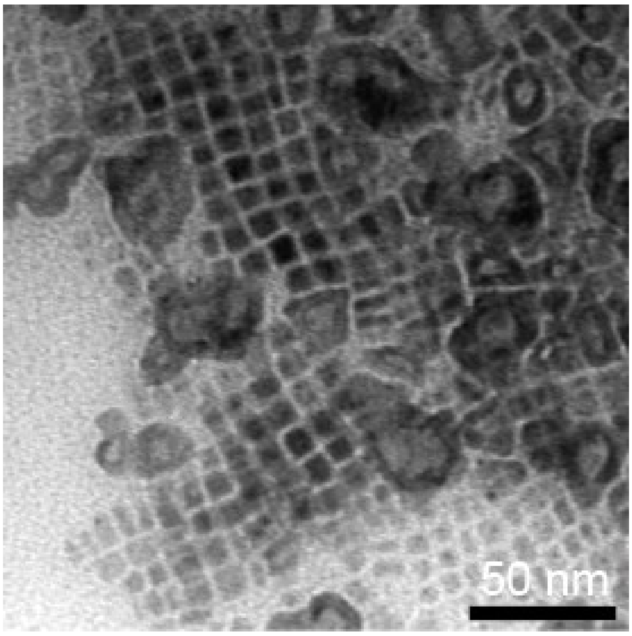

Fig S1. TEM image of TAE-$CsPbCl_3$ NCs after 14 hours of reaction. Scale bars, 50 nm.

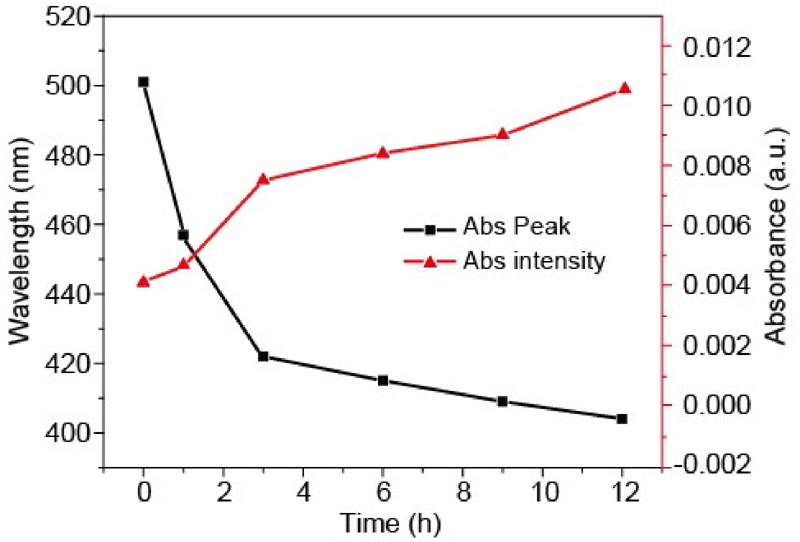

Fig S2. Absorbance peak correlated with intensity for $CsPbBr_3 \rightarrow CsPbCl_3$ via TAE methods.

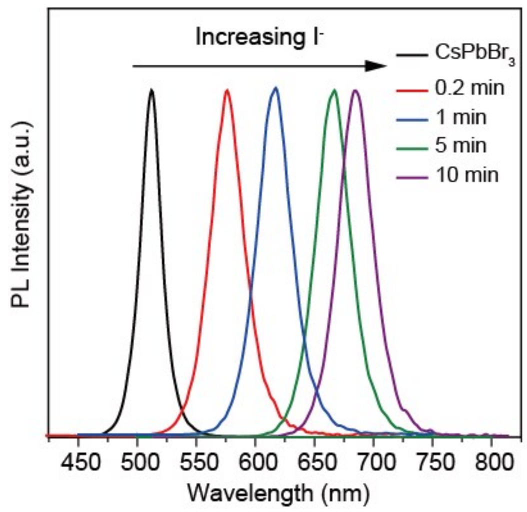

Fig S3. PL spectra of the TAE-$CsPb(Br,I)_3$ NCs.

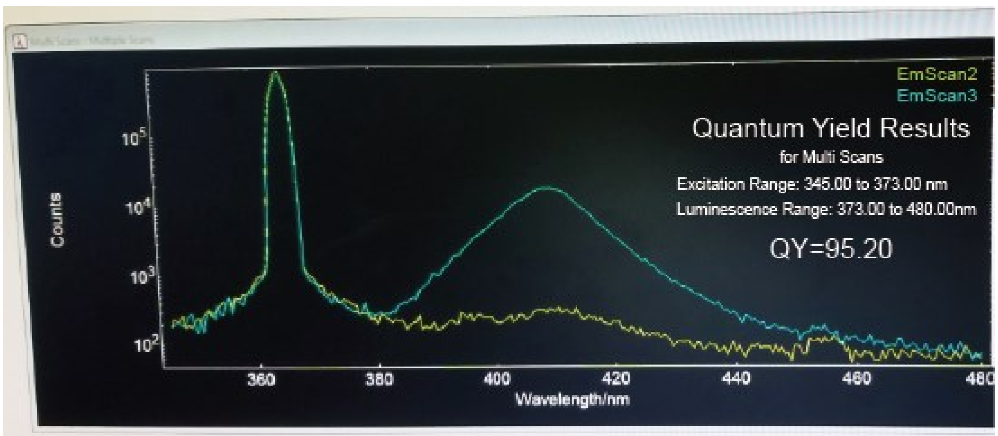

Fig S4. The absolute PLQYs measurement result of the TAE-$CsPbCl_3$ NCs (12h).

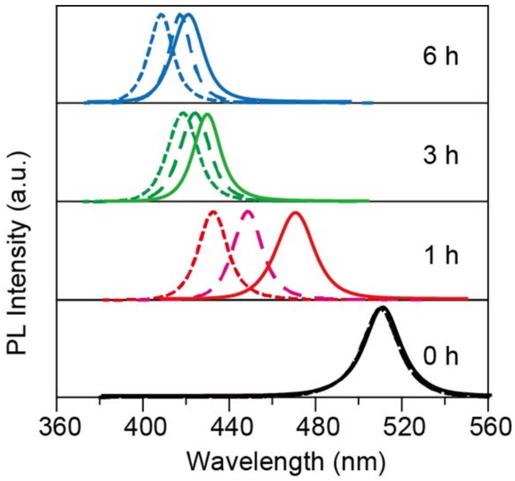

Fig S5. Evolution of the PL spectra of TAE-CsPb(Cl,Br)3 NCs using different ligands octylamine (dots), dodecylamine(short lines) and OAm (lines) at different reaction time.

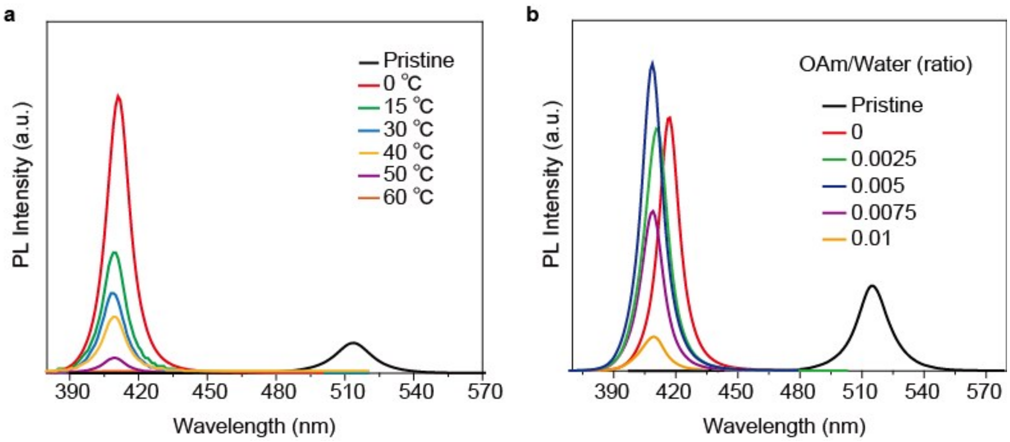

Fig S6. PL emission spectra with the increasing temperature (0℃ ~ 60℃) (a) and different amount of OAm after 12 h (b).

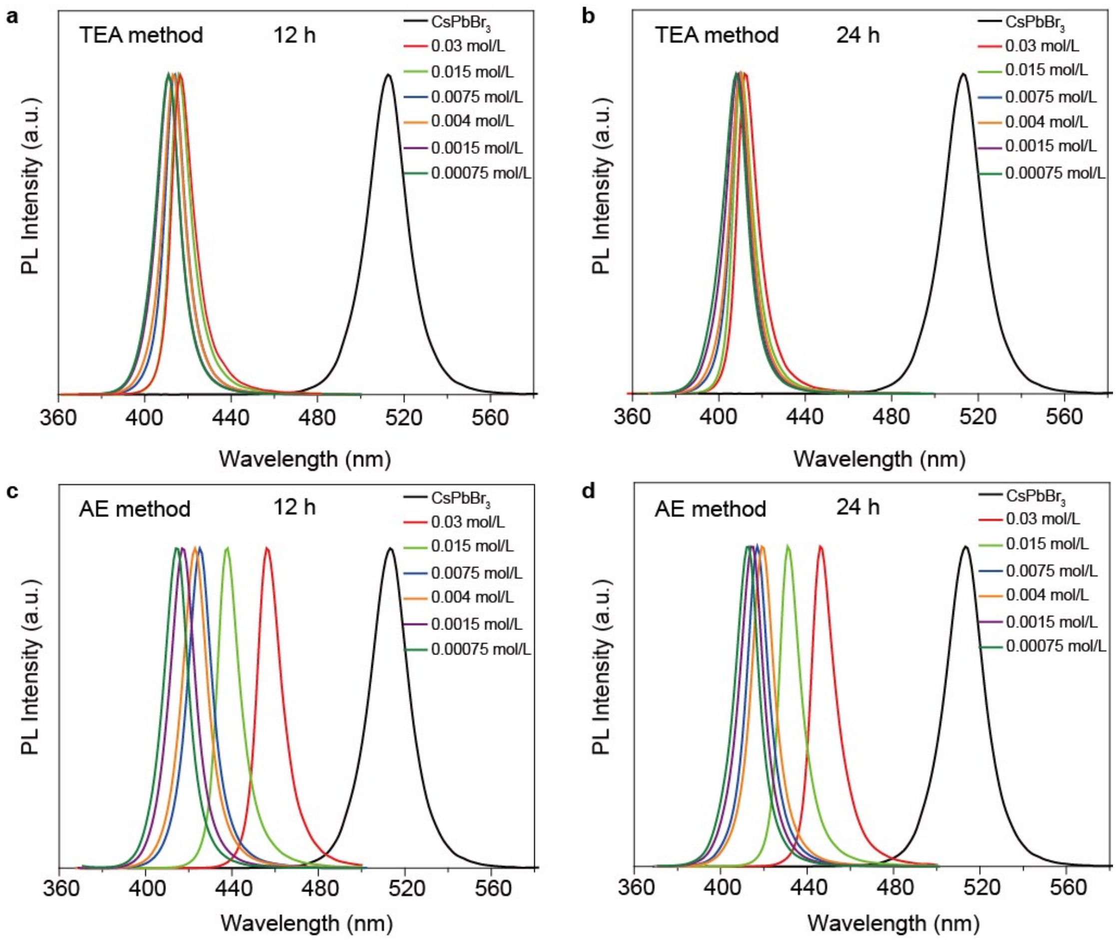

Fig S7. PL spectra of the TAE-$CsPb(Cl,Br)_3$ NCs (a,b) and AE-$CsPb(Cl,Br)_3$ NCs (c,d) with increasing concentration of pristine $CsPbBr_3$ NCs with same equal amount of $CdCl_2$.

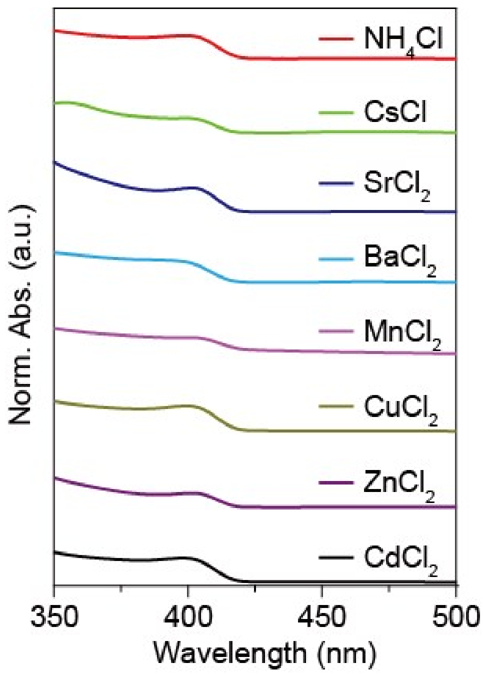

Fig S8. UV-visible absorption spectra of the TAE-CsPb(Cl,Br)$_3$ NCs with chloride salts solution.

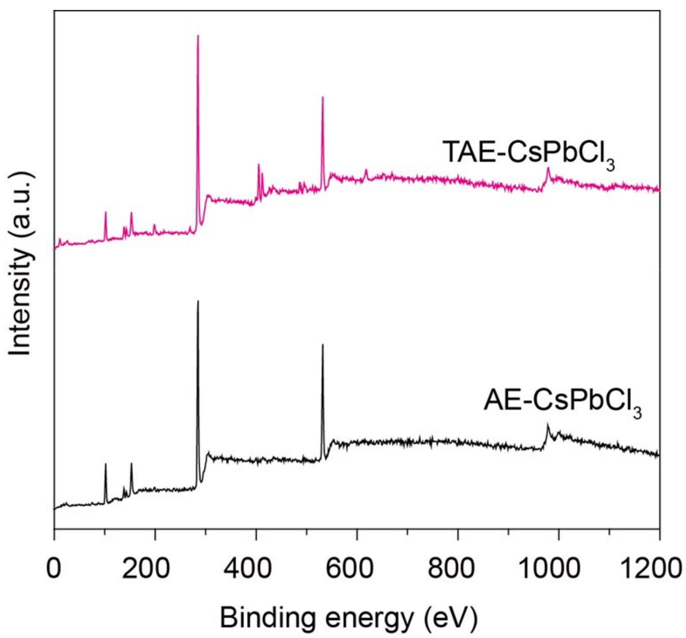

Figure S9. XPS spectra of AE-CsPbCl$_3$ and TAE-CsPbCl$_3$ NCs.

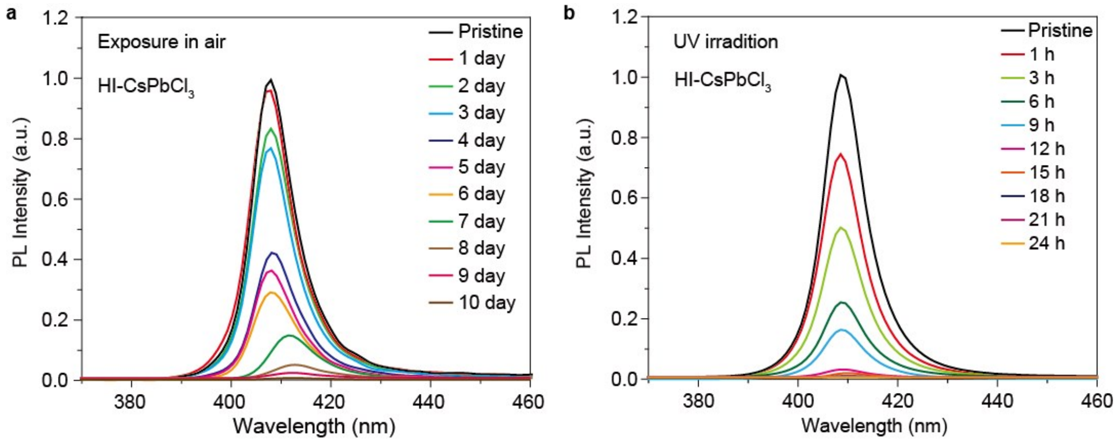

Figure S10. The PL spectra of $CsPbCl_3$ NCs exposed in air (a) and UV illumination (b).