

Supplementary information for

**Blue perovskite light-emitting diodes based on RbX-doped
polycrystalline CsPbBr₃ films**

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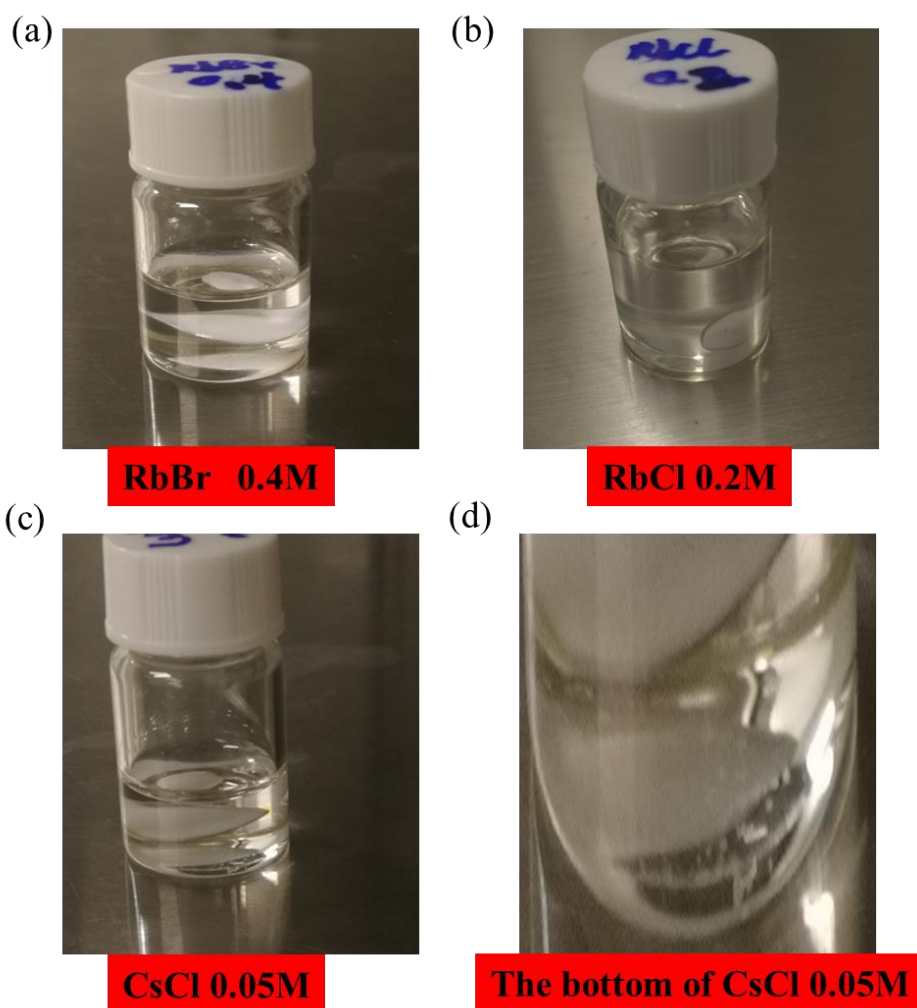


Figure S1. The solutions of different halide with various concentrations. It is noticed that the DMSO solutions of RbBr and RbCl are clean with the concentration of 0.4M and 0.2M respectively. But the 0.05M solution of CsCl is not completely dissolved and some CsCl solids are presented at the bottom of bottle. The RbBr and RbCl solutions are stirred at 70°C for 2h. And the CsCl solution is stirred at 70 °C over 24h.

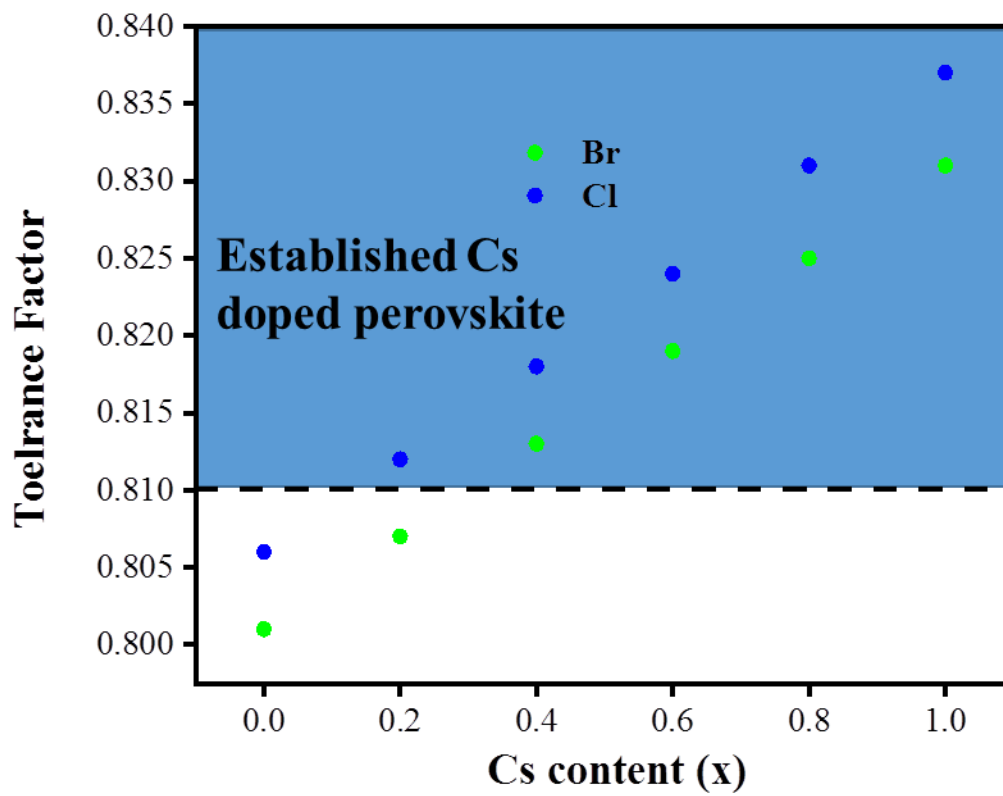


Figure S2. Tolerance factor of $\text{Cs}_x\text{Rb}_{1-x}\text{PbBr}(\text{Cl})_3$ with different compositions.

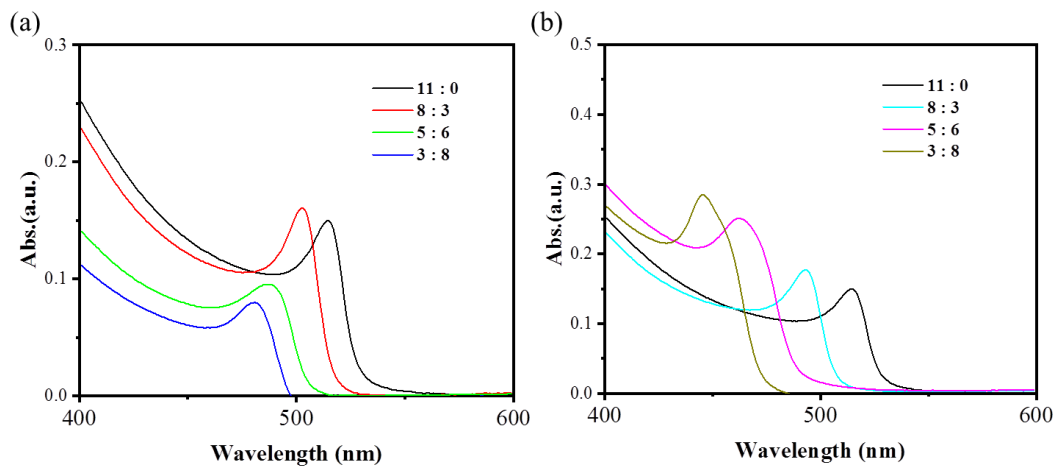


Figure S3. The absorption spectra of perovskite films prepared with different molar ratios of CsBr: RbBr (a) and CsBr:RbCl (b).

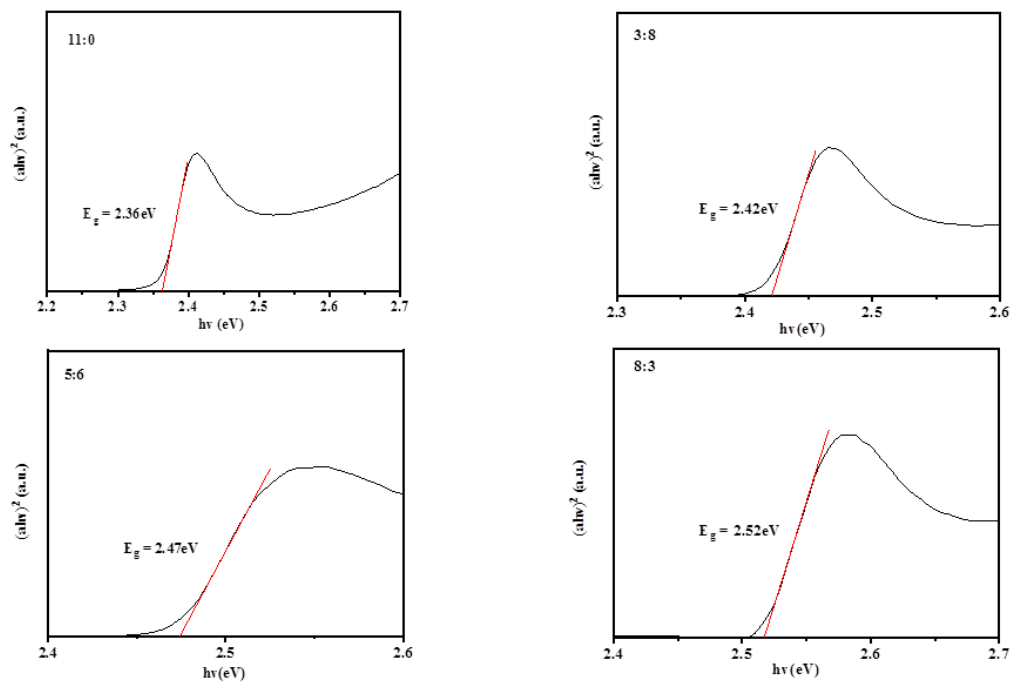


Figure S4. Tauc plots of the perovskite films prepared with different molar ratios of CsBr:RbBr.

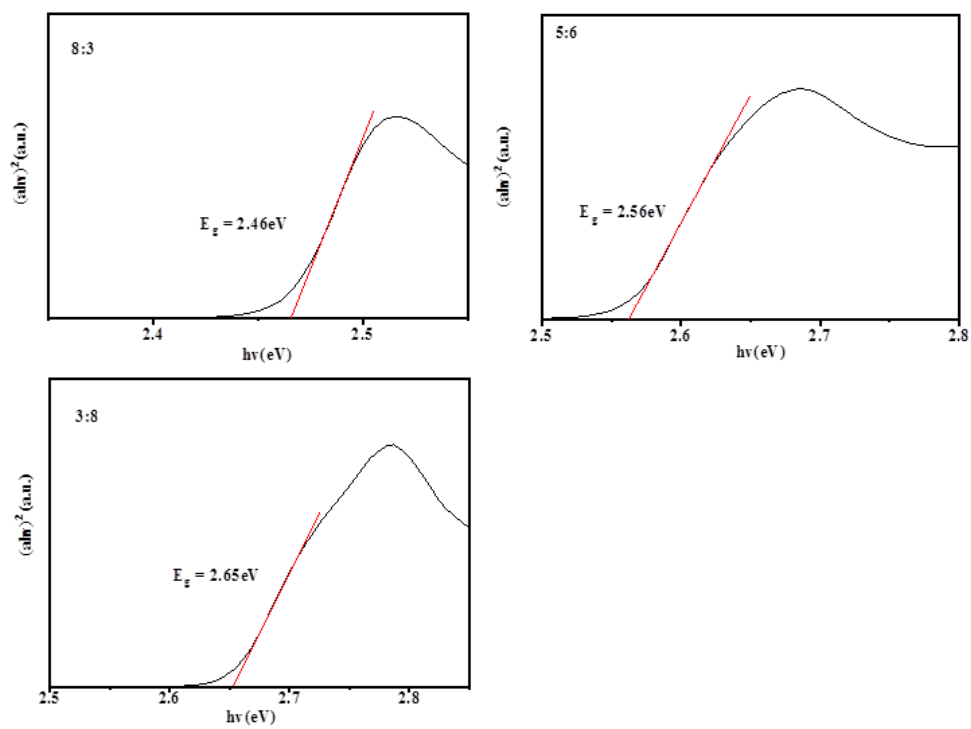


Figure S5. Tauc plots of the perovskite films prepared with different molar ratios of CsBr and RbCl.

Table S1. Calculated band gap and PL peak position from absorption spectra (Figure S3) and PL spectra (Figure 1c) respectively.

	CsBr : RbBr				CsBr : RbCl		
	11 : 0	8 : 3	5 : 6	3 : 8	8 : 3	5 : 6	3 : 8
Band Gap (eV)	2.36	2.42	2.47	2.52	2.46	2.56	2.65
PL peak position (nm)	524	510	498	492	505	477	473

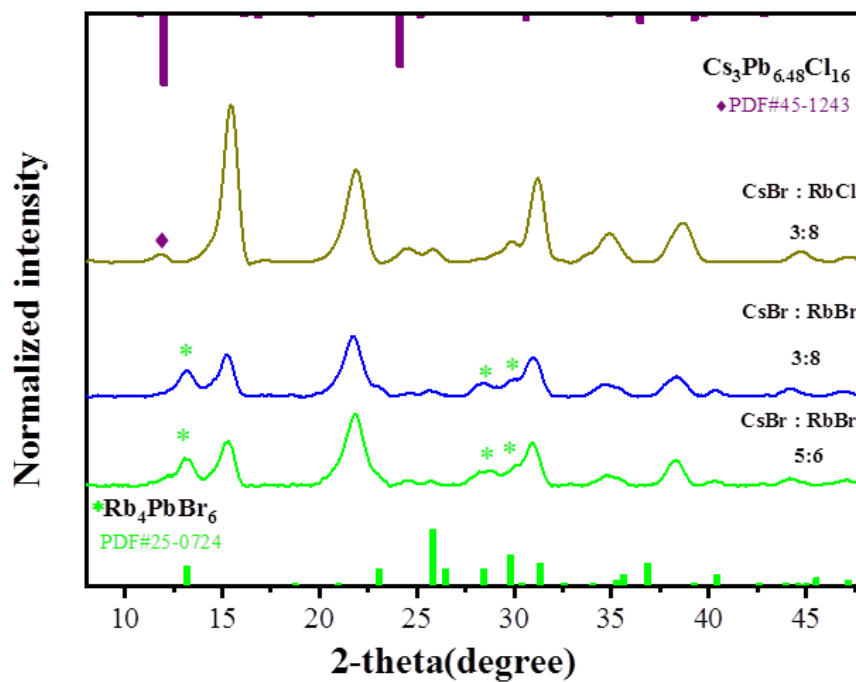


Figure S6. The XRD patterns of the perovskite films prepared with various CsBr:RbBr and CsBr:RbCl molar ratios. (upper reference is $\text{Cs}_3\text{Pb}_{6.48}\text{Cl}_{16}$ PDF# 45-1243, bottom reference is Rb_4PbBr_6 PDF# 18-0364).

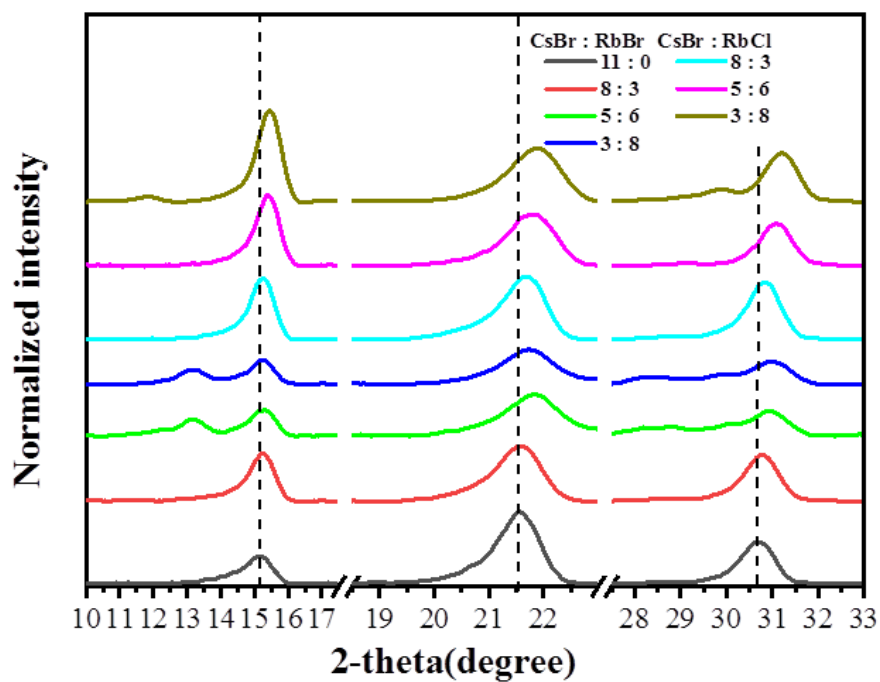


Figure S7. The zoom-in XRD patterns of the perovskite films prepared with various CsBr:RbBr and CsBr:RbCl molar ratios.

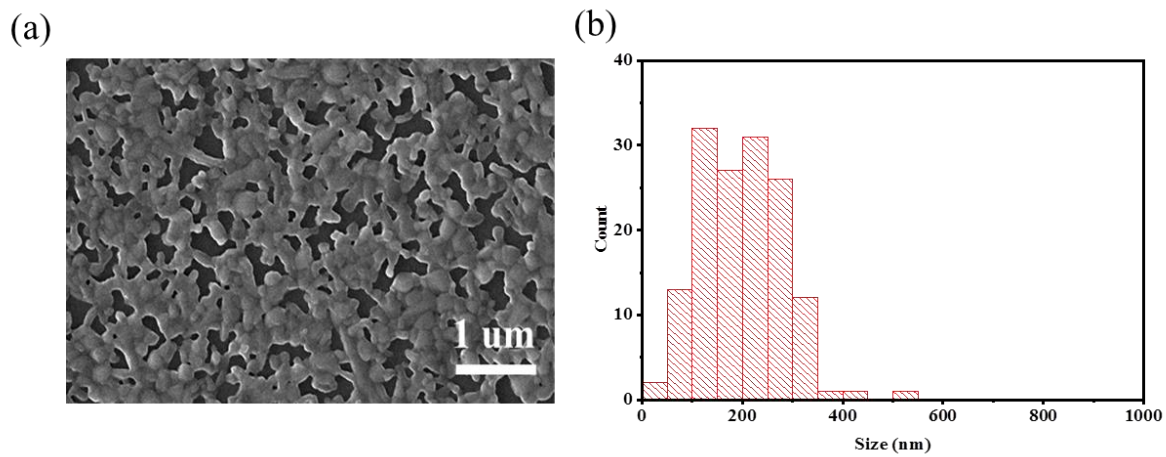


Figure S8. Top-view SEM image and calculated grain size distribution for the CsPbBr₃ perovskite films without doping RbX.

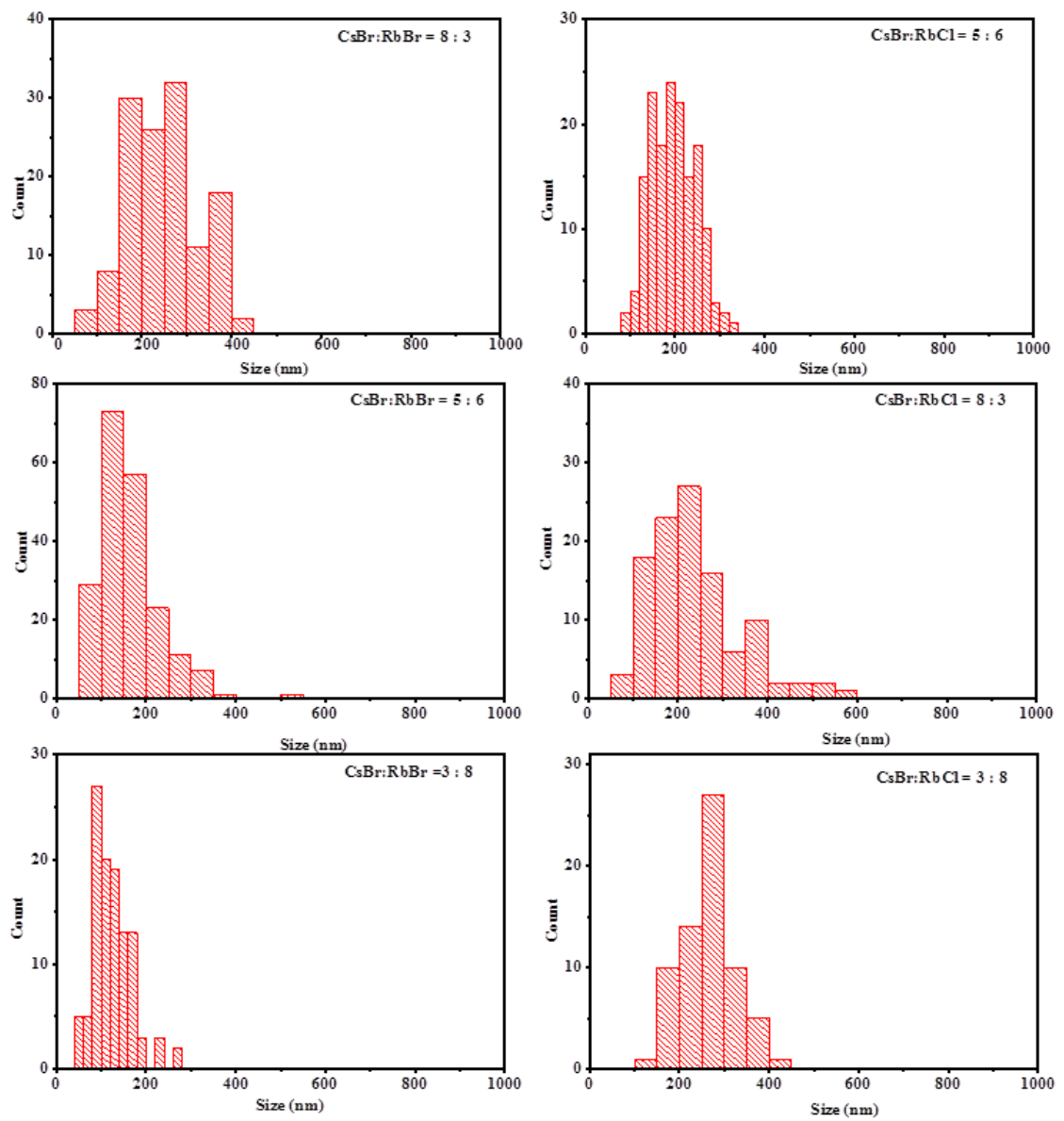


Figure S9. Calculated grain size Distribution of the perovskite films prepared with various CsBr:RbBr and CsBr:RbCl molar ratios.

Table S2. Calculated coverage degree and average grain size of the perovskite films prepared with various CsBr:RbBr and CsBr:RbCl molar ratios from SEM images (Figure 4).

	CsBr : RbBr				CsBr : RbCl		
	11 : 0	8 : 3	5 : 6	3 : 8	8 : 3	5 : 6	3 : 8
Coverage Degree	80%	84%	92%	99%	79%	95%	74%
Average Grain Size (nm)	200	246	163	124	236	195	264

Table S3. Bi-exponential fitting results for time-resolved PL spectra of the perovskite films prepared with various CsBr:RbBr and CsBr:RbCl molar ratios.

	Molar ratio (mol:mol)	F₁ (%)	τ₁ (ns)	F₂ (%)	τ₂ (ns)	R²	τ_{average} (ns)
CsBr:RbBr	11:0	85.19	11.98	14.81	39.45	0.99989	16.05
	8: 3	99.58	18.84	4.42	305.46	0.99339	20.04
	5: 6	83.05	12.24	16.95	91.63	0.99942	25.69
	3: 8	83.29	12.53	16.71	161.27	0.99744	37.39
CsBr:RbCl	8: 3	83.19	4.93	16.81	33.27	0.99975	9.69
	5: 6	89.62	9.63	10.38	248.41	0.99737	34.41
	3: 8	93.76	7.12	6.24	235.35	0.99919	21.36

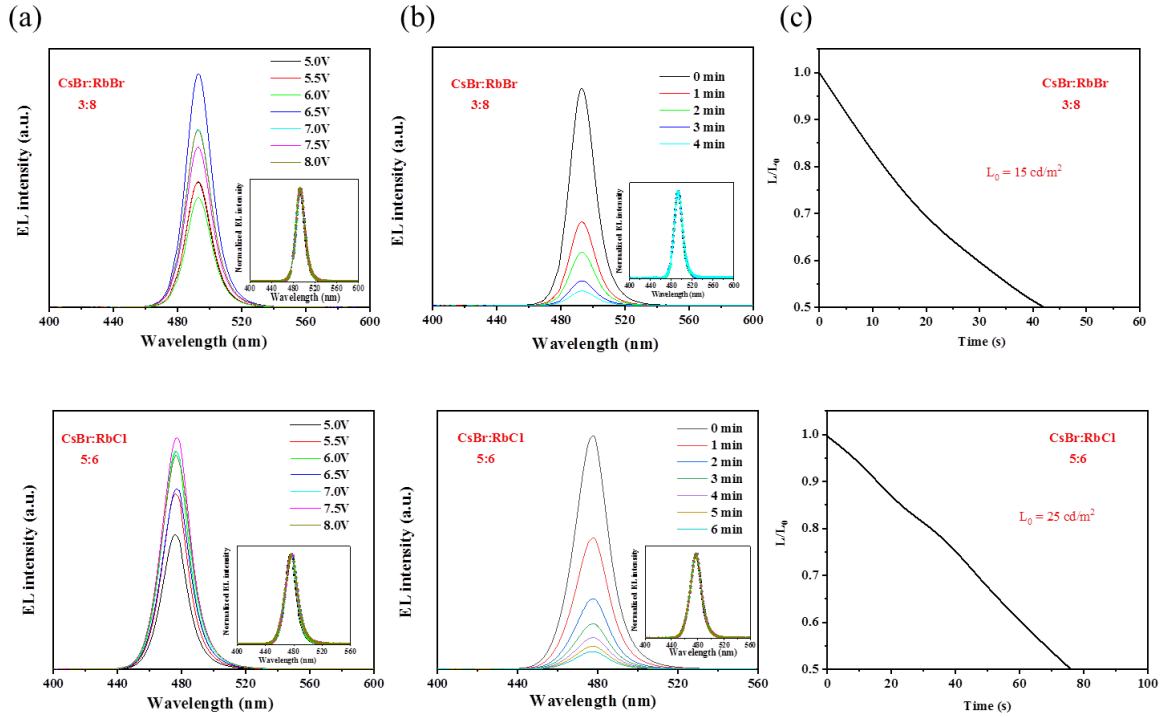


Figure S10. (a) EL spectra of the blue PeLEDs under different driving voltages. (b) EL spectra of PeLEDs as a function of operating time. (c) Lifetime measurement of the PeLEDs at given luminances. The inset in (a) and (b) is the corresponding normalized EL spectra.

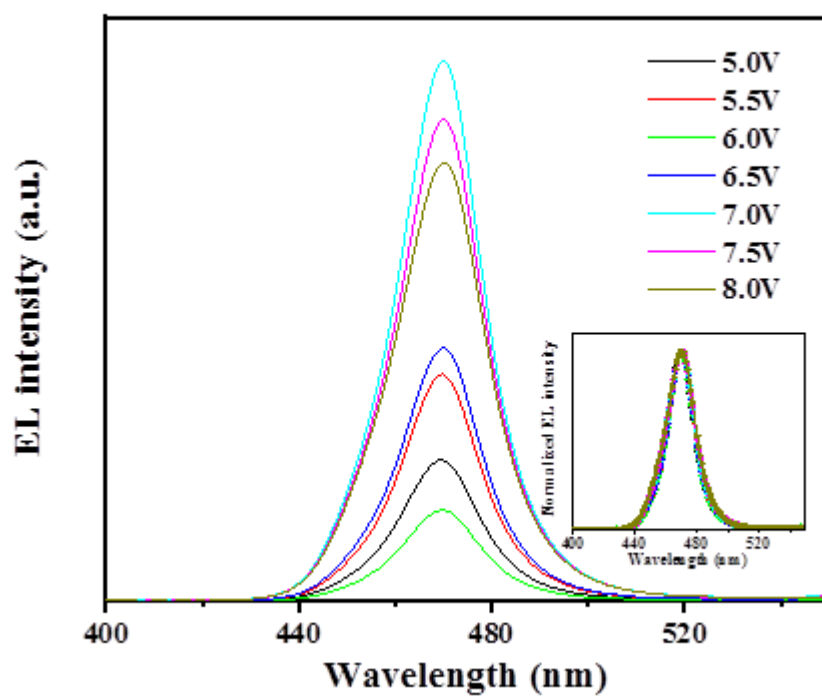


Figure S11. EL spectra of the blue PeLEDs based on the CsBr:RbCl (3:8) perovskite EML under different driving voltages. The inset is the corresponding normalized EL spectra.