Supporting Information

Efficient and Color Stable Blue Perovskite Light-Emitting Diodes Achieved via Dual-Additive Phase Modulation

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Device	V _{on} ^{a)}	L _{max}	CE _{max}	EQE _{max}	λ_{max}	
Device	[V]	$[cd/m^2]$	[cd/A]	[%]	[nm]	
w/o	3.4	1263	6.9	5.2	488	
1mg EDACl ₂	3.4	751.9	4.4	4.1	479	
2mg EDACl ₂	3.6	428.1	3.2	3.1	478	
3mg EDACl ₂	4	286.8	1.9	1.7	479	

Table S1 Performance of PeLEDs with different content of EDACl₂.

^{a)} The turn-on voltages of PeLEDs are obtained at the luminance of 1 cd m⁻² according to the

J-L-V curves

Table S2 Performance of PeLEDs with different content of NaBr.

Davias	V _{on} ^{a)}	L _{max}	CE _{max}	EQE _{max}	λ_{max}	
Device	[V]	$[cd/m^2]$	[cd/A]	[%]	[nm]	
w/o	3.4	751.9	4.4	4.1	479	
5% NaBr	3.4	570.6	3.2	3.2	477	
10% NaBr	3.8	550.3	3.0	3.3	474	
15% NaBr	4	349.7	1.8	2.1	473	

a) The turn-on voltages of PeLEDs are obtained at the luminance of 1 cd m⁻² according to the

J-L-V curves

Perovskite	Emission	٨	τ_1	٨	τ_2	τ_{avg}	PLQY	k _{rad}	k _{nonrad}
emitter	[nm]	A_1	[ns]	A ₂	[ns]	[ns]	[%]	[s ⁻¹]	[s ⁻¹]
w/o	488	0.91	3.85	0.11	18.68	5.45	66	1.2×10 ⁸	6.2×10 ⁷
w/ EDACl ₂	479	0.77	4.15	0.23	19.72	7.73	55	7.1×10 ⁷	5.8×10 ⁷
w/ EDACl ₂	474	0.82	5.44	0.24	22.58	9.32	64	6.9×10 ⁷	3.9×10 ⁷
+INaBr									

Table S3 Transient and steady-state optical properties of perovskite films w/o, w/ $EDACl_2$ and w/ $EDACl_2$ + NaBr.

The decay curves are fitted by the bi-exponential function:

$$I = A_1 e^{-t/\tau_1} + A_2 e^{-t/\tau_2}$$

Where, *I* is the normalized photoluminescence intensity; A_1 and A_2 are the decay amplitudes; τ_1 and τ_2 correspond to the lifetime constants of a fast component and a slow component. The τ_{ave} is given by the formula:

$$\tau_{ave} = \frac{A_1 \tau_1 + A_2 \tau_2}{A_1 + A_2}$$

Since τ_{ave} could be given by

$$\frac{1}{\tau_{ave}} = k_{rad} + k_{nonrad}$$

and the PLQY could be given by

$$PLQY = \frac{k_{rad}}{k_{rad} + k_{nonrad}}$$

it follows that

$$k_{rad} = \frac{PLQY}{\tau_{ave}}$$

Daviaa	V _{on} ^{a)}	L _{max}	CE _{max}	EQE _{max}	λ_{max}	
Device	[V]	$[cd/m^2]$	[cd/A]	[%]	[nm]	
w/o PSSNa	3.8	550.3	2.9	3.3	474	
PSSNa	3.4	736.7	4.0	4.6	474	

Table S4 Performance of PeLEDs without and with PSSNa.

^{a)} The turn-on voltages of PeLEDs are obtained at the luminance of 1 cd m⁻² according to the

J-L-V curves



Fig. S1 Device performance of PeLEDs with different content of $EDACl_2$ (a) J-V characteristics. (b) L-V characteristics. (c) Current efficiency versus voltage curves.



Fig. S2 Device performance of PeLEDs with different content of NaBr (a) *J-V* characteristics.(b) *L-V* characteristics. (c) Current efficiency *versus* voltage curves.



Fig. S3 HRTEM images of perovskite films w/ EDACl₂ + NaBr.



Fig. S4 Optical properties of quasi-2D perovskites with different ratio of PABr to PEABr. (a) Absorption and (b) PL spectra.



Fig. S5 Box of EQE statistics of PeLEDs with pristine and modified PEDOT:PSS layer.



Fig. S6 EL spectra of PeLEDs operating under different voltages. (a) PeLED with and (b) without the introduction of $EDACl_2$ and NaBr.



Fig. S7 EL spectra of PeLED with $EDACl_2$ + NaBr under continuous operation at the voltages corresponding to corresponding to 100 cd/m².