

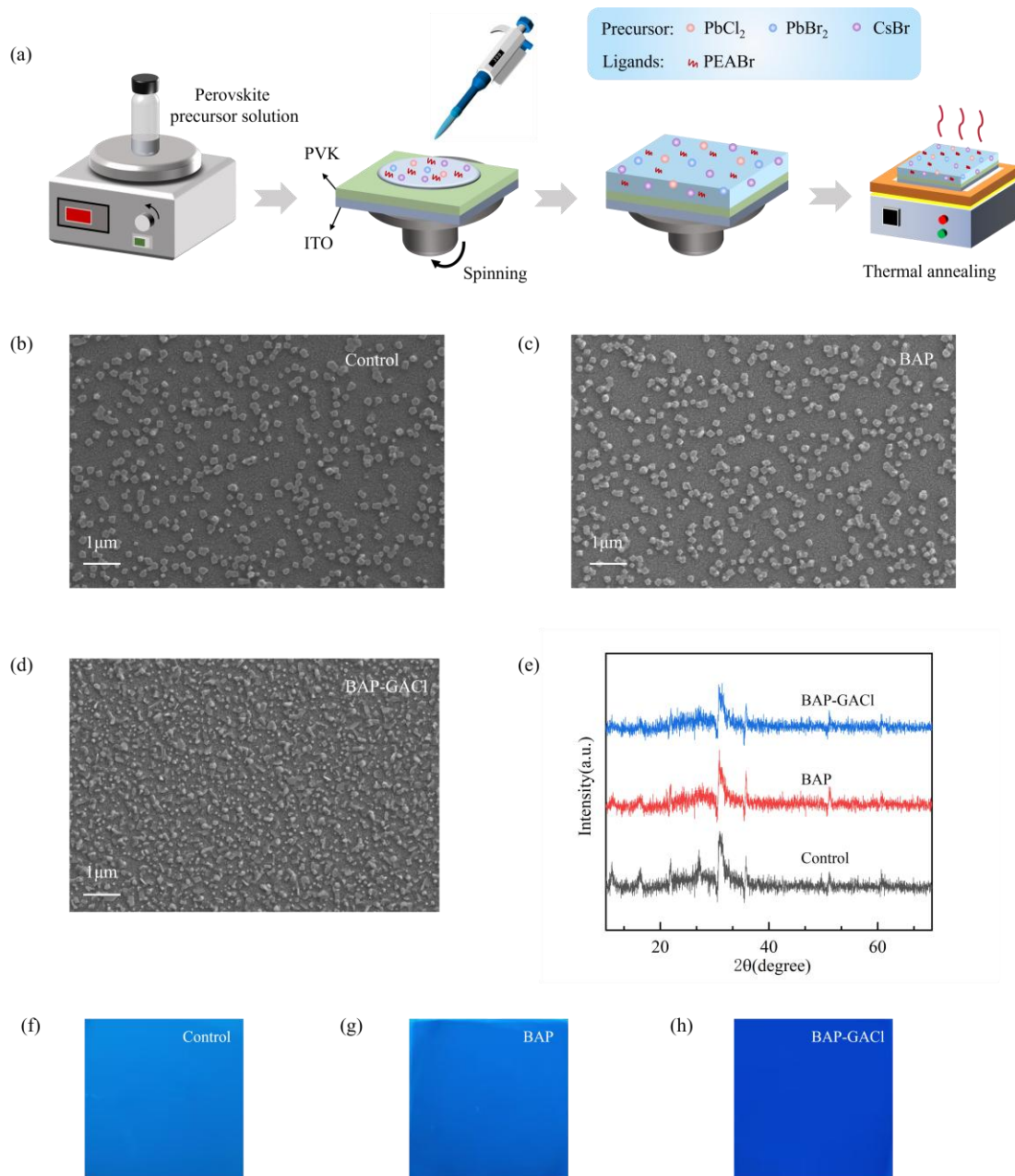
## Supporting information

### Efficient and stable blue perovskite light-emitting diodes enabled by dual additive strategy

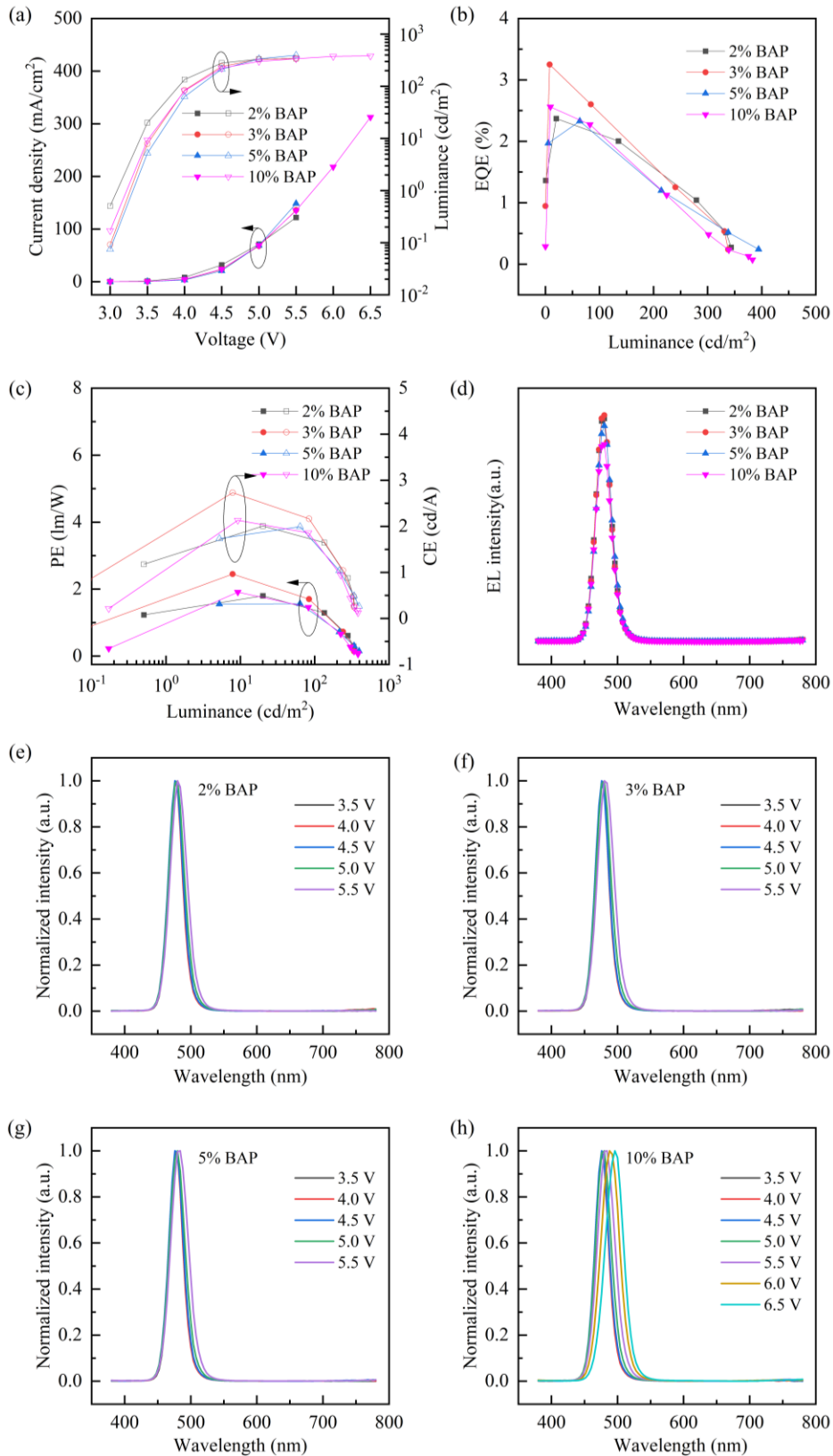
Dandan Li,<sup>a</sup> Yan Bao,<sup>a</sup> Run Wang,<sup>b</sup> Jinjiang Wang,<sup>a</sup> Yu Liu,<sup>a</sup> Lei Cao,<sup>a</sup> Yanhong Deng,<sup>\*a</sup> Hengyang Xiang<sup>b</sup>

*a* College of Physics and Electronics Engineering, Hengyang Normal University, Hengyang, Hunan 421002, P. R. China. E-mail: 2006318dyh@hynu.edu.cn

*b* MIIT Key Laboratory of Advanced Display Materials and Devices, Institute of Optoelectronics & Nanomaterials, School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing, Jiangsu 210094, P. R.China. E-mail: xiang.hengyang@njust.edu.cn



**Fig. S1** (a) The process of the perovskite precursor solution preparation, spin coating and annealing. (b-d) The SEM images, and (e) XRD spectrum of quasi-two-dimensional perovskite films without additive, BAP additive, and both BAP and GACl additives. (f-h) Emission pattern of a film under ultraviolet irradiation.



**Fig. S2** (a)  $J$ - $V$ - $L$  characteristic curve, (b) EQE- $L$  characteristic curve, (c) PE- $L$ -CE characteristic curve, (d) EL spectrum at 5.0 V, and (e-h) EL spectrum curve with voltage for blue perovskite light-emitting diodes with different BAP concentrations.

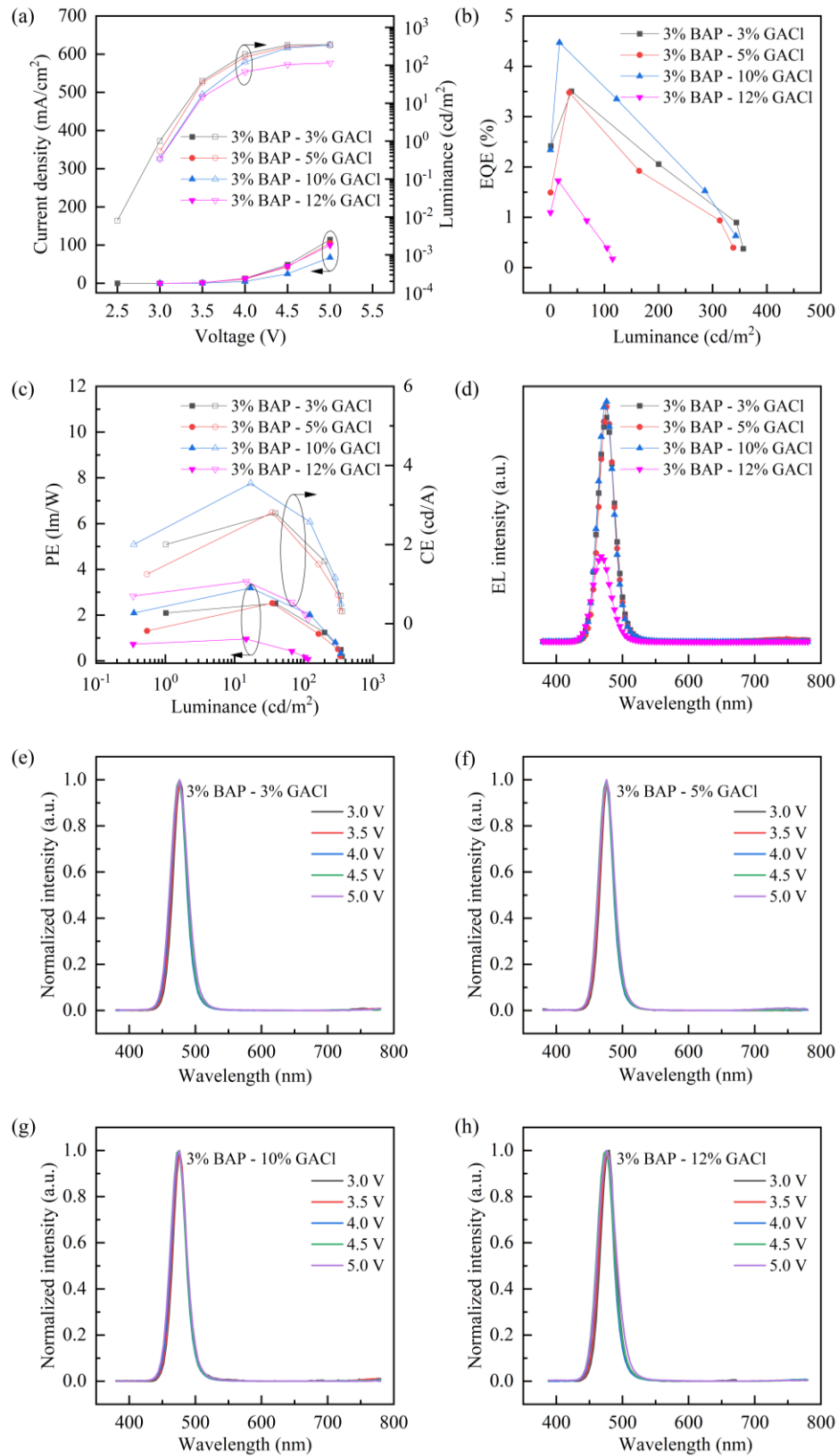
**Table S1** Photoelectric performance of devices with different BAP concentration

Device	$V_{on}^a$ (V)	$PE_{max}^b$ (lm/W)	$CE_{max}^b$ (cd/A)	$EQE_{max}^b$ (%)	$L_{max}^b$ (cd/m <sup>2</sup> )	EL Peak <sup>c</sup> (nm)
2% BAP	3.09	1.80	2.01	2.37	343.3	476
3% BAP	3.27	2.45	2.73	3.25	338.1	476
5% BAP	3.30	1.56	1.99	2.33	394.2	476
10% BAP	3.22	1.91	2.13	2.56	383.0	476

<sup>a</sup> The turn on voltage when the brightness is 1 cd/m<sup>2</sup>.

<sup>b</sup> PE, CE, EQE,  $L$  are the abbreviation of power efficiency, current efficiency, external quantum efficiency, luminance, respectively. Subscript max indicates the maximum value.

<sup>c</sup> Represents the emission peak at  $EQE_{max}$ .



**Fig. S3** (a)  $J$ - $V$ - $L$  characteristic curve, (b) EQE- $L$  characteristic curve, (c) PE- $L$ -CE characteristic curve, (d) EL spectrum at 5.0 V, and (e-h) EL spectrum curves with varied voltage for devices based on different GACI concentrations.

**Table S2** Detailed parameters of devices with different GACI concentrations

Device	$V_{on}$ (V)	$PE_{max}$ (lm/W)	$CE_{max}$ (cd/A)	$EQE_{max}$ (%)	$L_{max}$ (cd/m <sup>2</sup> )	EL Peak (nm)
3% BAP - 3% GACI	3.00	2.51	2.80	3.50	356.6	476
3% BAP - 5% GACI	3.07	2.52	2.81	3.48	338.2	476
3% BAP - 10% GACI	3.13	3.18	3.55	4.47	342.7	476
3% BAP - 12% GACI	3.14	0.96	1.07	1.73	115.1	468