Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information For "Poly(ethylene oxide)-Assisted Energy Funneling for Efficient Perovskite Light Emission"

Tianfei Xu,[a†] Yan Meng,[a†] Miaosheng Wang,[b] Mingxing Li,[c] Mahshid Ahmadi,[b] Zuhong Xiong,[a]

Shubin Yan,[b,d] Ping Chen[a, b] and Bin Hu[b*]*

[a] *School of Physical Science and Technology, Southwest University, Chongqing 400715, China*

[b] *Joint Institute for Advanced Materials, Department of Materials Science and Engineering, University of Tennessee, Knoxville, TN 37996, USA*

[c] *Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, New York 11973, USA*

[d] *Science and Technology on Electronic Test and Measurement Laboratory, North University of China, Taiyuan 030051, China*

Corresponding Authors:

[1*] E-mail: chenping206@126.com (Ping Chen), [2*] E-mail: bhu@utk.edu (Bin Hu).

† These authors contributed equally to this work.

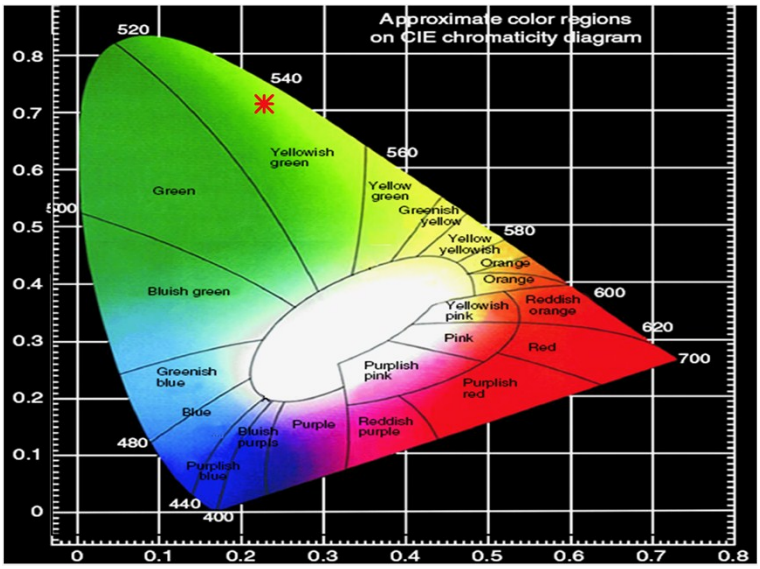

Figure S1. The Commission Internationale de l'Eclairage (CIE) color coordinates of PEO:$FAPbBr_3$ perovskite thin films.

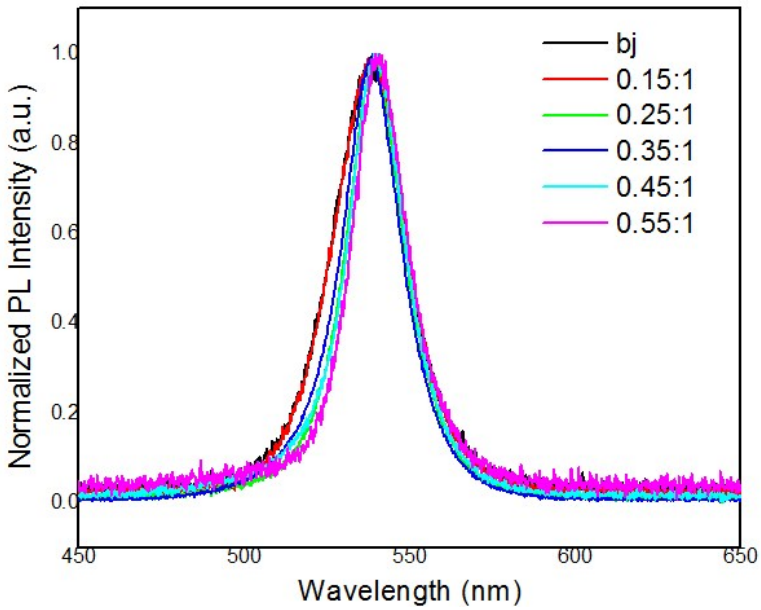

Figure S2. Normalized PL spectra of PEO:$FAPbBr_3$ films with different ratios of PEO.

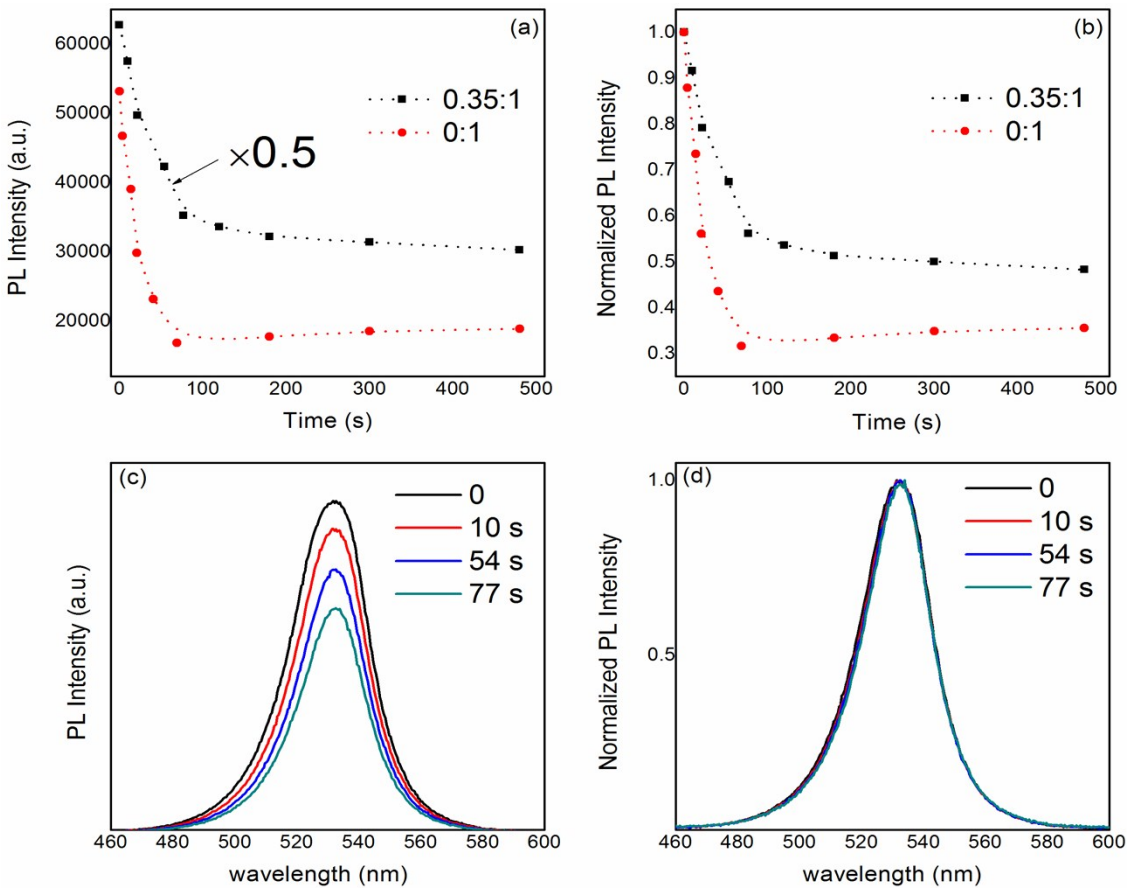

Figure S3. The PL stabilities of PEO-$FAPbBr_3$ film and pure $FAPbBr_3$ film.

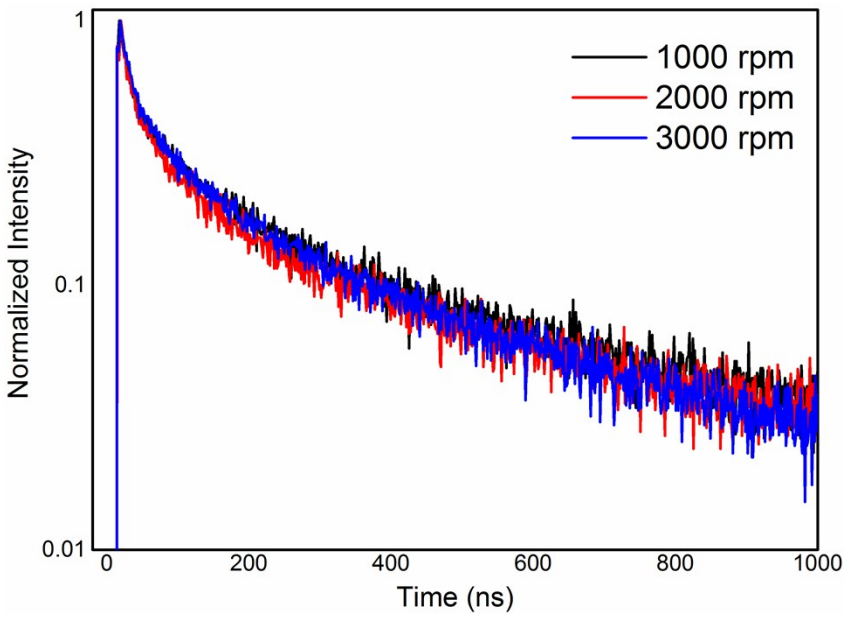

Figure S4. The transient PL decays of 0.35:1 film fabricated by different spin-speed.

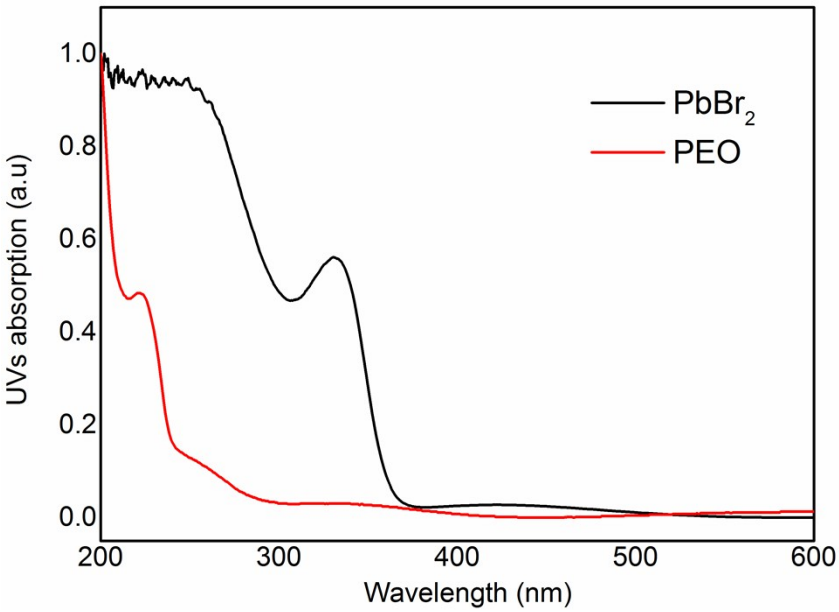

Figure S5. The UVs absorption spectrum of the PEO and $PbBr_2$ films.

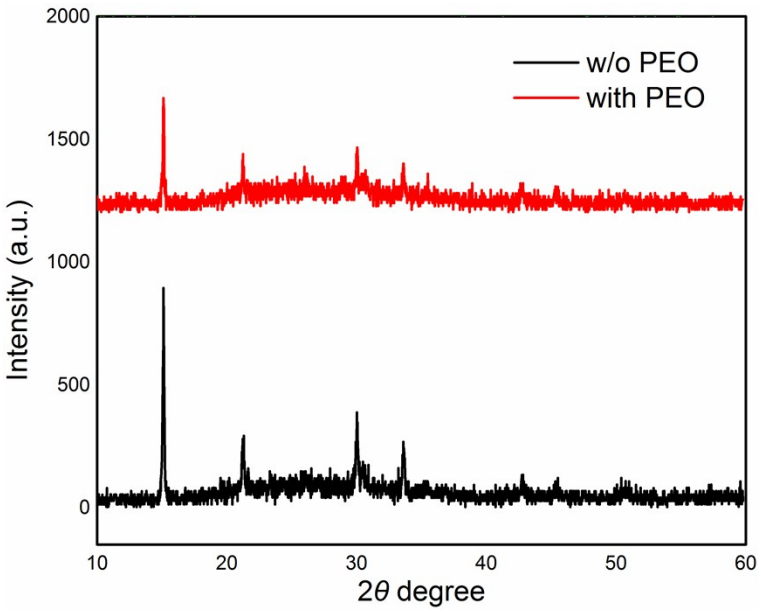

Figure S6. The XRD patterns of PEO:$FAPbBr_3$ perovskite thin film with/without PEO

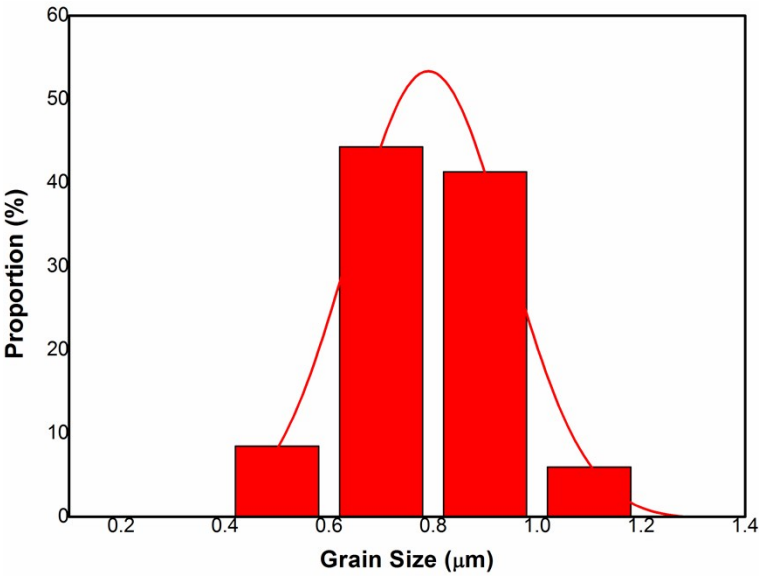

Figure S7. The grain size distribution histogram of pure $FAPbBr_3$ film.

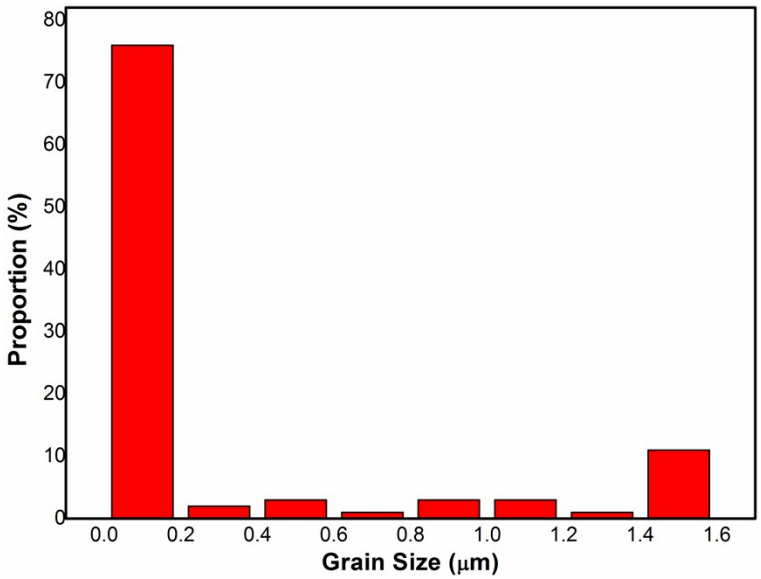

Figure S8. The grain size distribution histogram of 0.55:1 film.

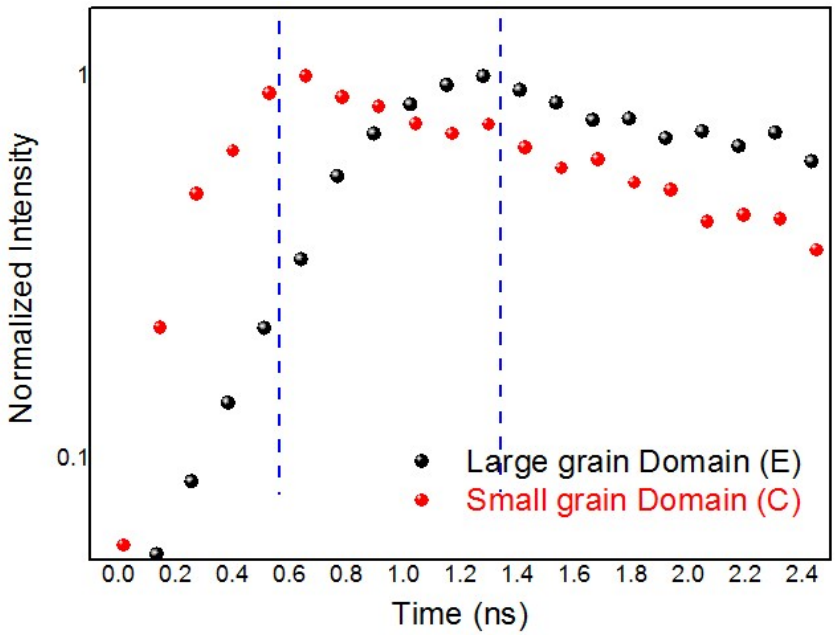

Figure S9. The PL lifetime of large grain domain (E) and small grain domain (C) in 0.35:1 film examined in a much shorter time scale (0-2.4 ns).

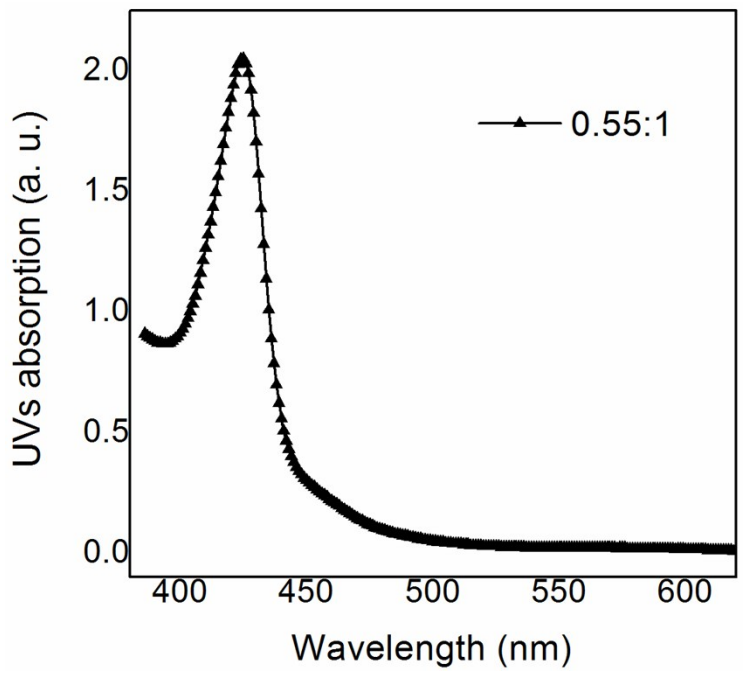

Figure S10. The UVs absorption spectrum of the 0.55:1 film.

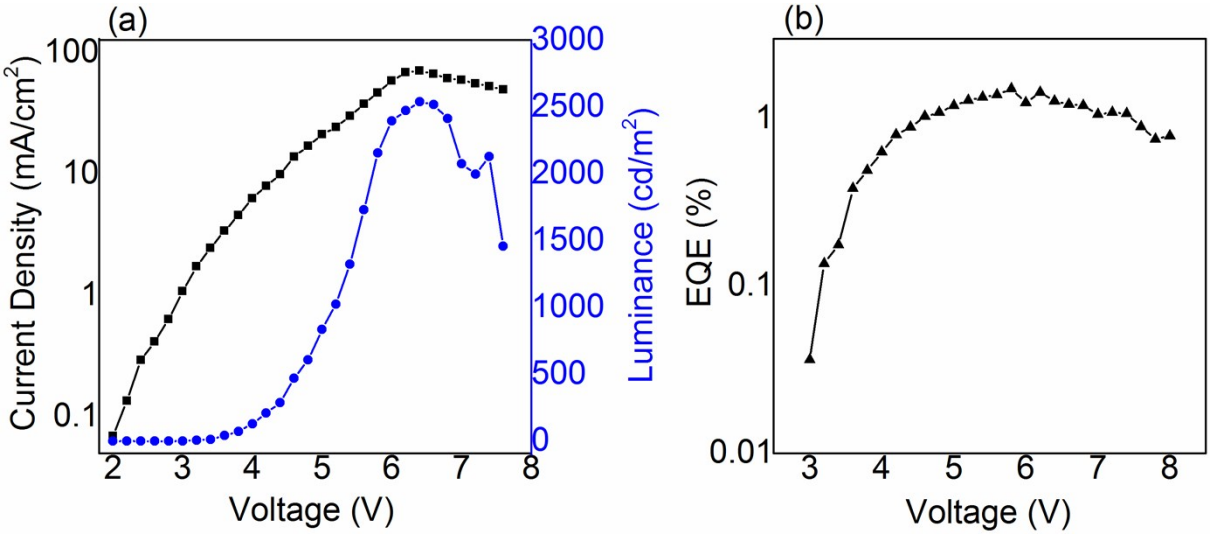

Figure S11. The *J-L-V* characteristics of PeLEDs based on the structure of ITO/PEDOT:PSS/ PEO:$FAPbBr_3$ (0.35:1)/TPBi/Cs_2CO_3/Al.

Table S1. Fitting parameters of transient PL decay curves in Figure 1d.

Volume ratio	τ_1 (ns)	A_1 (%)	τ_2 (ns)	A_2 (%)	τ_3 (ns)	A_3 (%)	τ_{avg} (ns)
0:1	0.13	29.33	1.26	50.98	8.71	19.70	2.39
0.15:1	3.19	27.85	30.8	42.02	185.4	30.12	69.6
0.25:1	11.45	59.11	78.9	24.01	438.5	16.88	99.7
0.35:1	23.63	18.90	120.0	29.34	590	51.76	345.1
0.45:1	19.02	22.78	116.2	33.80	563.5	43.42	288.2
0.55:1	25.0	21.91	169.5	41.81	500	36.27	257.7

Table S2. PEO:$FAPbBr_3$ film thickness with different ratios of PEO.

Volume ratio	0	0.15:1	0.25:1	0.35:1	0.45:1	0.55:1
Thickness (nm)	600.4±13.4	568.3±18.3	460.4±28.1	373.4±14.8	341.6±26.9	327.4±15.2

Table S3. 0.35:1 film thickness with different spin-speed.

spin-speed (rpm)	1000	2000	3000
Thickness (nm)	649.5±15.0	522.9±25.5	418.6±7.8

Table S4. Fitting parameters of transient PL decays of 0.35:1 film fabricated by different spin-speed.

spin-speed (rpm)	τ_1 (ns)	A_1 (%)	τ_2 (ns)	A_2 (%)	τ_3 (ns)	A_3 (%)	τ_{avg} (ns)
1000	20.6	21.80	116.8	31.63	572.0	46.56	307.7
2000	15.17	15.34	116.0	33.98	500.0	50.68	295.1
3000	23.63	18.90	120.0	29.34	590	51.76	345.1

Table S5. Fitting parameters of transient PL decay curves in Figure 3g-h.

Volume Ratio	A_1(%)	τ_1 (ns)	A_2(%)	τ_2 (ns)	τ_{avg} (ns)
A	41.8	6.73	58.2	26.61	18.3
B	56.8	4.97	43.2	27.49	14.7
B’	59.0	4.83	41.0	21.34	11.6
C	84	4.63	16	89	18.2
D	62.8	3.97	37.2	253.7	97
E	45.1	4.79	54.9	661	364
F	29.3	24.5	70.7	250	167
G	36.3	42.8	63.8	265	183
H	47.6	24.1	52.4	242	139