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

Supporting Information

Perovskite templating via bathophenanthroline additive for efficient light-emitting devices

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Content

Additional Results

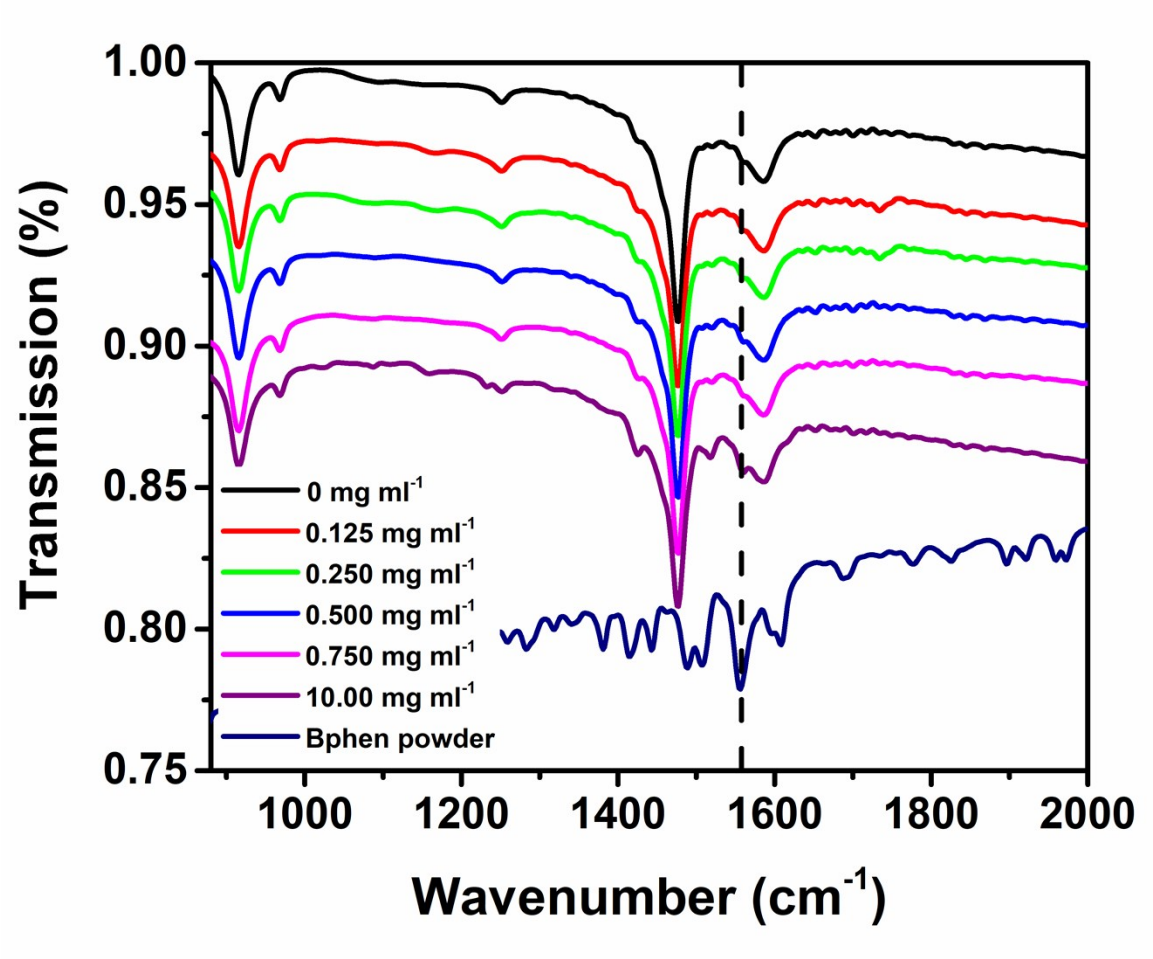


Figure S1. FTIR spectra of reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films as well as pure BPhen powder. Due to instrument limitation, the stretching due to the C=N bond (~1550 cm^{-1}) was observable only in the sample prepared with 10 mg mL^{-1} BPhen concentration. The spectra are offset to provide a clearer view of the expected contribution due to C=N bond stretching.

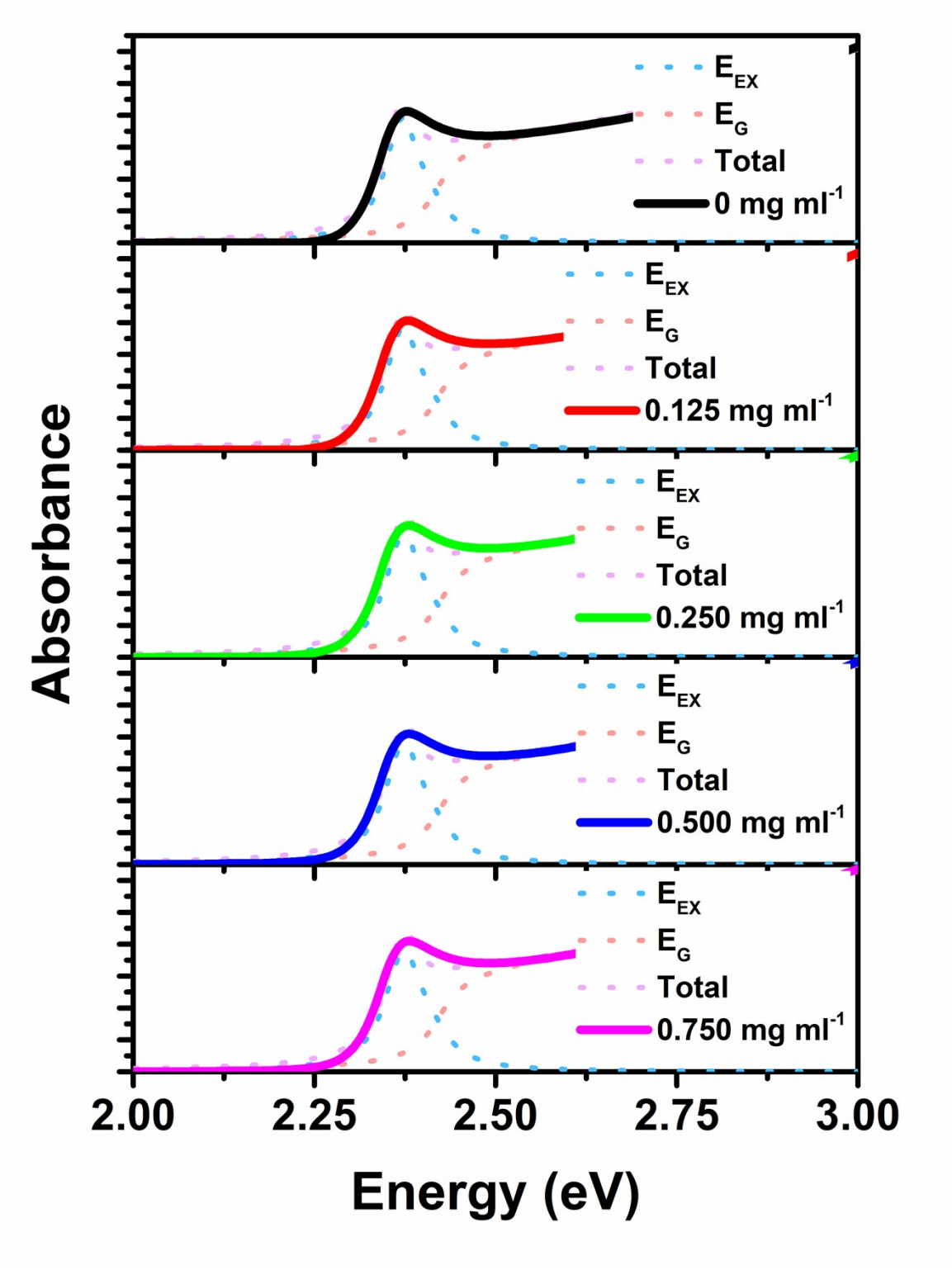


Figure S2. Elliot fitting of absorbance curves for reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films

Table S1. Exciton binding energy and optical band gap energy of reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films obtained by Elliot's fitting of the absorbance spectra in Figure S2.

Sample	Exciton Binding Energy (E_{EX})	Band Gap (E_G)
0 mg ml^{-1}	50 meV	2.4 eV
0.125 mg ml^{-1}	50 meV	2.4 eV
0.250 mg ml^{-1}	50 meV	2.4 eV
0.500 mg ml^{-1}	50 meV	2.4 eV
0.750 mg ml^{-1}	50 meV	2.4 eV

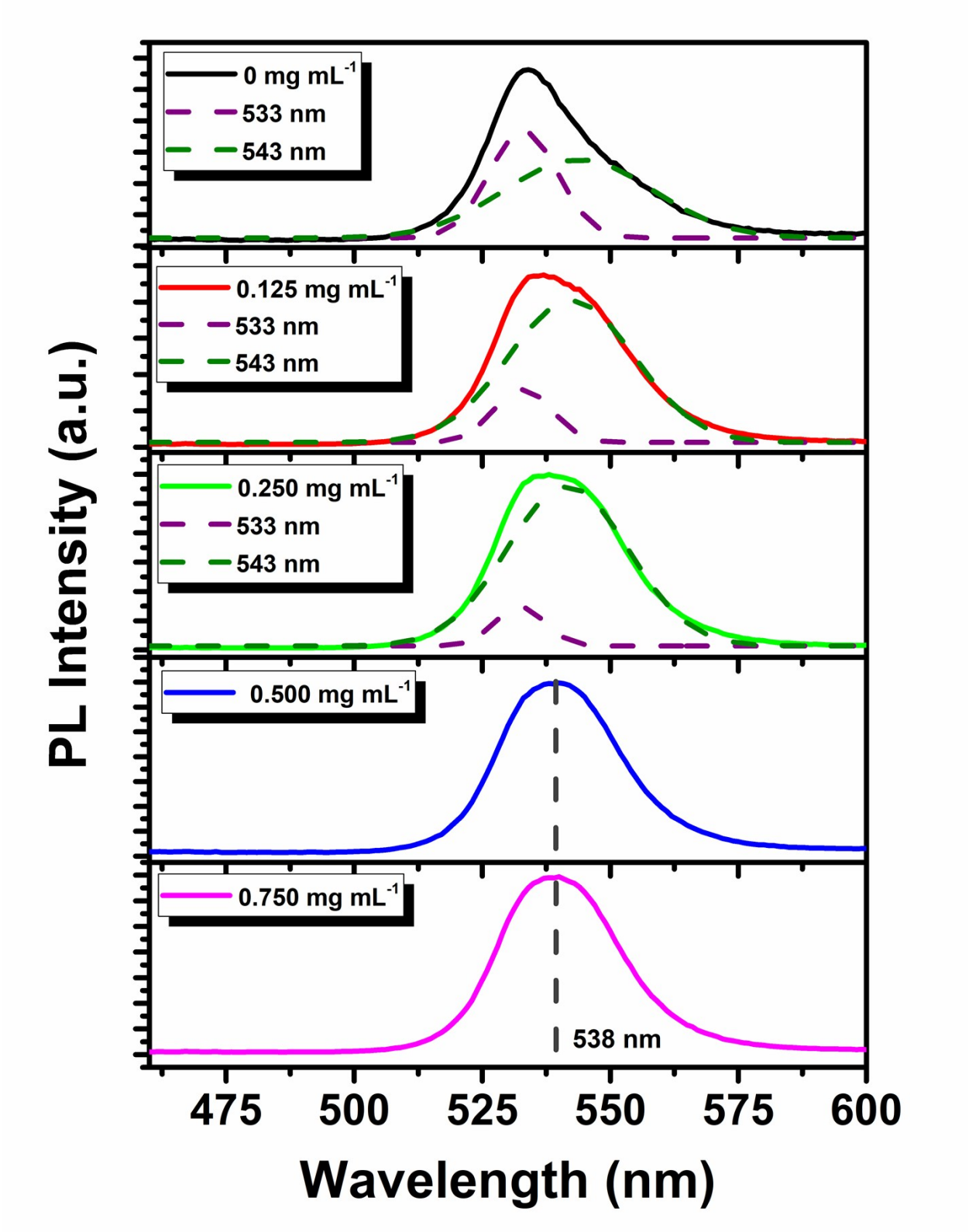


Figure S3: Peak fitting for PL spectra of reference and BPhen-incorporated $CH_3NH_3PbBr_3$ film

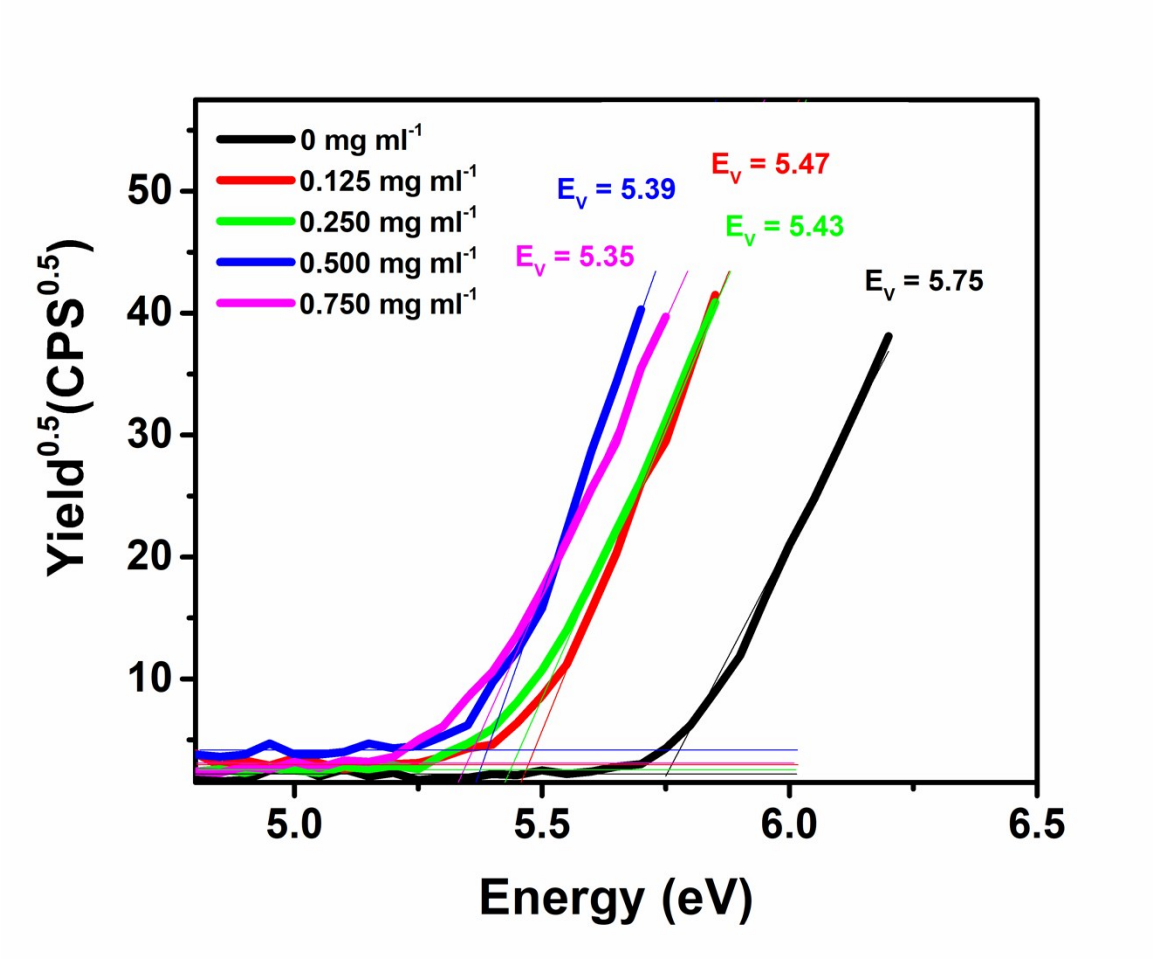
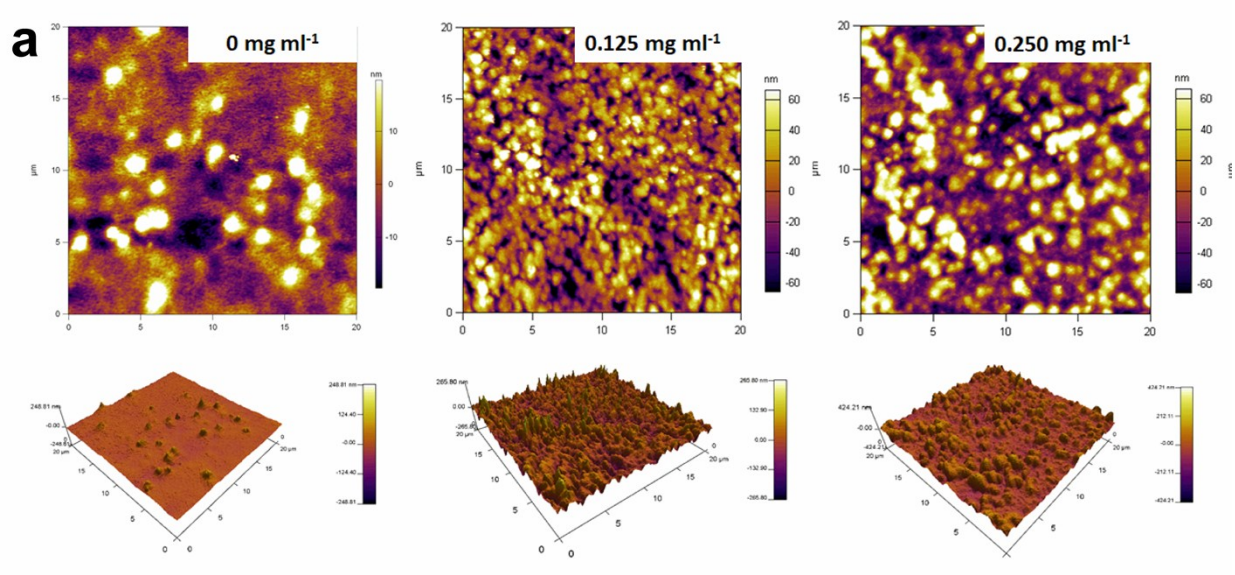
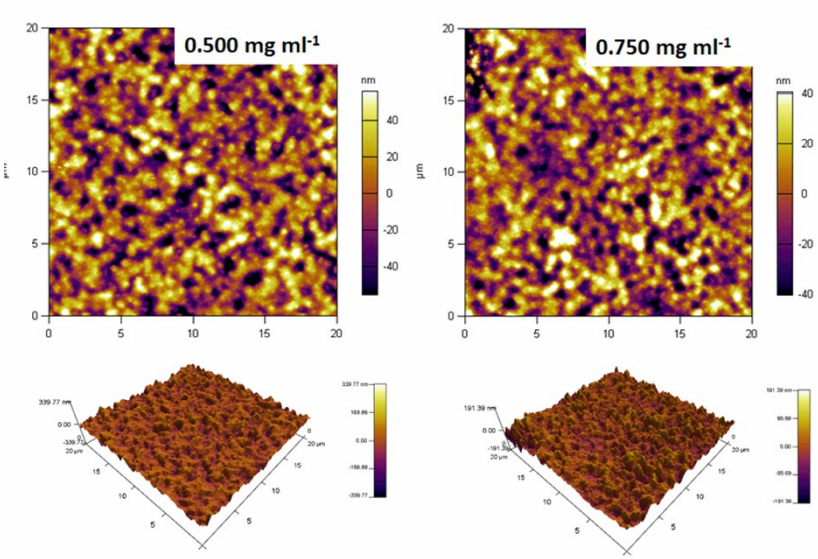


Figure S4. Valence band maximum estimation obtained using PESA measurements for reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films.

Table S2. Summary of decay lifetimes of reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films.

Sample	a_1	A_1	T_1	a_2	A_2	T_2	T_{ave}
0 mg ml^{-1}	0.258	0.2716	2.026	0.692	0.72842	18.426	13.9721
0.125 mg ml^{-1}	0.342	0.3548	3.112	0.622	0.64523	20.413	14.2751
0.250 mg ml^{-1}	0.389	0.3994	2.421	0.585	0.60062	14.693	9.79176
0.500 mg ml^{-1}	0.401	0.4199	2.016	0.554	0.5801	12.541	8.1216
0.750 mg ml^{-1}	0.456	0.4423	2.303	0.575	0.55771	13.812	8.7217


a
0 mg ml-1
0.125 mg ml-1
0.250 mg ml-1
nm
µm


0.500 mg ml-1
0.750 mg ml-1
nm
µm

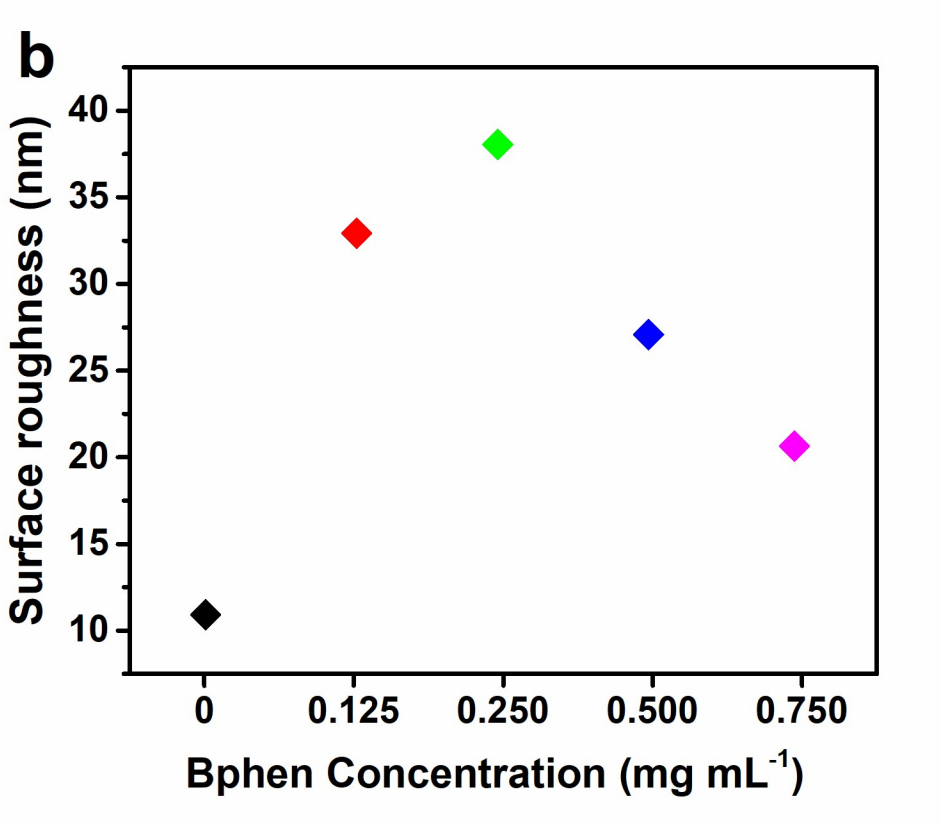


Figure S5. (a) Surface topology taken using AFM and (b) estimated surface roughness of reference and BPhen-incorporated $CH_3NH_3PbBr_3$ films.

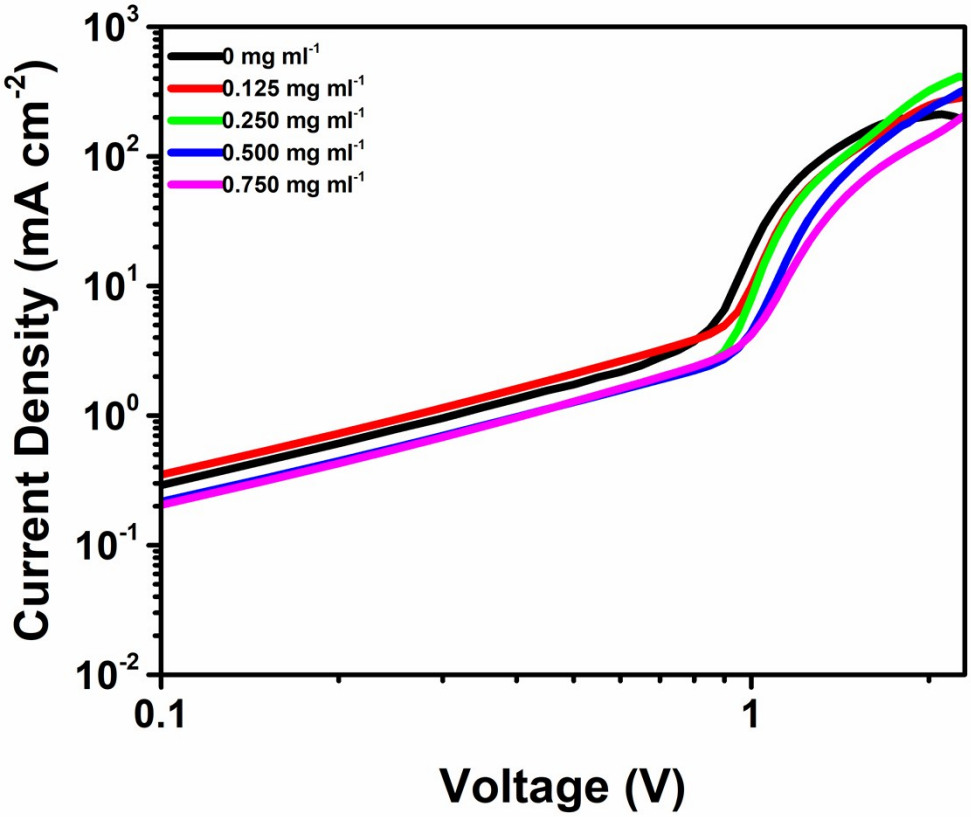


Figure S6. Current density against voltage curves for reference and BPhen-incorporated $CH_3NH_3PbBr_3$ hole-only devices. The device architecture for the hole-only device consists of ITO/PEDOT: PSS/perovskite/Au.

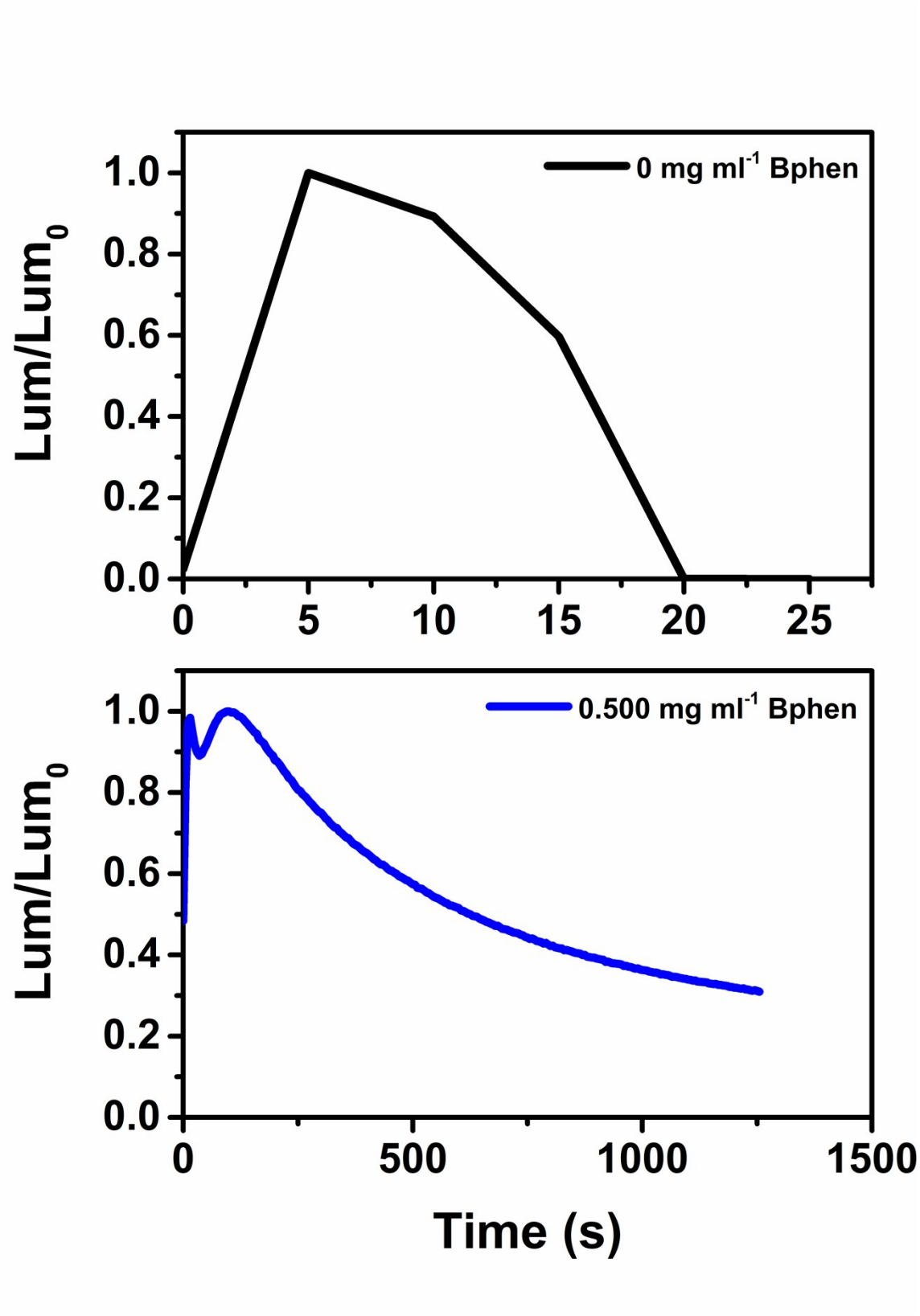


Figure S7. Plot of luminance against time for the 0 and 0.500 mg mL^{-1} devices measured under constant current

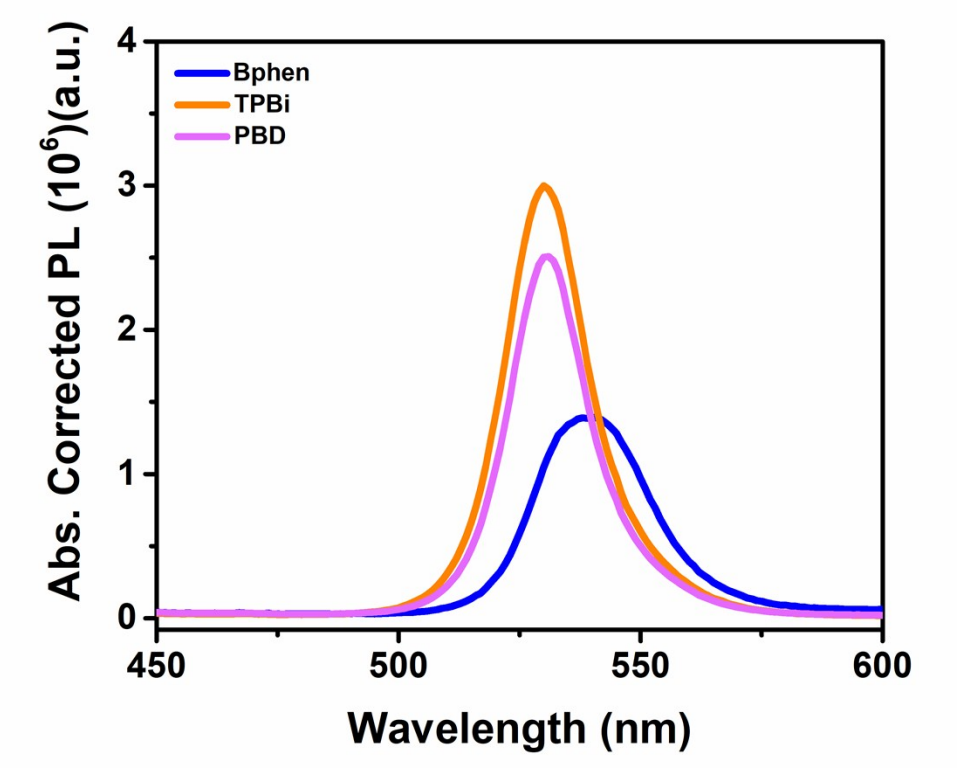


Figure S8. Absorbance-corrected PL intensity of BPhen, TPBi and PBD-incorporated $CH_3NH_3PbBr_3$ films with fixed concentration of 0.500 mg mL^{-1} in toluene.

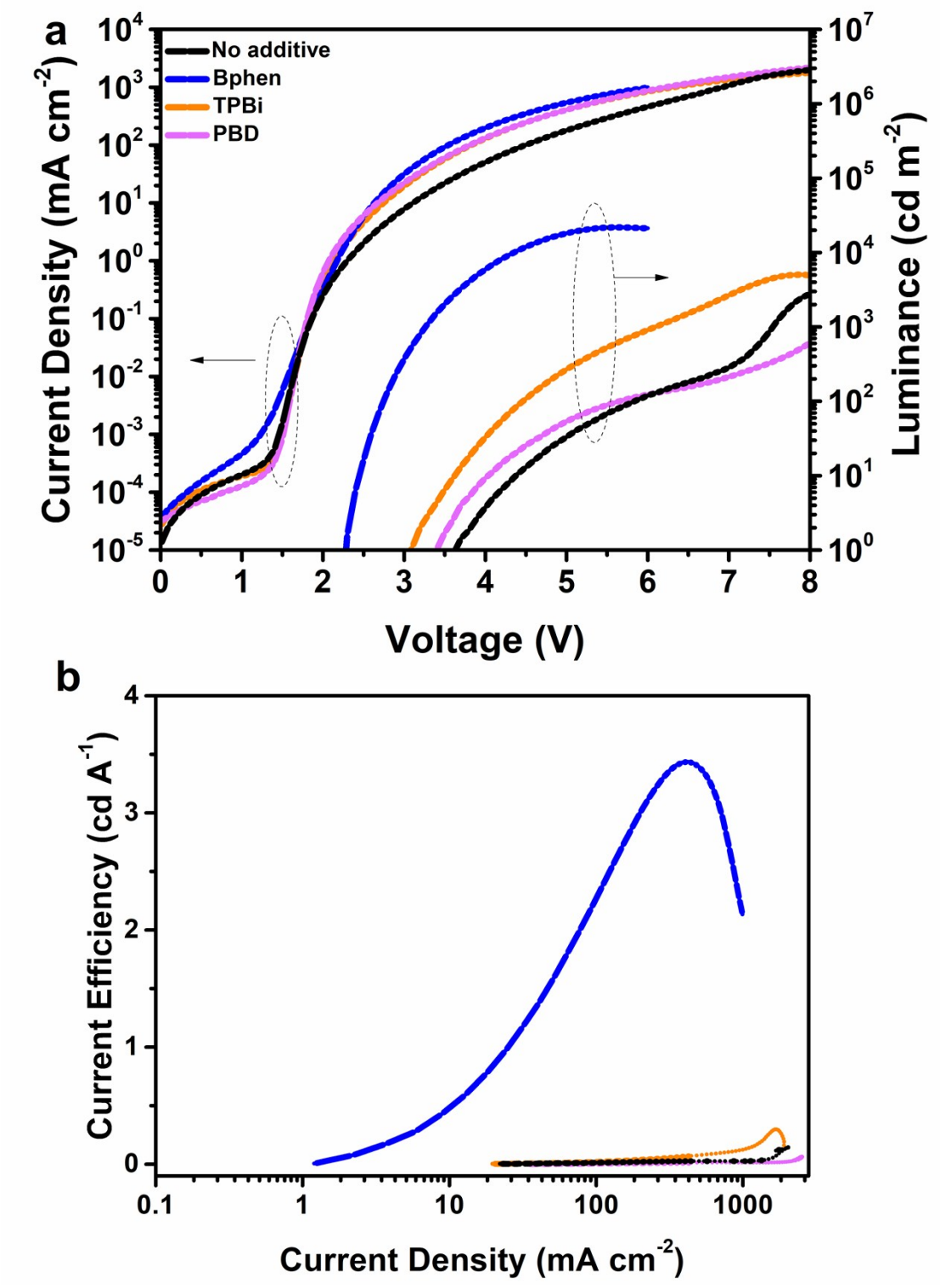


Figure S9. (a) Current density and luminance against voltage and (b) current efficiency against current density of BPhen, TPBi and PBD-incorporated $CH_3NH_3PbBr_3$ films with fixed concentration of 0.500 mg mL^{-1} in toluene.

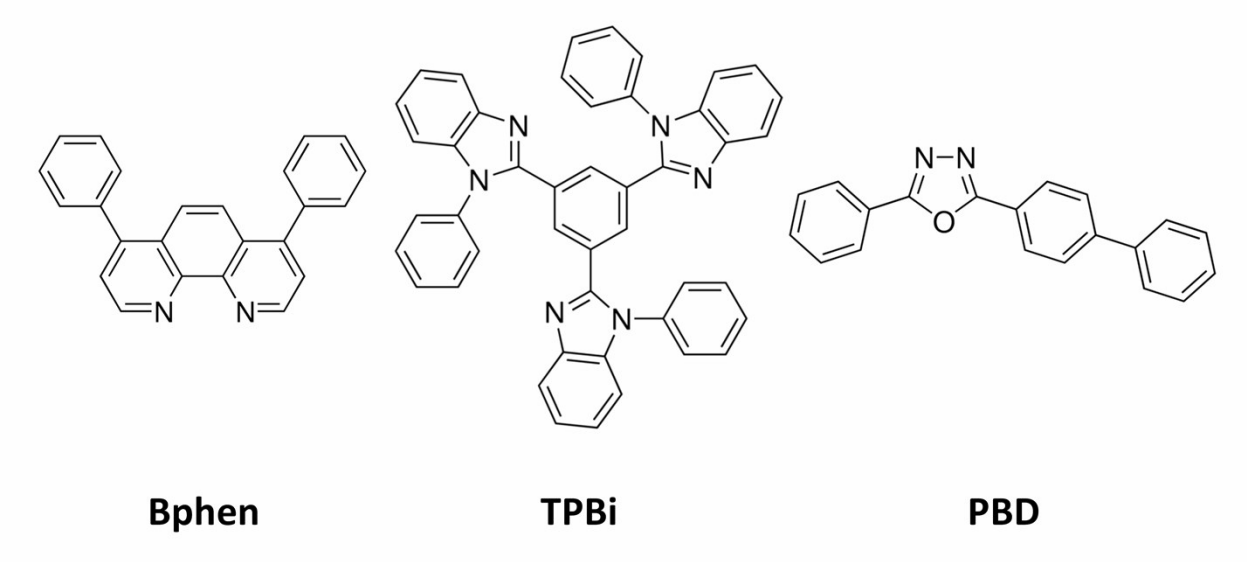


Figure S10. Molecular structure of the small molecule additives used in this work: BPhen, TPBi and PBD.