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

Electronic supplementary information

Compositional optimization of mixed cation Dion-Jacobson perovskites for efficient green light emission

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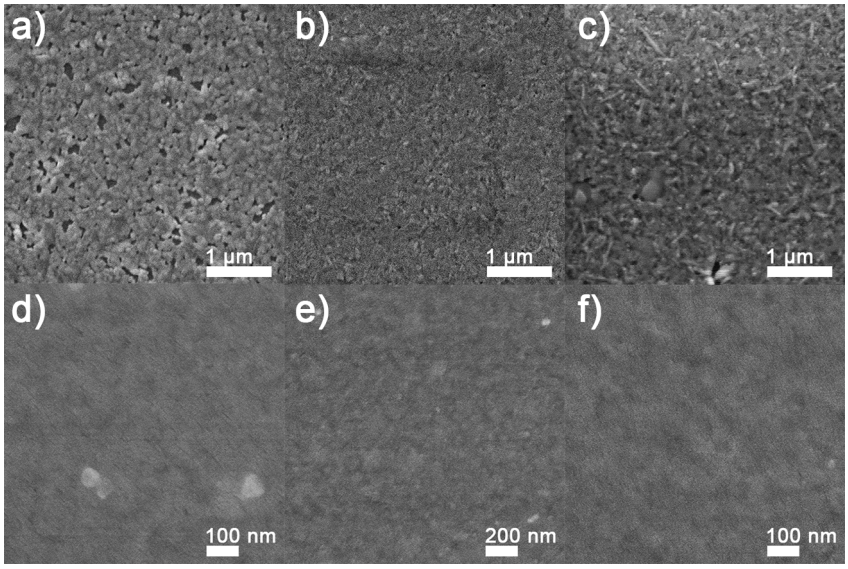

Figure S1. SEM images of $(DDA_xHDA_{1-x})Cs_{n-1}Pb_nBr_{3n+1}$ films for different values of x and surface passivation conditions; a) x=0, b) x=0.25 c) x=0.5 d) x=0.75 e) x=0.75 with TPPO, and f) x=1.

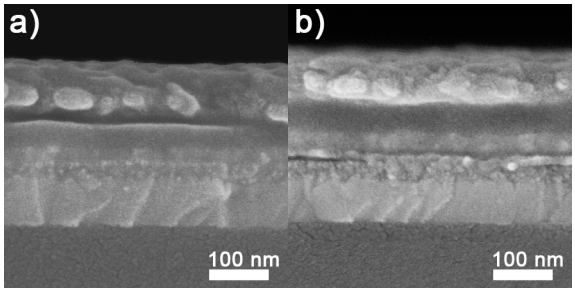

Figure S2. Cross-sectional SEM images of $(DDA_xHDA_{1-x})Cs_{n-1}Pb_nBr_{3n+1}$ films for a) x=0.75 and b) x=1. The perovskite film thickness is 25 nm and 30 nm for x=0.75 and x=1, respectively.

Table S1 PLQY values and LED performance parameters for different $(DDA_xHDA_{1-x})Cs_{n-1}Pb_nBr_{3n+1}$ film compositions x. The maximum EQE, current efficiency, and maximum luminance correspond to the best values observed in the entire batch, and do not necessarily correspond to the same device.

x	PLQY (%)	Maximum EQE (%)	Average EQE (%)	Maximum Luminance (cd/m^2)	Average Luminance (cd/m^2)	Maximum Current Efficiency (cd/A)	Emission wavelength (nm)	T_{50} (min)	Number of devices
0 (HDA)	1.4	1.23	1.06±0.39	4679	3479	4.5	520	4	11
0.25	13.6	8.76	6.57±1.50	5506	3854	24.6	510	19	13
0.5	15.2	7.34	4.85±1.03	5213	4253	21.2	510	26	14
0.75	20.0	9.41	8.1±0.55	7174	6259	28.0	512	70	24
1 (DDA)	16.7	7.28	5.66±0.93	5708	4567	20.3	510	60	20
0.75 with TPPO	41.5	12.85	11.34±1.10	2726	2358	38.3	512	13	12

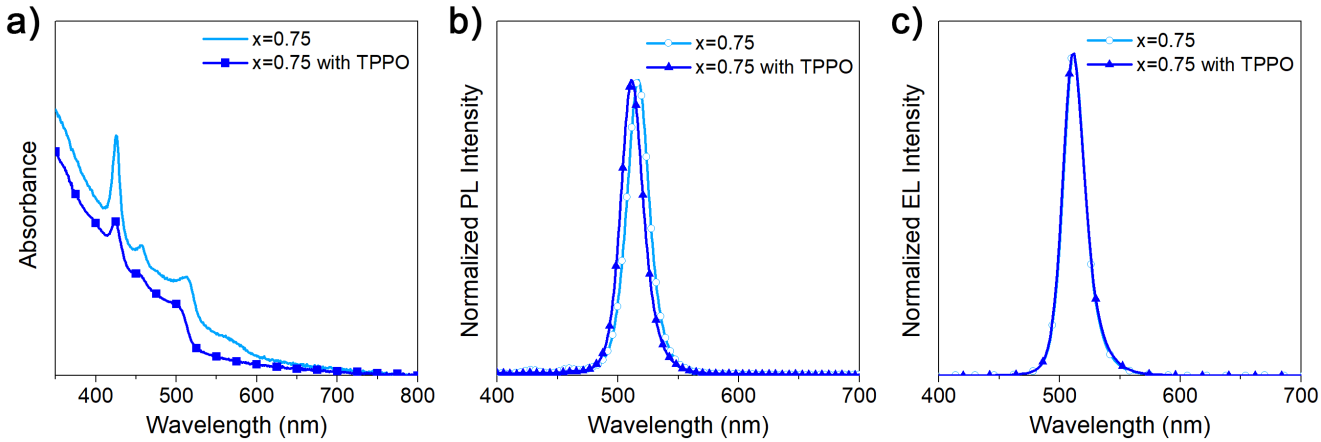

Figure S3. a) Absorption spectra and b) normalized PL spectra of $(DDA_{0.75}HDA_{0.25})Cs_{n-1}Pb_nBr_{3n+1}$ films with and without TPPO surface passivation; c) Normalized EL spectra of $(DDA_{0.75}HDA_{0.25})Cs_{n-1}Pb_nBr_{3n+1}$ films with and without TPPO surface passivation.

Table S2. Hole and electron trap density from hole and electron only devices, respectively, can be calculated using the equation $N_{traps} = 2\varepsilon_0\varepsilon_r V_{TFL}/(qL^2)$, where the ε_0, ε_r, q, and L are the vacuum permittivity, the relative dielectric constant, elementary charge, and the thickness of the perovskite films, respectively.[1,2]

	V_{TFL} Hole Only (V)	N_{traps} (h) (cm^{-3})	V_{TFL} Electron Only (V)	N_{traps} (e) (cm^{-3})
x=0 (HDA)	0.45	0.96×10^{17}	0.83	1.77×10^{17}
x=0.75	0.84	1.79×10^{17}	1.25	2.67×10^{17}
x=1 (DDA)	0.67	1.43×10^{17}	1.24	2.64×10^{17}

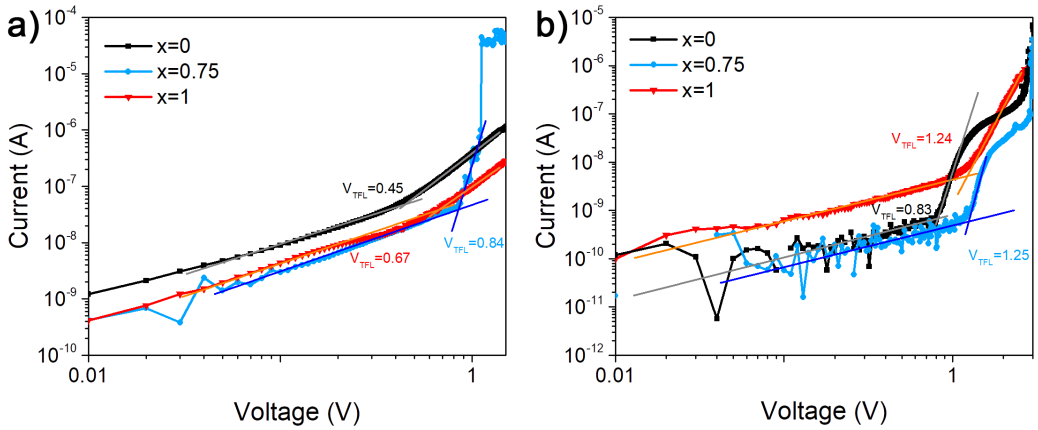

Figure S4. I-V curves of a) hole-only devices with the architecture ITO/NiO_x/TFB/Perovskite/TFB/MoO_3/Al and b) electron only devices with the architecture ITO/ZnO/Perovskite/TPBi/Liq/Al for $(DDA_xHDA_{1-x})Cs_{n-1}Pb_nBr_{3n+1}$ films with different values of x.

References

1. Z. Fang, W. Chen, Y. Shi, J. Zhao, S. Chu, J. Zhang and Z. Xiao, Adv. Funct. Mater., 2020, 30, 1909754.
2. Q. Dong, Y. Fang, Y. Shao, P. Mulligan, J. Qiu, L. Cao and J. Huang, Science, 2015, 347, 967-970.