SUPPLEMENTARY INFORMATION

Effects of hole transport layer on the performance of sky-blue Dion-Jacobson perovskite light-emitting diodes

Wen Ting Sun,[1] Yanling He,[1] Muhammad Umair Ali,[1] Qiye Liu,[2] Hongbo Mo,[1] Sijia Wang,[3] Alan Man Ching Ng,[4] and Aleksandra B. Djurišić[1,*]

[1] Department of Physics, The University of Hong Kong, Pokfulam Road, Hong Kong

[2] Shenzhen Institute for Quantum Science and Engineering, and Department of Physics, Southern University of Science and Technology, Shenzhen 518055, China

[3] Department of Mechanical Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong

[4]Core Characterization Facility, Southern University of Science and Technology, No. 1088, Xueyuan Rd., Shenzhen, 518055, Guangdong, PR China.

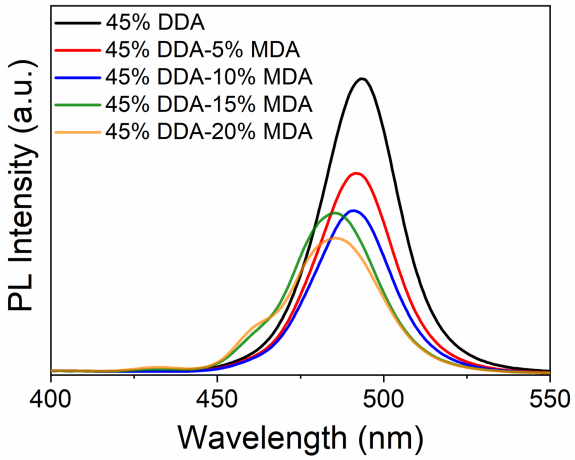

Figure S1. PL spectra of perovskites with 45% $DDABr_2$ and different content of $MDABr_2$.

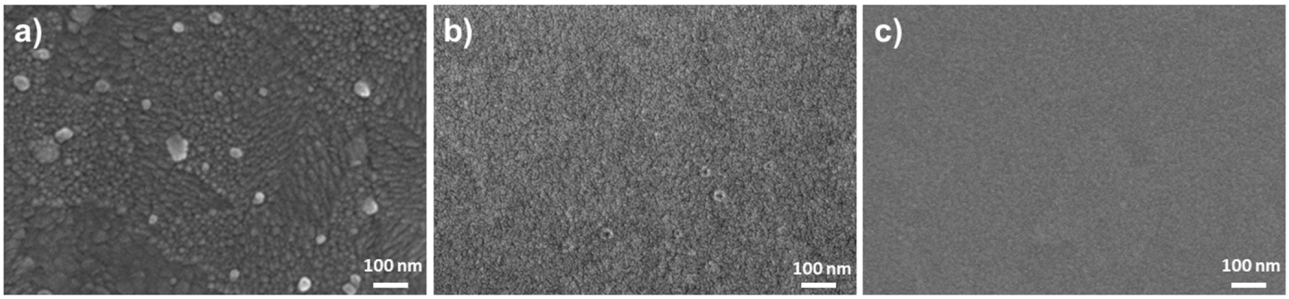

Figure S2. SEM images of DDA-MDA perovskite on different HTLs: a) 2PACz, b) 2PACz/PVK and c) 2PACz/PVK/TSPO1.

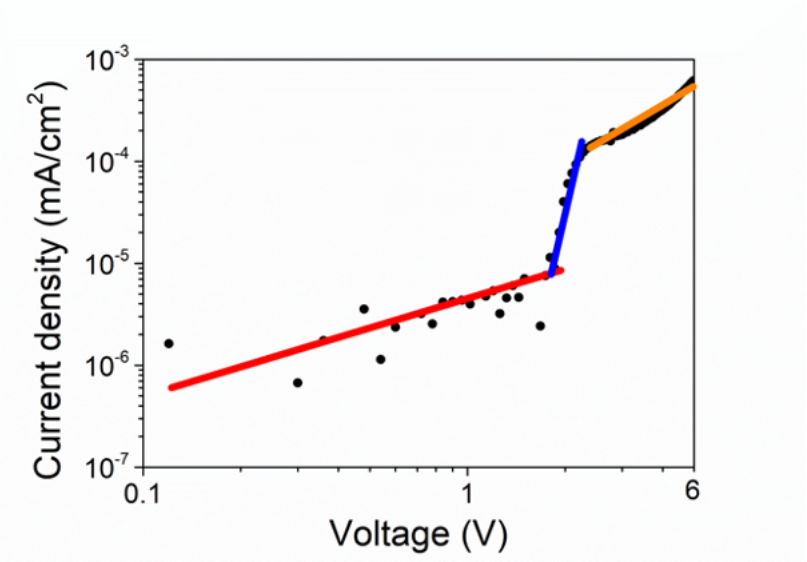

Figure S3. Space-charge-limited current (SCLC) measurement of electron-only device with the architecture ITO/SnO_2/PEIE/DDA-MDA perovskite/TPBi/Liq/Al.

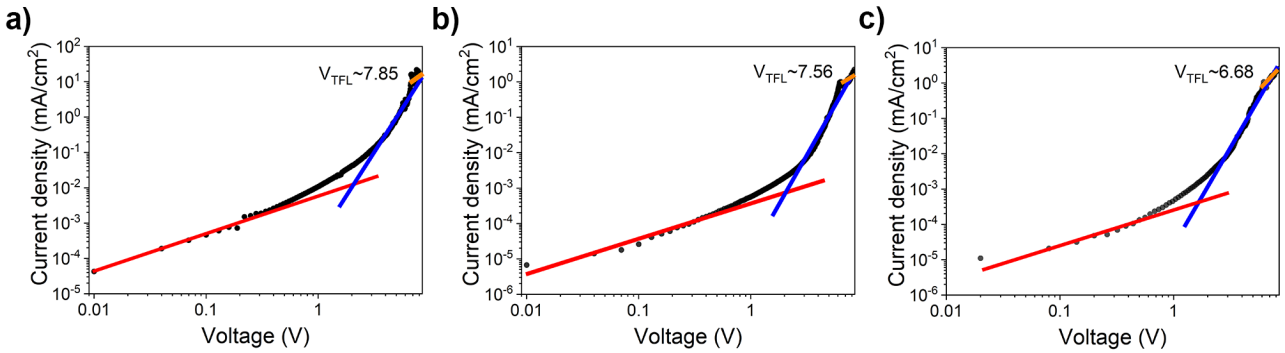

Figure S4. SCLC measurement of DDA-MDA perovskite-based LED devices with different HTLs: a) 2PACz, b) 2PACz/PVK, and c) 2PACz/PVK/TSPO1. Device architecture was ITO/HTL/Perovskite/CBP/MoO_x/Al, where CBP denotes 4,4′-bis(N-carbazolyl)-1,1′-biphenyl.

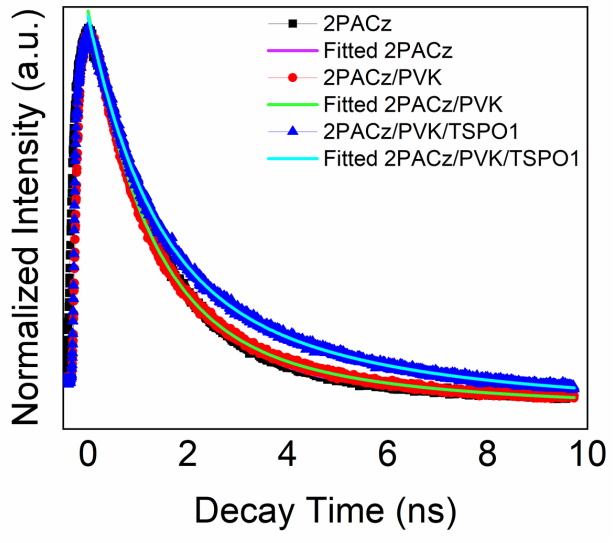

Figure S5. TRPL decay curves of perovskite films on different HTLs.

Table S1. Fitting parameters of TRPL curves to exponential decay model described as $I(t) = \Sigma_i^n A_i exp(^{-t}/_{\tau_i})$, with average decay time calculated as $\tau_{avg} = \Sigma_i^n A_i \tau_i / \Sigma_i^n A_i$.

HTL	A_1	τ_1 (ns)	A_2	τ_2 (ns)	τ_{avg} (ns)
2PACz	0.94	1.52	-	-	1.52
2PACz/PVK	0.75	1.16	0.23	4.00	1.83
2PACz/PVK/TSPO1	0.60	1.18	0.36	4.26	2.34

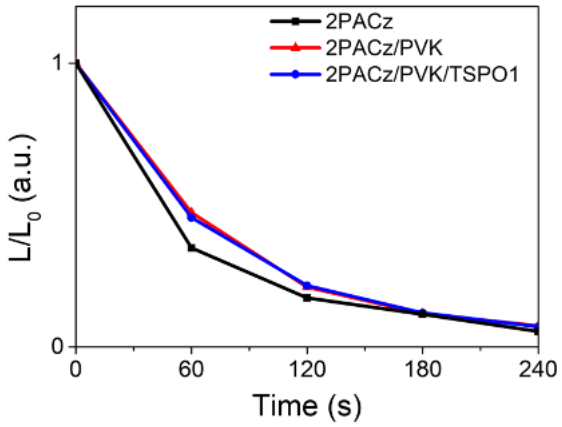

Figure S6. The luminance of devices as a function of time at a fixed current bias of 0.2 mA (corresponding to initial luminance in the range 90-99 cd/m^2).

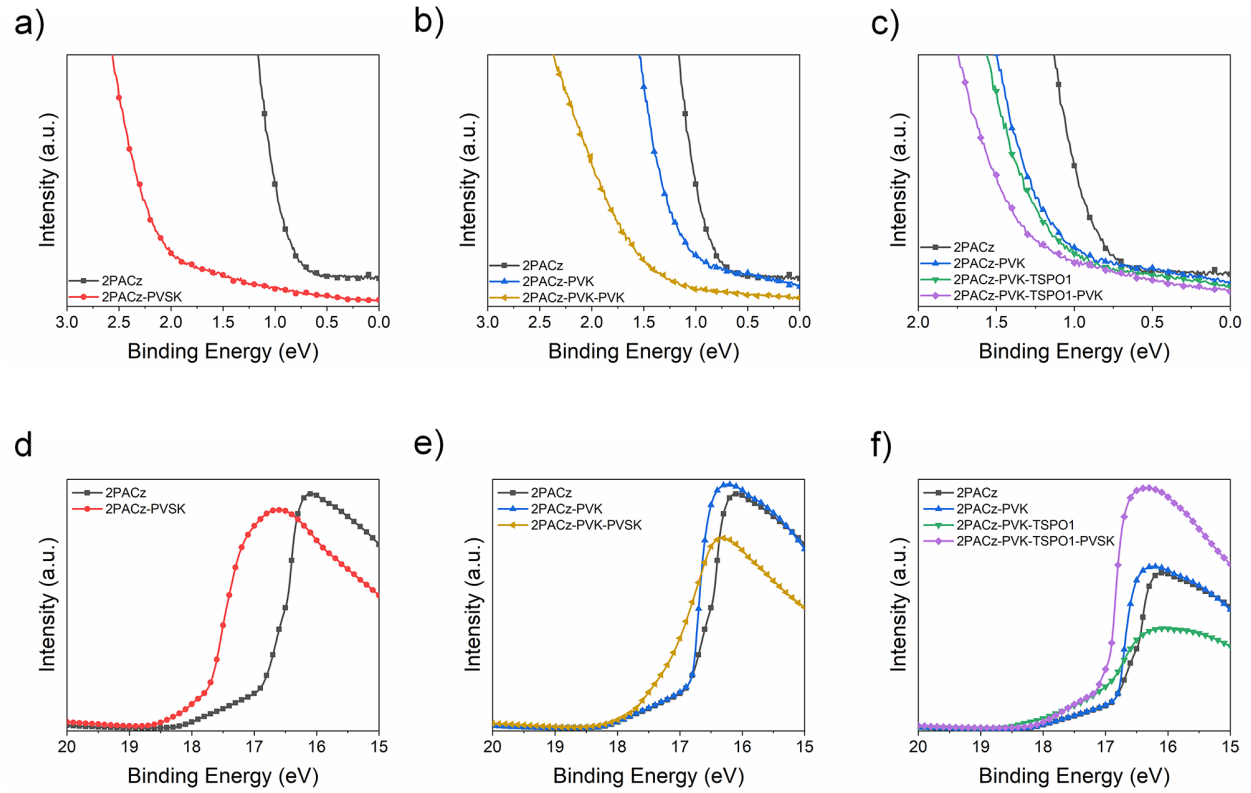

Figure S7. a) Fermi edge of 2PACz and 2PACz/PVSK, b) Fermi edge of 2PACz, 2PACz/PVK and 2PACz/PVK/PVSK, c) Fermi edge of 2PACz, 2PACz/PVK, 2PACz/PVK/TSPO1 and 2PACz/PVK/TSPO1/PVSK, d) SE Cut-off of 2PACz and 2PACz/PVSK, e) SE Cut-off of 2PACz, 2PACz/PVK and 2PACz/PVK/PVSK and f) SE Cut-off of 2PACz, 2PACz/PVK, 2PACz/PVK/TSPO1 and 2PACz/PVK/TSPO1/PVSK.