

Improving the performance of perovskite solar cells using a dual-hole transport layer

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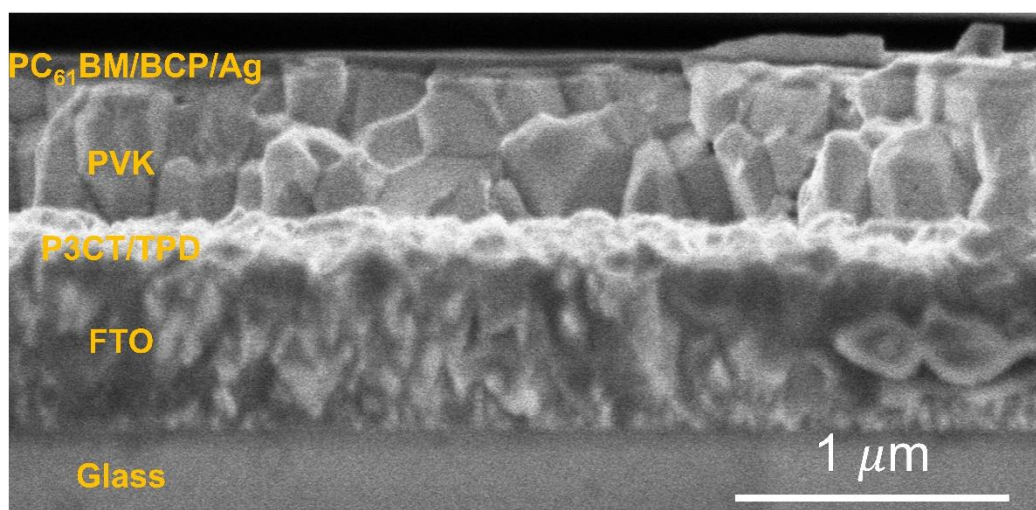


Figure S1 Inverted structure of the triple cation perovskite solar cell.

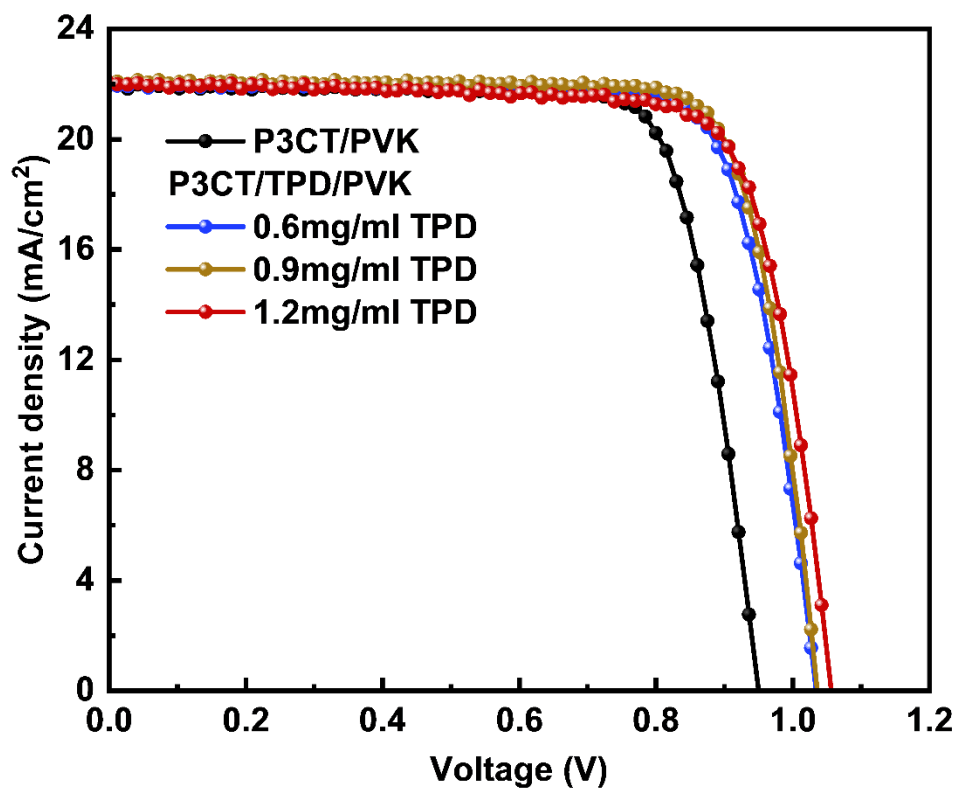


Figure S2 J - V curves of the control and different concentrations of Poly-TPD devices

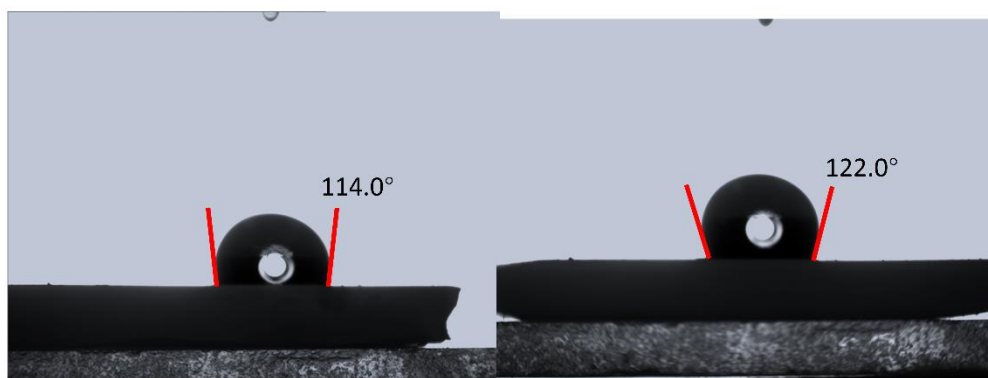


Figure S3 The water contact angles of P3CT-N only film and dual-HTLs film.

Table S1 The detail fitting parameters of the TRPL decay curves.

Device	τ_1	F1	τ_2	F1	τ_{ave}
P3CT/PVK	31.17	14.63	156.63	85.37	137.61
P3CT/TPD/PVK	9.92	14.02	94.13	85.98	82.32

Table S2. Average photovoltaic parameters of pristine and dual-HTLs perovskite solar cells

Device	V_{oc} (V)	J_{sc} (mA/cm²)	FF (%)	PCE (%)
P3CT/PVK	1.001±0.011	20.511±0.476	78.257±2.453	16.061±0.529
P3CT/TPD/PVK	1.102±0.014	22.144±0.463	78.334±1.257	19.101±0.488