

Supporting information

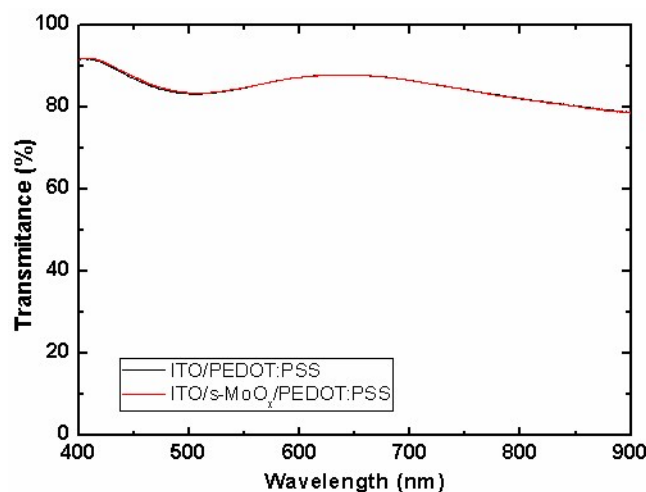


Figure S1. The transmittance of the substrate of ITO/PEDOT:PSS and ITO/s-MoO_x/PEDOT:PSS.

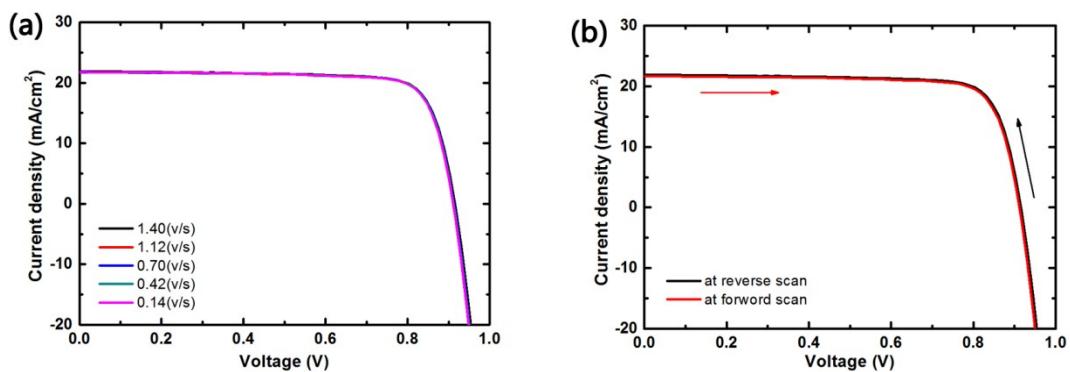


Figure S2. J-V hysteresis. J–V curves for the optimized perovskite solar cell of ITO/s-MoO_x/PEDOT/perovskite/PCBM/TOPD/Ag with different scan rate (a) and with different scan direction (b).

Table S1. The photovoltaic parameters of the 28 device A and device C respectively.

Device #A	V_{oc}	J_{sc}	FF	PCE
1	0.88	18.17	69.59	11.13
2	0.91	16.46	68.37	10.22
3	0.885	17.51	69.67	10.80
4	0.903	18.95	66.75	11.42
5	0.89	19.23	70.77	12.11
6	0.88	18.3	69.2	11.14
7	0.88	17.16	67.59	10.19
8	0.876	15.86	67.66	9.39
9	0.87	16.12	66.8	9.38
10	0.87	17.97	67.76	10.59
11	0.884	18.52	67.55	11.06
12	0.88	16.34	67.73	9.73
13	0.89	18.08	66.77	10.77
14	0.88	17.82	69.93	11.00
15	0.89	16.46	70.28	10.29
16	0.91	16.57	70.7	10.71
17	0.91	16.23	71.62	10.59
18	0.89	18.08	66.77	10.77
19	0.906	17.11	69.73	10.81
20	0.91	18.82	67.44	11.53
21	0.91	19.68	66.01	11.82
22	0.903	17.54	67.6	10.7
23	0.874	17.62	67.73	10.43
24	0.864	18.01	69.51	10.81
25	0.875	17.21	68.68	10.34
26	0.889	18.88	67.98	11.41
27	0.89	17.27	70.69	10.88
28	0.89	17.2	70.22	10.73

Device #C	V_{oc}	J_{sc}	FF	PCE
1	0.907	19.98	78.41	14.21
2	0.91	19.996	78.05	14.01
3	0.903	19.5	76.3	13.43
4	0.904	20.66	75.13	14.03
5	0.891	21.7	79.15	15.3
6	0.89	20.84	78.59	14.58
7	0.914	21.75	80.7	16.04
8	0.91	20.74	75.27	14.21
9	0.91	20.68	76.1	14.31
10	0.88	20.69	78.69	14.33
11	0.907	20.54	75.77	14.11
12	0.89	20.16	79.97	14.28
13	0.89	21.28	76.67	14.51

14	0.901	19.41	76.44	13.37
15	0.905	19.46	76.48	13.47
16	0.89	20.53	78.36	14.22
17	0.90	18.76	77.63	13.05
18	0.90	20.97	77.2	14.40
19	0.88	22.16	79.94	15.62
20	0.89	21.73	79.51	15.38
21	0.88	21.89	77.65	14.96
22	0.914	20.62	78.24	14.74
23	0.91	22.02	74.80	14.98
24	0.88	22.03	76.35	14.8
25	0.904	19.45	77.21	13.58
26	0.92	21.5	78.21	15.46
27	0.913	21.12	80.32	15.48
28	0.905	22.5	75.02	15.27
