

Supporting Information

Fulleropyrrolidinium Iodide as An Efficient Electron Transport

Layer for Air-Stable Planar Perovskite Solar Cells

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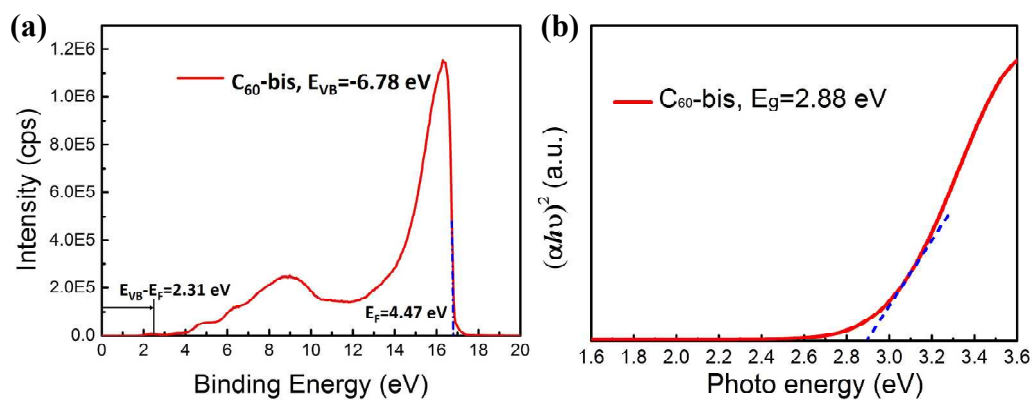


Figure S1. (a) Ultraviolet photoelectron spectrometer (UPS) and (b) ultraviolet-visible absorption spectroscopy measurements (UV-Vis) of C₆₀-bis.

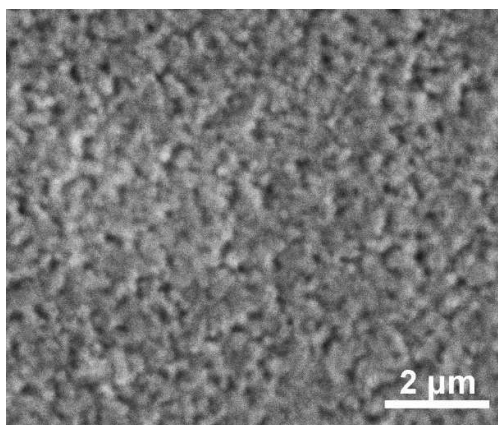


Figure S2. Top view SEM image of C₆₀-bis on perovskite films

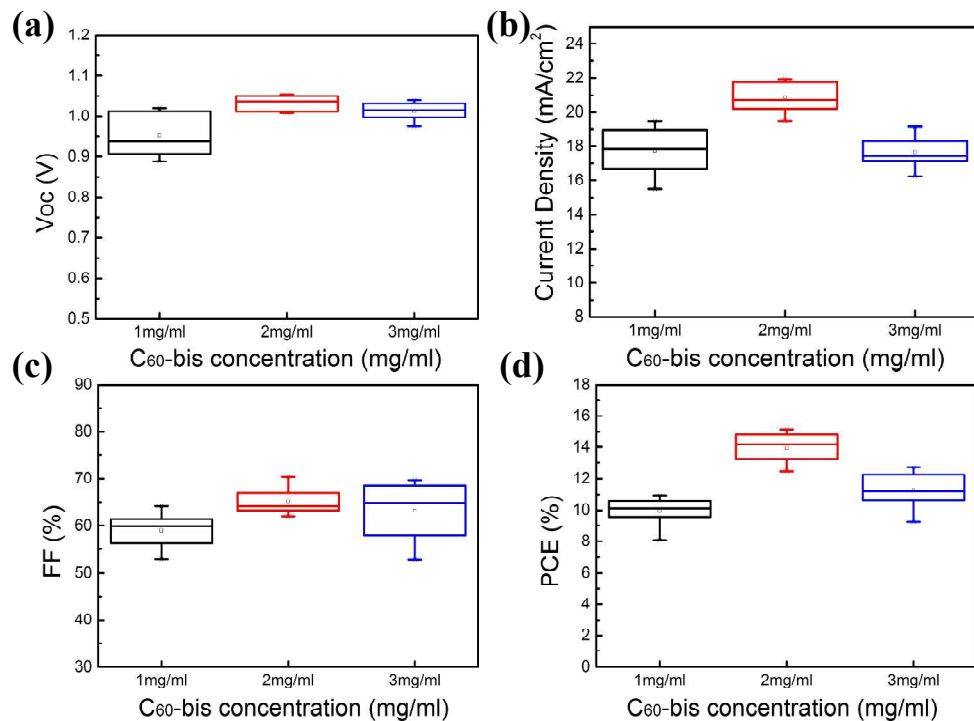


Figure S3. Performance statistics (a) V_{oc} , (b) J_{sc} (c) FF and (d) PCE of the devices with different concentration of C_{60} -bis layer under 100 mW/cm^2 illumination, in which data are extracted from their J - V characteristics.

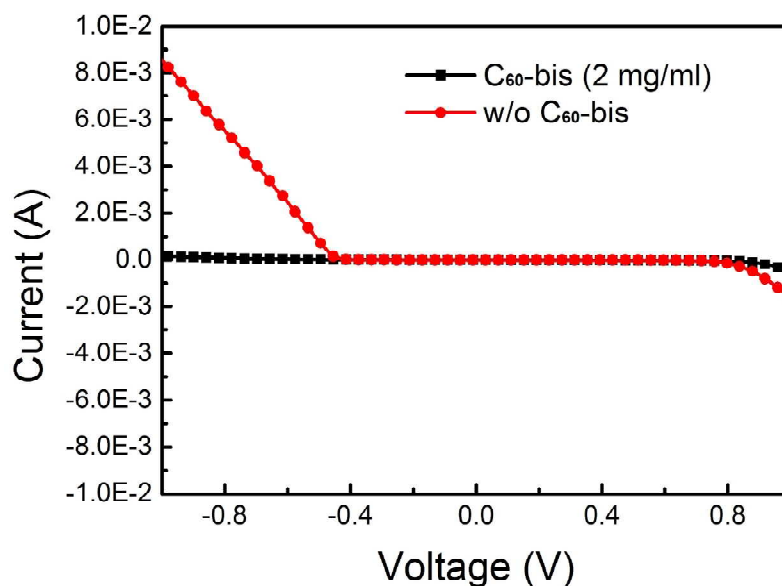


Figure S4. Dark J - V characteristics of devices without the C_{60} -bis layer and with a 2 mg/ml C_{60} -bis layer.

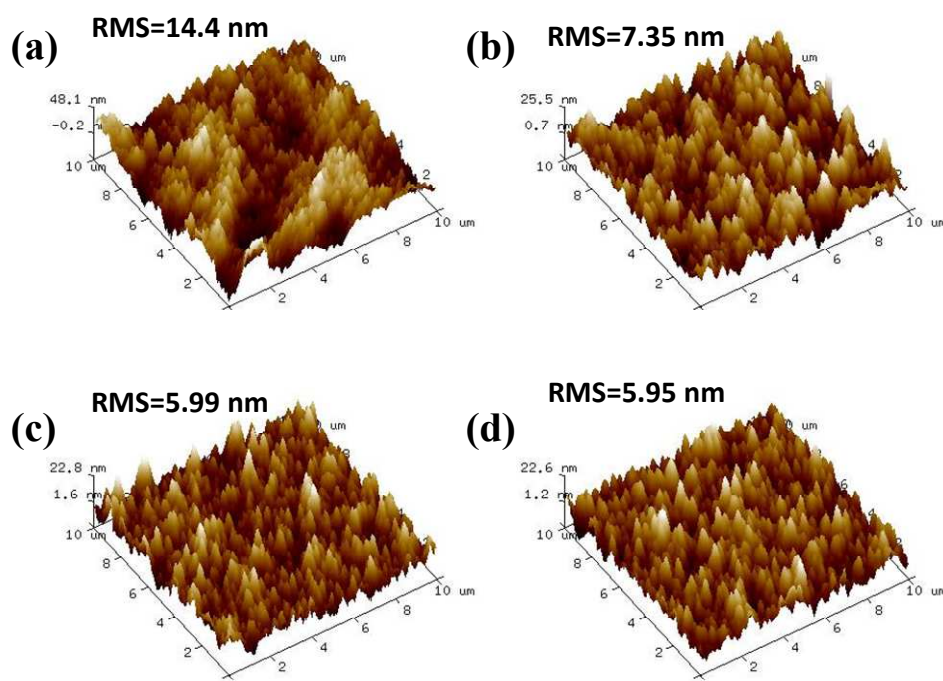


Figure S5. Tapping-mode AFM images of varying thickness of C₆₀-bis layers on MAPbI₃: (a) bare MAPbI₃, (b) C₆₀-bis (1mg/ml)/ MAPbI₃, (c) C₆₀-bis (2mg/ml)/ MAPbI₃, (d) C₆₀-bis (3mg/ml) MAPbI₃. The RMS roughness values for the images of a-d are 14.4, 7.35, 5.99 and 5.95 nm, respectively.

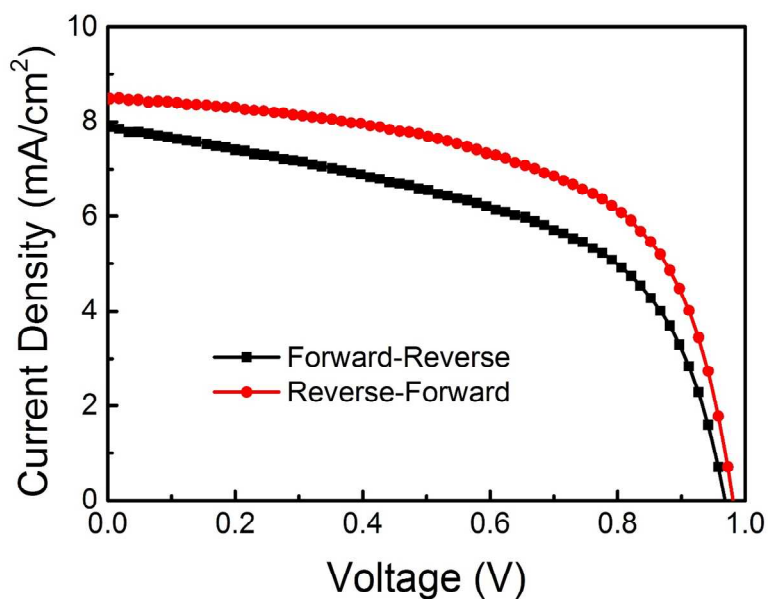


Figure S6. *J-V* characteristics applying different bias scanning directions under 100 mW/cm² illumination for devices without C₆₀-bis layer.

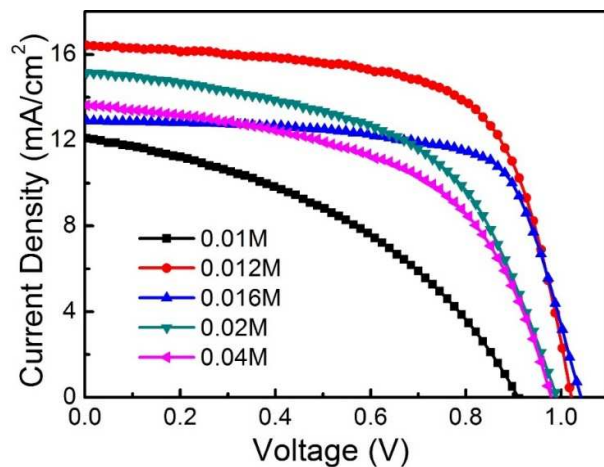


Figure S7. J - V characteristics under AM 1.5G 100 mW/cm² illumination of perovskite solar cells with varying concentration of the NiO precursor solution.

Table S1 Summary of performance metrics of the devices with varying concentration of NiO precursor solution.

	Voc (mV)	Jsc (mA/cm2)	FF	PCE
0.01M	910.68	12.65	41.44	4.78
0.012M	1021.95	17.19	65.86	11.57
0.016M	982.4	13.52	68.98	9.16
0.02M	991.6	15.87	54.21	8.53
0.04M	979.9	14.26	54.27	7.59

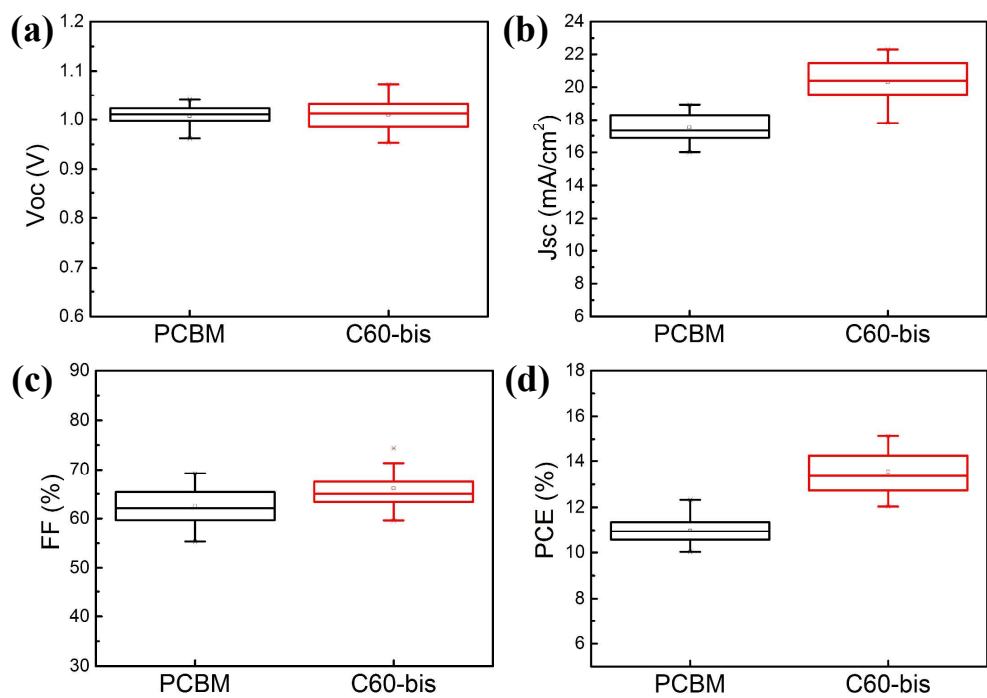


Figure S8. Parameters statistics (a)Voc, (b)Jsc (c)FF and (d) PCE of the devices with different ETLs (PCBM and C₆₀-bis) under 100 mW/cm² illumination, in which data are extracted from their *J-V* characteristics.

Table S2 Summary of performance metrics of the devices with 2mg/ml C₆₀-bis with different scan direction

	Voc (V)	Jsc (mA/cm ²)	FF (%)	PCE (%)
FS	1.06	19.8	71.1	14.95
RS	1.05	19.6	71.7	14.84