Supplementary Information

An easy method to modify PEDOT:PSS / perovskite interface for solar cells with efficiency exceeding 15%

S. Shahbazi,[a] F. Tajabadi,[b] H-S. Shiu,[c] R. Sedighi,[d] E. Jokar,[c] S. Gholipour,[e] S. Afshar,[a] E. W-G.Diau[c] and N.Taghavinia[d,f]

a. Department of Chemistry, Iran University of Science and Technology, Tehran 16846-13114, Iran. E-mail: sh_afshar@iust.ac.ir

b. Department of Nanotechnology and Advanced Materials, Materials and Energy Research Center, Karaj 3177983634, Iran, E-mail: f.tajabadi@merc.ac.ir

c. Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan. E-mail: diau@mail.nctu.edu.tw

d. Faculty of Physics and Chemistry, Alzahra University, Tehran, 1993893973, Iran

e,f Institute for Nanoscience and Nanotechnology and Physics Department, Sharif University of Technology, Tehran 14588-89694, Iran. E-mail:taghavinia@sharif.edu

Table S1. Photovoltaic performance under one-sun irradiation (AM 1.5G, power density 100 mW cm^{-2}) for perovskite solar cells with PA-treated PEDOT:PSS fabricated under the same experimental conditions, using a mask with active area 0.04 cm^2.

PA-Treated PEDOT:PSS			
Eff%	FF	V_{OC}	J_{SC}
13.47	82.28	0.85	19.24
13.42	82.67	0.849	19.12
13.47	80.31	0.892	18.81
13.38	80.73	0.887	18.67
14.23	82.9	0.883	19.43
14.1	83.3	0.878	19.28
15.06	78.95	0.877	21.75
13.9	83.4	0.854	19.7
13.67	82.6	0.847	19.53
13.37	80.9	0.868	19.05
13.86 ±0.55	81.90 ± 1.54	0.870±0.020	19.42 ± 0.70

Table S2. Photovoltaic performance under one-sun irradiation (AM 1.5G, power density 100 mW cm^{-2}) for perovskite solar cells with pristine PEDOT:PSS fabricated under the same experimental conditions, using a mask with active area 0.04 cm^2.

Pristine PEDOT:PSS			
Eff%	FF	V_{OC}	J_{SC}
13.24	75.82	0.84	20.78
12.79	73.32	0.827	21
11.48	66.71	0.833	20.65
12.53	70.59	0.82	21.6
13.37	75.25	0.842	21.09
12	74.75	0.862	18.6
12.84	73.93	0.83	20.9
12.83	76.46	0.867	19.36
12.77	76.41	0.865	19.31
12.29	74.37	0.863	19.15
12.61 ± 0.59	73.761±3.20	0.844+0.01	20.24±1.00

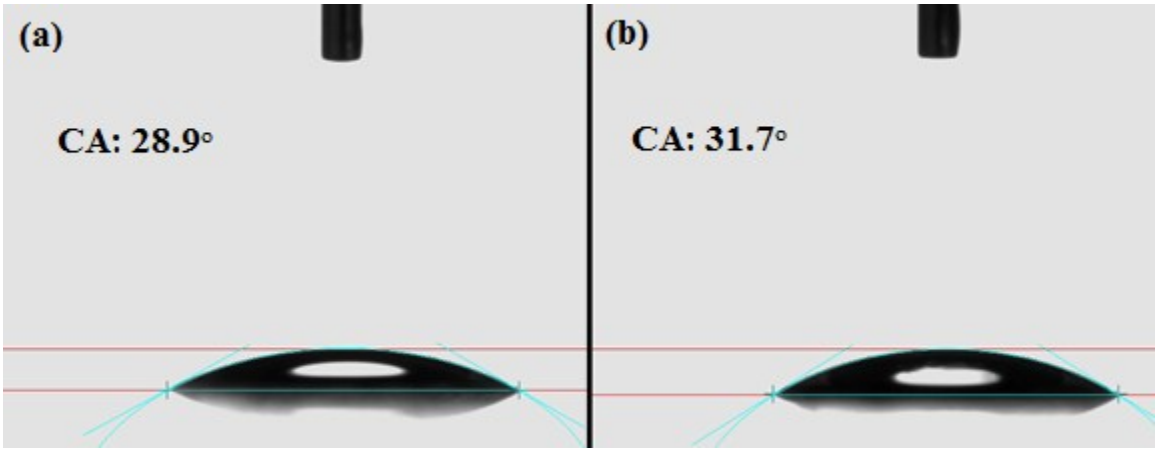


Fig. S1 Contact angles formed by DMF drops on PA- treated PEDOT:PSS (a) and pristine PEDOT:PSS (b) surfaces.

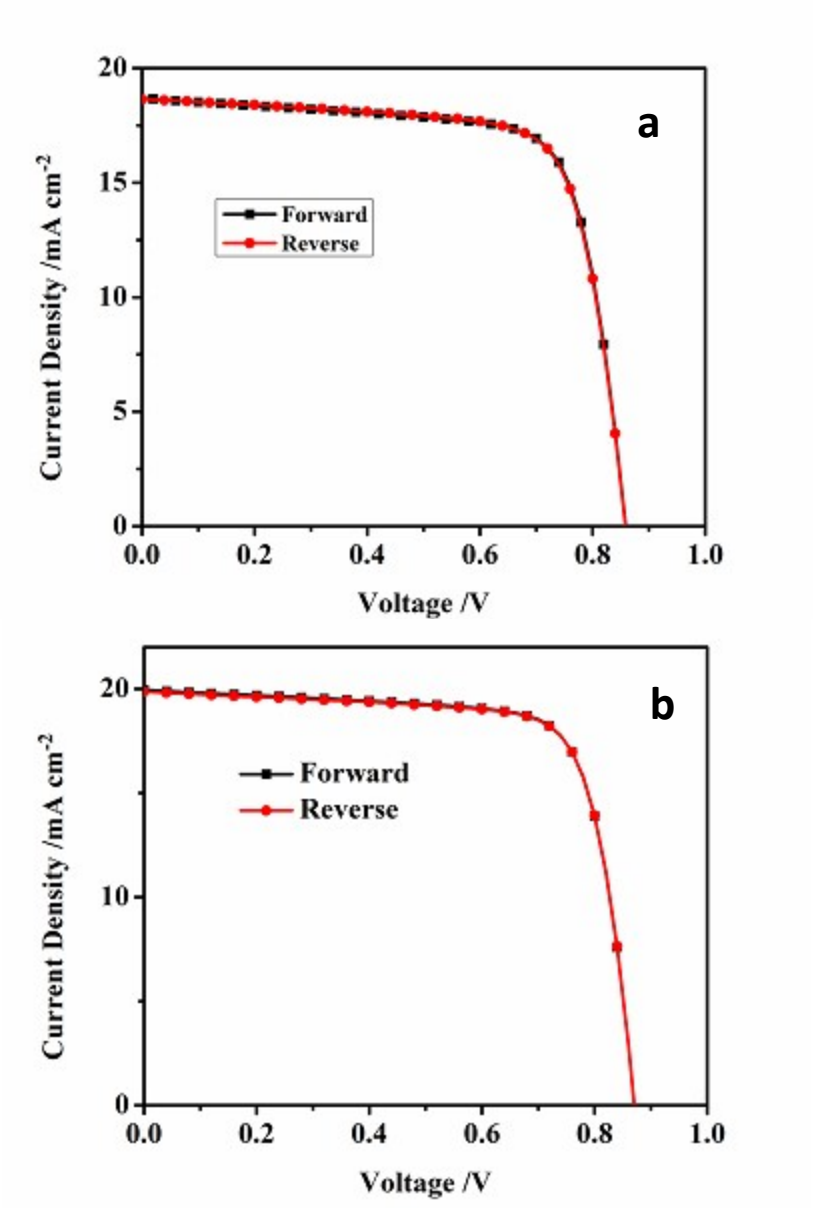


Fig. S2 (a) Forward and backward J-V cures for pristine PEDOT: PSS (b) and PA-treated PEDOT: PSS based device (b).

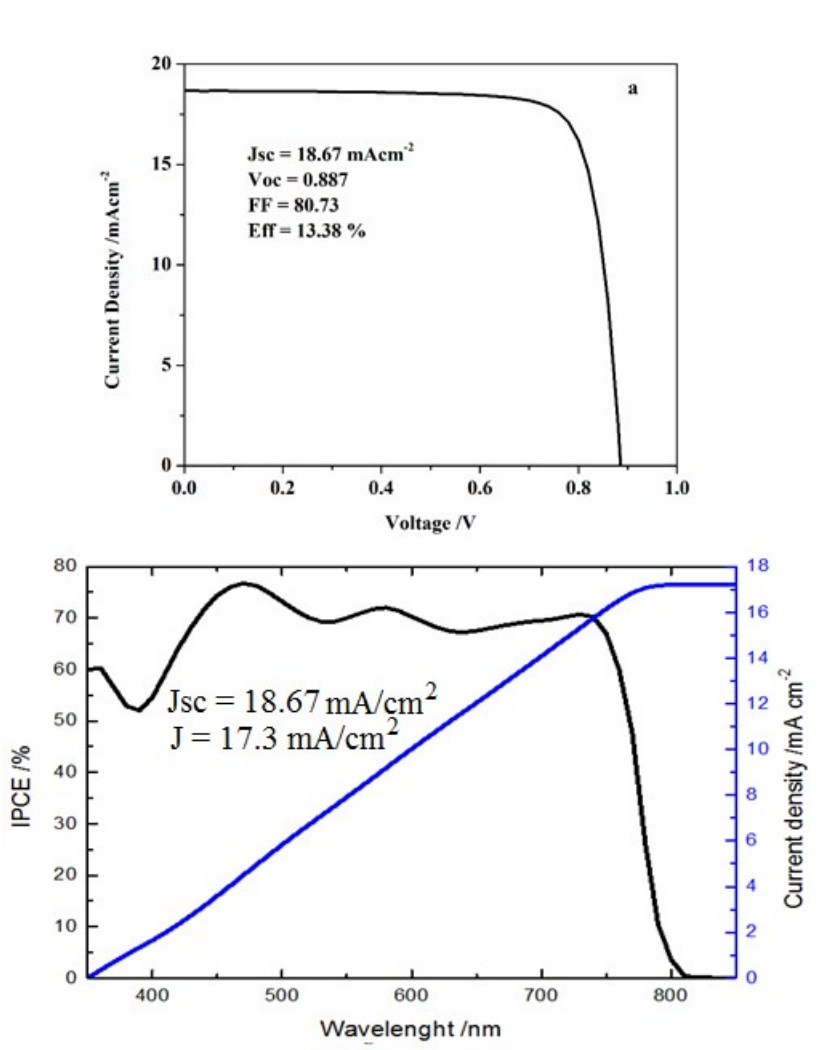


Fig. S3 Photovoltaic characteristic plots of (a) current-voltage curves and (b) IPCE action spectra for a typical device with PA-treated PEDOT:PSS.

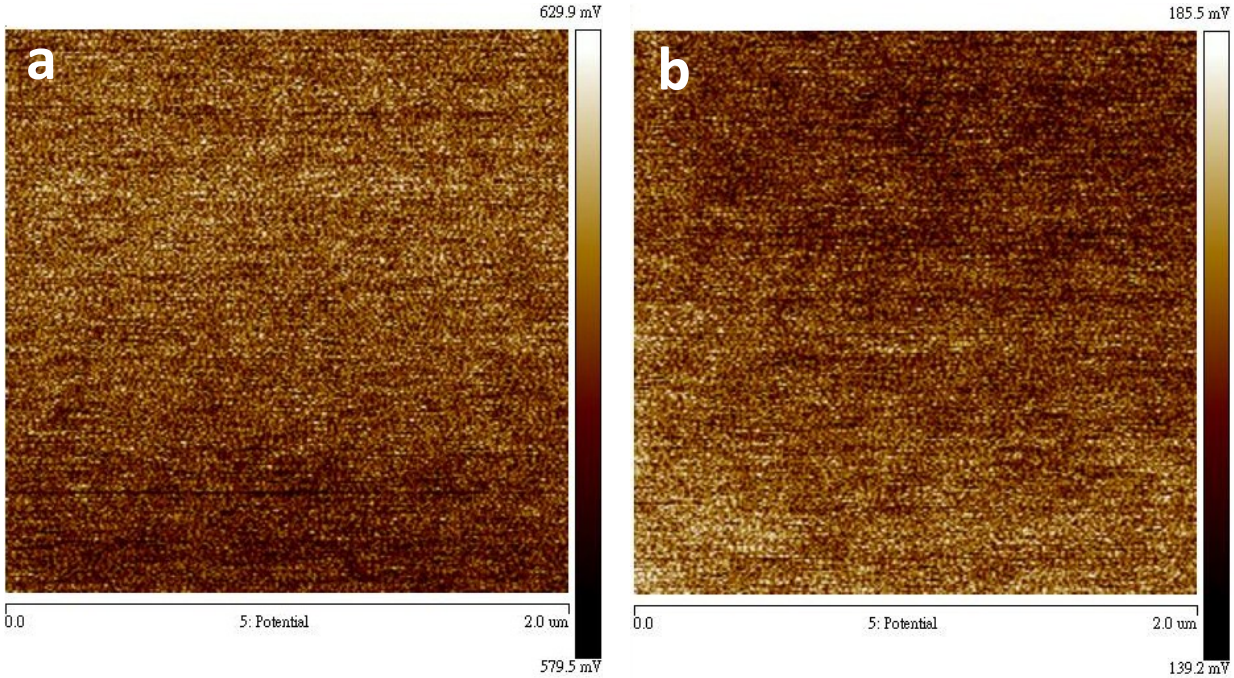


Fig. S4 Two dimensional surface potential map of (a) pristine PEDOT: PSS (Mean= 0.605 V) and (b) PA- treated PEDOT:PSS (Mean= 0.162 V) surface.

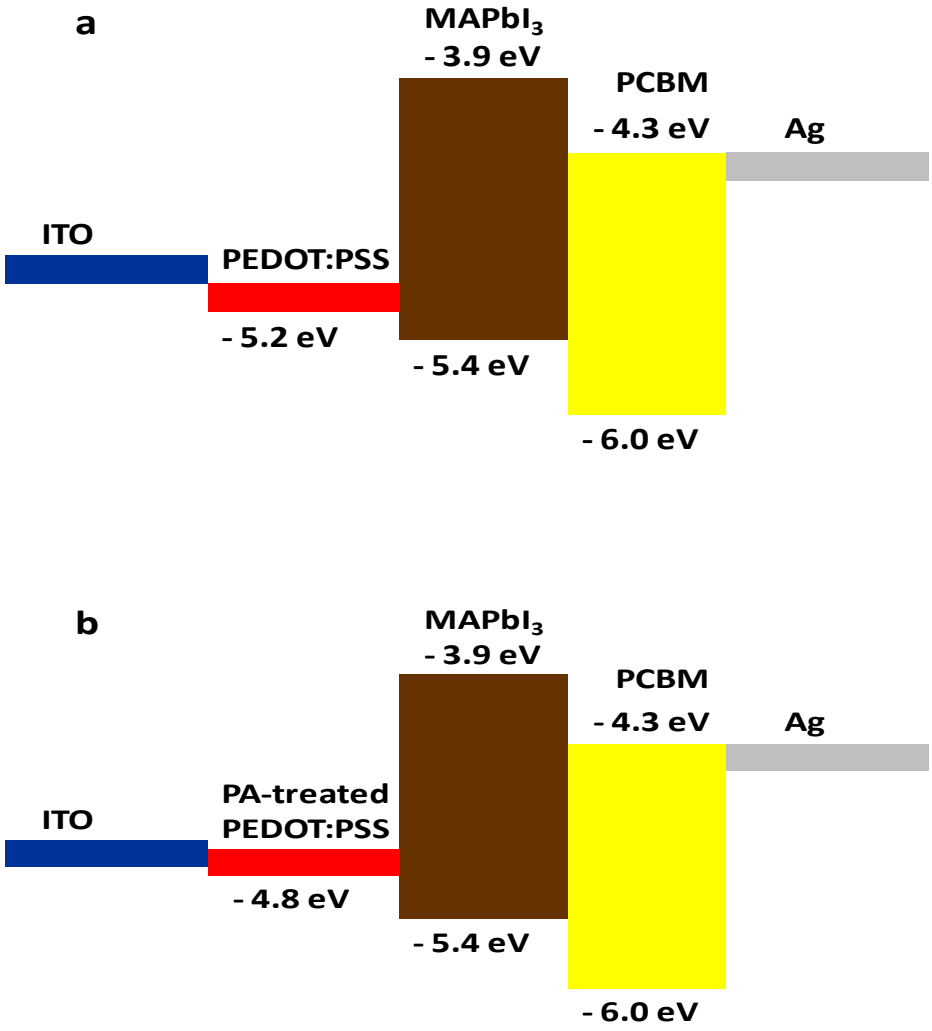
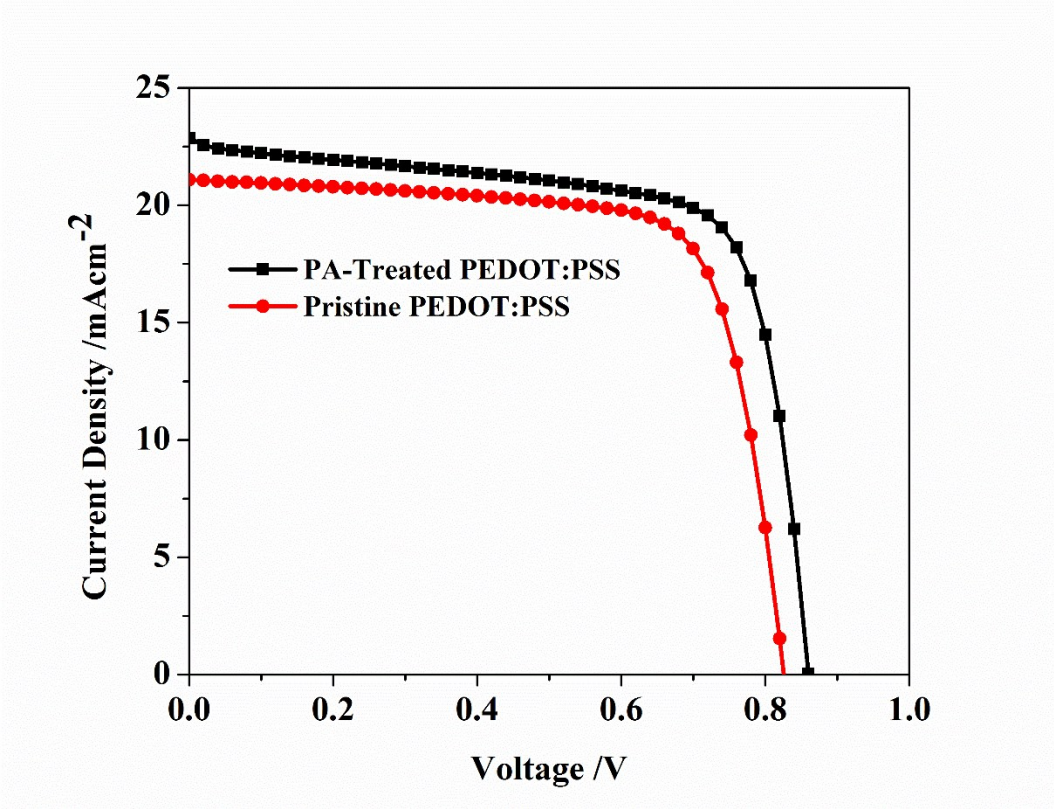


Fig. S5 The schematic of the energy level diagrams for perovskite solar cells with (a) pristine PEDOT:PSS and (b) PA-treated PEDOT:PSS .

Table S3 and Fig. S6. Photovoltaic performance under one-sun irradiation (AM 1.5G, power density 100 mW cm^{-2}) for perovskite solar cells with pristine PEDOT:PSS and PA-treated PEDOT:PSS fabricated under the same experimental conditions as in the text. The difference is using a mask with active area 0.06 cm^2.



	Eff(%)	FF	V_{OC} (V)	J_{SC} (mA/cm^2)	Active area (cm^2)
PA-Treated PEDOT:PSS	14.3	72.8	0.860	22.5	**0.06**
Pristine PEDOT:PSS	12.79	73	0.827	21	**0.06**

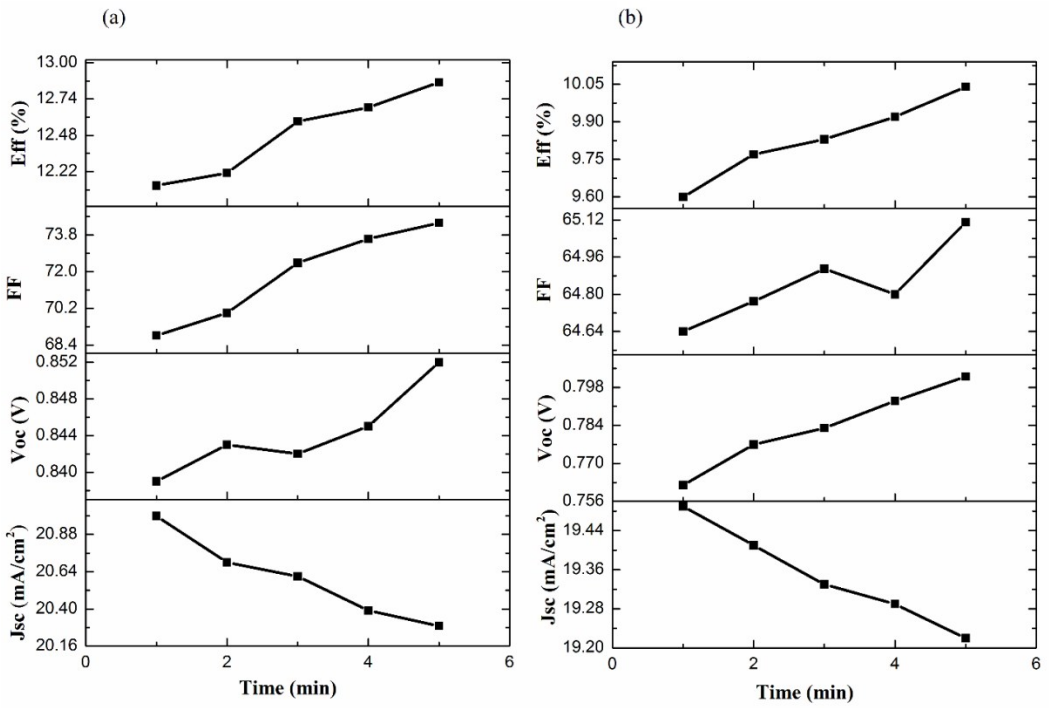


Fig. S7 Variations of device performance parameters measured under light soaking (full sun intensity) for perovskite solar cells with PA-treated PEDOT:PSS (a) and pristine PEDOT:PSS (b).