Supplementary Information

Covalent Organic Nanosheets for the Effective Charge Transport Layer in Planar-type Perovskite Solar Cells

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Keywords: Covalent organic framework, Covalent organic nanosheet, Perovskite layer, Hybrid solar cell, Charge transport layer

Table S1. Average photovoltaic parameters of PSCs fabricated with and without CON-10, respectively. (The parameters represent the standard deviation based on 7 devices per condition).

Average	V_{OC} [V]	J_{SC} [mA/cm^2]	FF [%]	PCE [%]
PEDOT:PSS	0.97	15.10	0.61	8.91
PEDOT:PSS/CON-10	0.95	16.54	0.64	10.10

Table S2. *J-V* curves of PSCs devices fabricated with CON-10 and TiO_x electron transport layer.

Hole transport layer	V_{OC} [V]	J_{SC} [mA/cm^2]	FF [%]	PCE [%]
CON-10/PEDOT:PSS with TiOx	0.98	14.76	74	10.72

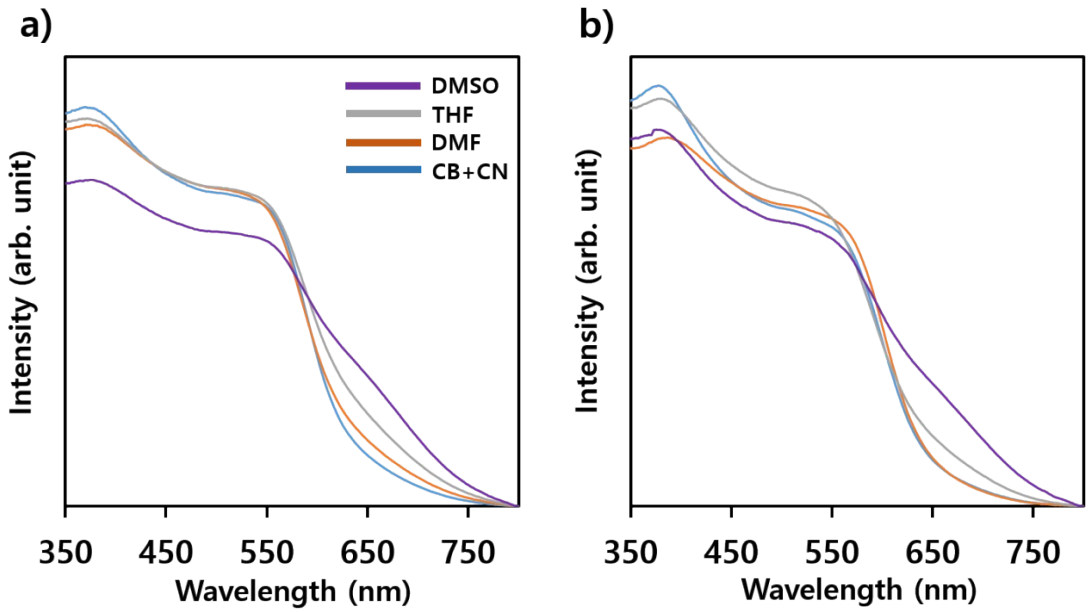

Figure S1. The UV-Vis absorbance spectra of CON-10 (a) and CON-16 (b) in film states casted from various solvents.

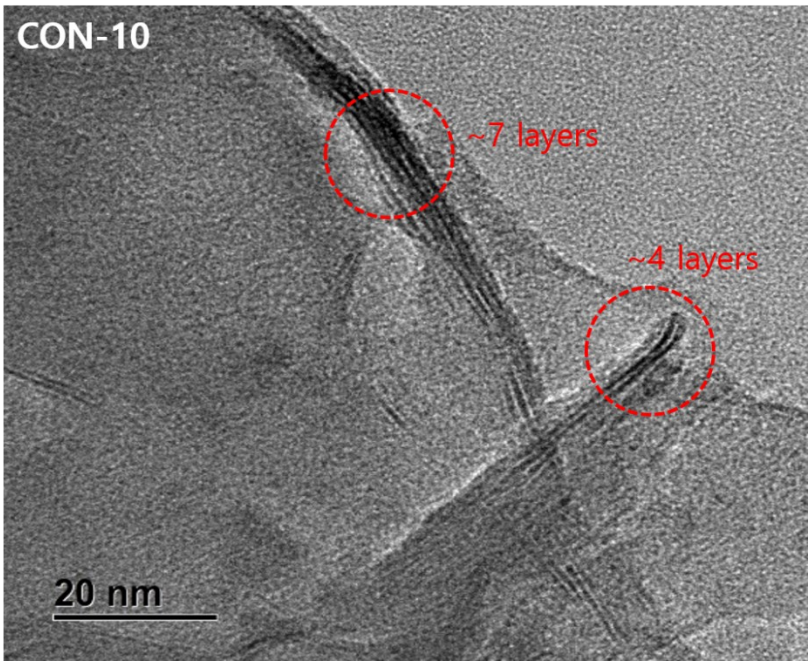

Figure S2. The TEM image representing the layer thickness (the circled area with red dashed line) of the primary particles of CON-10

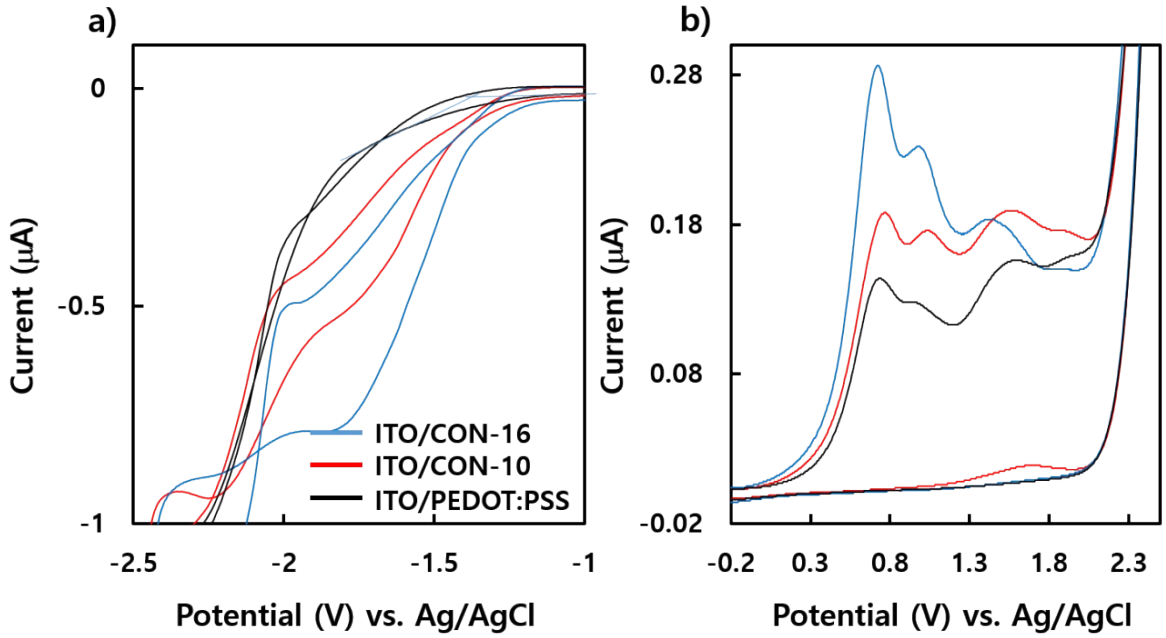

Figure S3. Cyclicvoltammetry profiles of CON-16 (blue), CON-10 (red) and PEDOT:PSS (black) on ITO with respect to a Ag/AgCl reference electrode in degassed anhydrous DMSO; (a) reduction potential onset region and (b) oxidation potential onset region (b).

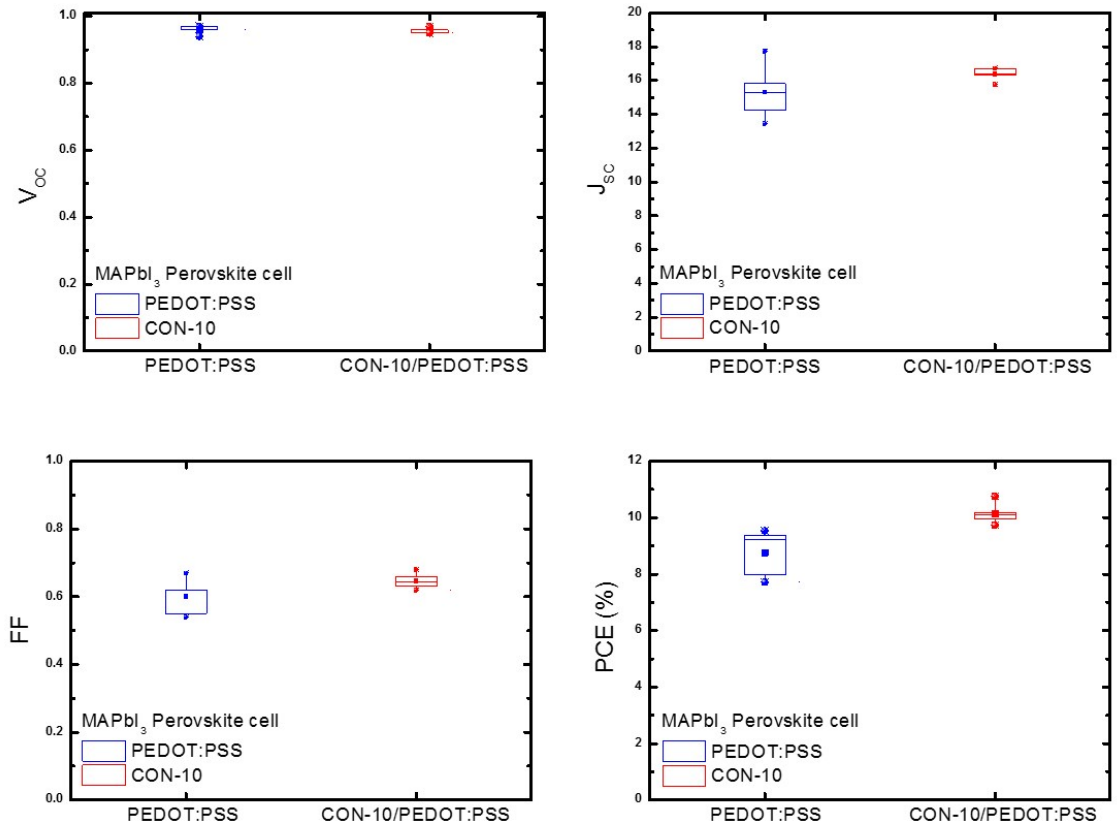

Figure S4. Photovoltaic parameters of PSCs fabricated with and without CON-10. (Error deviations represent the standard deviation based on 7 devices per condition).

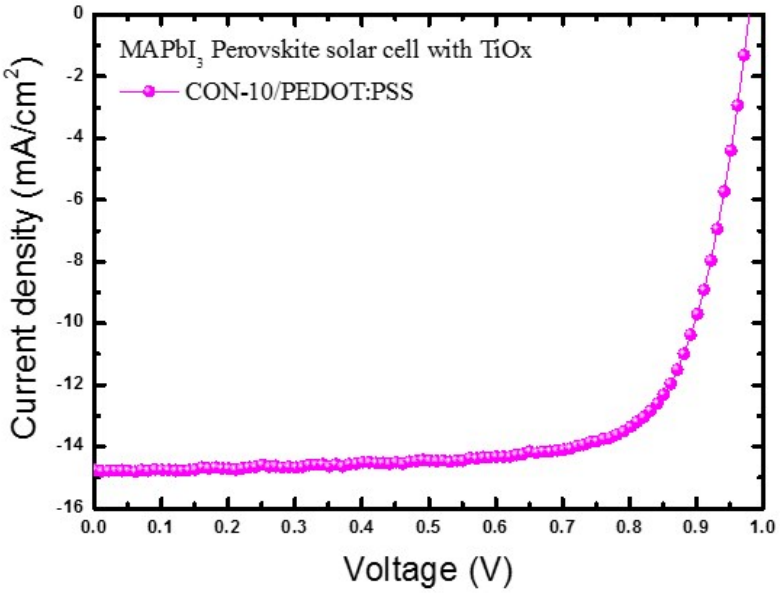

Figure S5. *J*−*V* characteristics of PSCs fabricated with and without CON-10 and TiO_x electron transport layer.