

Supporting Information

Nontoxic $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$ Perovskite Solar Cells Free of Hole Conductors with an Alternative Architectural Design and a Solution-Processable Approach

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Figure S1

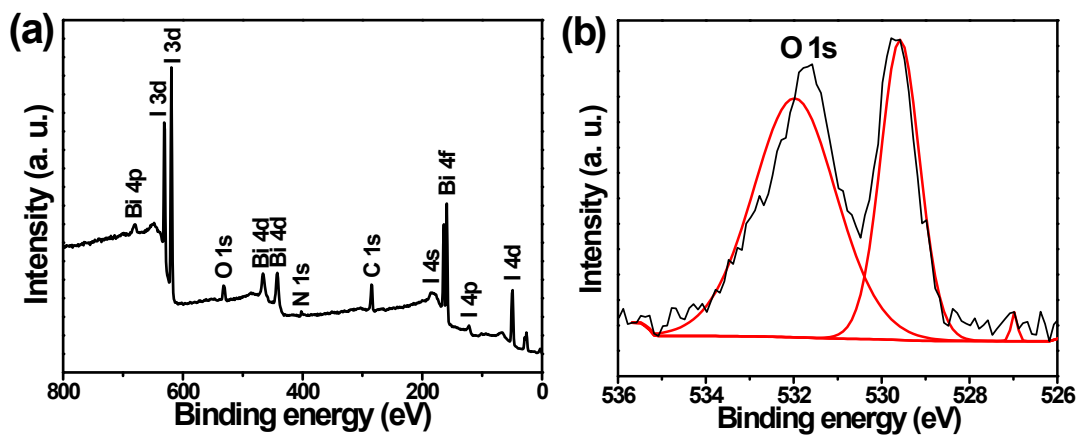


Fig. S1 XPS spectrum of MBI monocystal powder: (a) survey-scan spectrum and (b) the highresolution spectra O 1s.

Figure S2

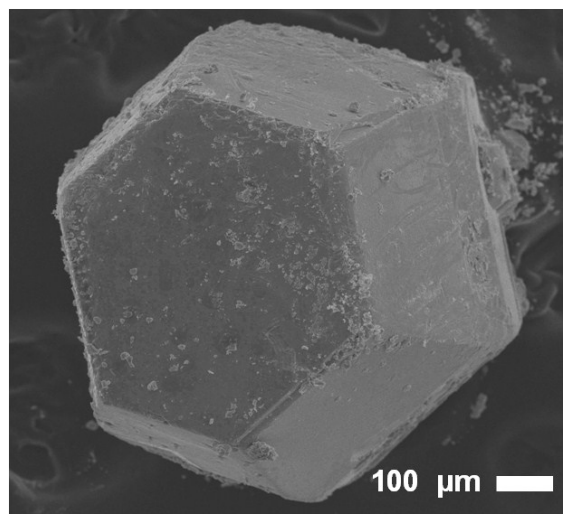


Fig. S2 The low resolution SEM image of single crystals of MBI.

Figure S3

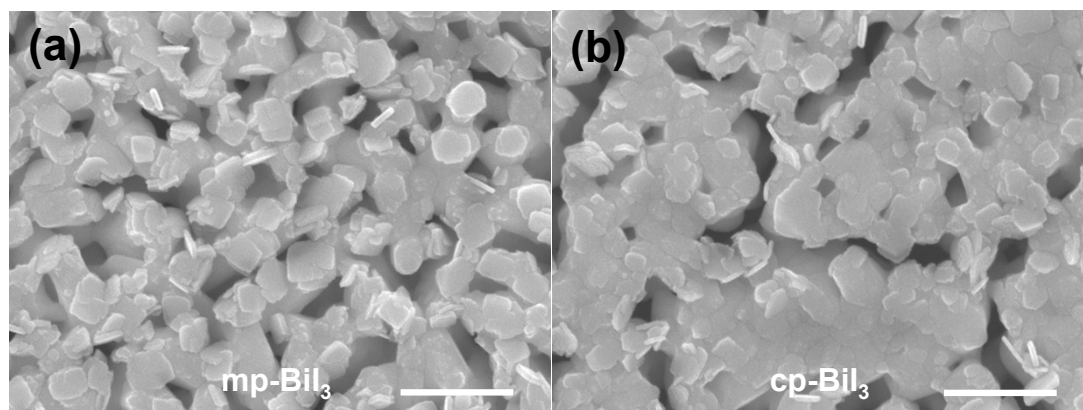


Fig. S3 SEM image of mp-Bil₃ and cp-Bil₃ layers, the scale bars on the images are 500 nm.

Figure S4

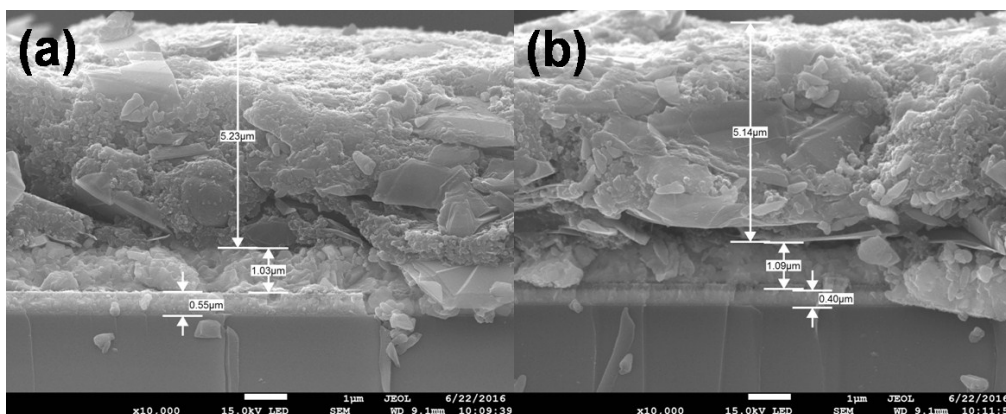


Fig. S4 Cross-sectional FE-SEM image of the overall planar (a) and mesoporous (b) devices, both of the scale bars on the images are 1 μm.

Figure S5

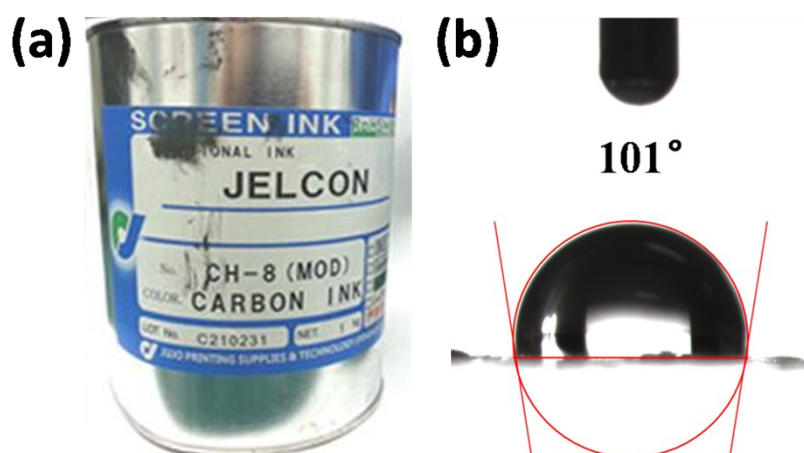


Fig. S5 (a) Image of carbon conductive paste. (b) Contact angles for H₂O on carbon surfaces in a full cell.

Table S1 The composition of the carbon paste.

Composition	Percentage (%)	Chemical formula
Pigment (black carbon)	15–25 (1–10)	–
Synthetic resin	10–20	–
Diethylene glycol monoethyl ether acetate	45–55	$C_8H_{16}O_4$
Aromatic hydrocarbon (naphtha)	10–20	C12–C13 (majority of alkyl benzene)

Table S2 Summarized average and standard deviation values for 7 devices based on different devices architecture and MBI-fabricated method under simulated AM 1.5G (100 mW cm⁻² irradiance).

samples	V_{oc} (mV)	J_{sc} (mA cm ⁻²)	FF (%)	PCE (%)
1-mp	830 ± 54	0.253 ± 0.024	23.4 ± 1.6	0.049 ± 0.003
1-cp	721 ± 24	0.223 ± 0.014	22.2 ± 1.1	0.034 ± 0.004
2-mp	709 ± 10	0.277 ± 0.022	22.9 ± 1.7	0.045 ± 0.004
2-cp	490 ± 36	0.132 ± 0.012	26.2 ± 1.2	0.015 ± 0.001