Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Supporting Information

Low-cost and high-performance selenium indoor photovoltaics

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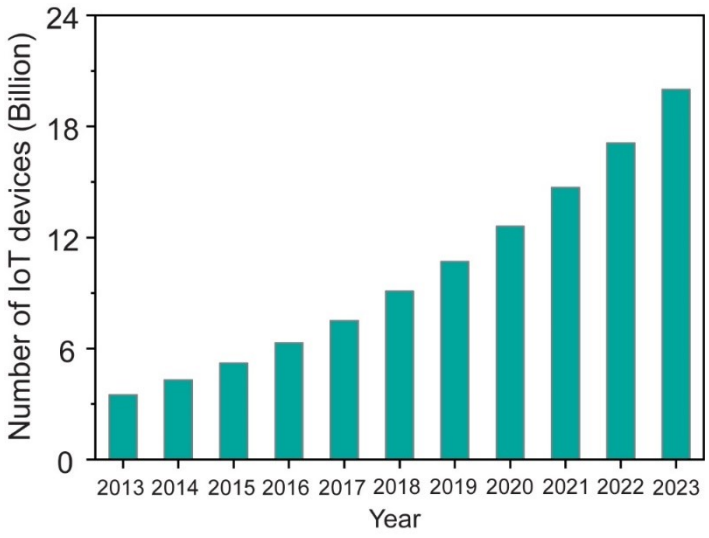

Fig. S1. Number of IoT device connections.[1]

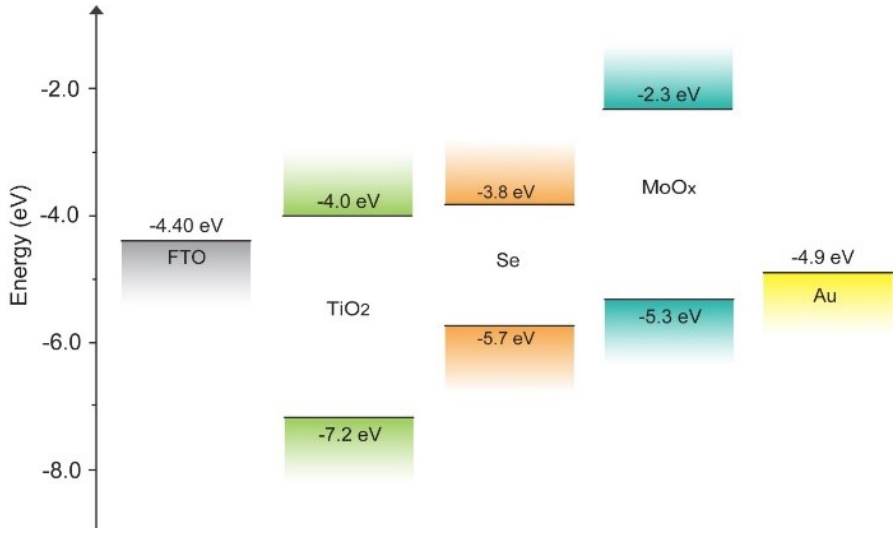

Fig. S2. The schematic energy level diagram of the Se solar cell device.[2,3]

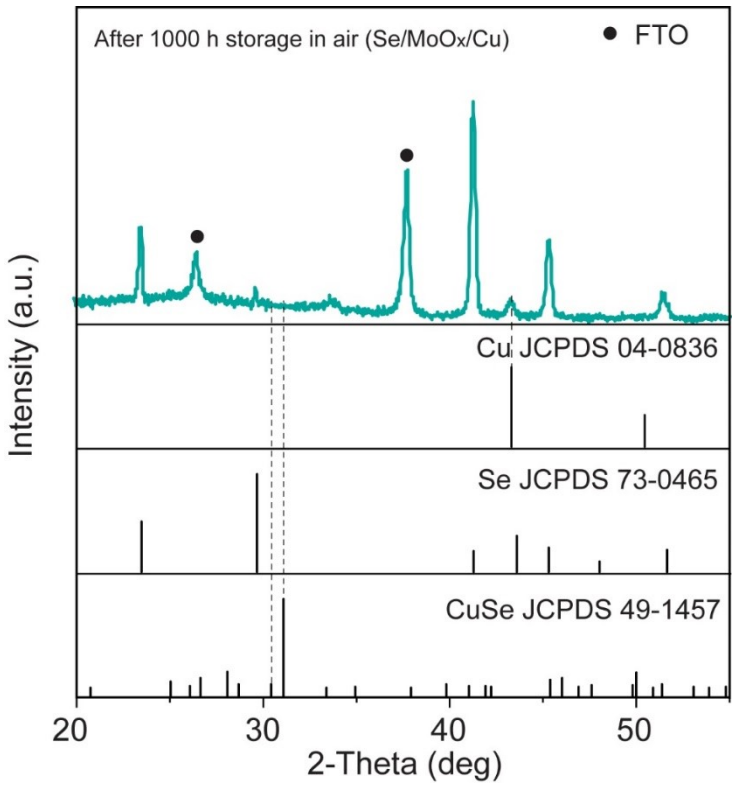

Fig. S3. XRD pattern of Se/MoO_x/Cu device stored in ambient atmosphere at room temperature for 1000 h.

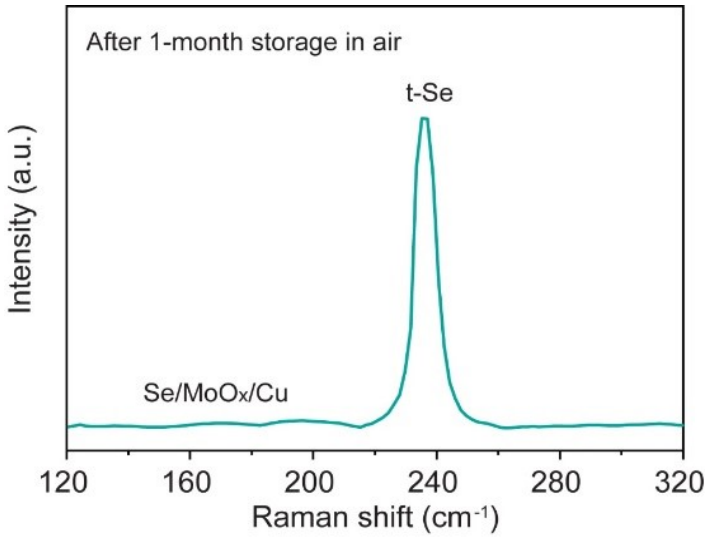

Fig. S4. Raman spectrum of Se/MoO_x/Cu device after 1-month storage in air.

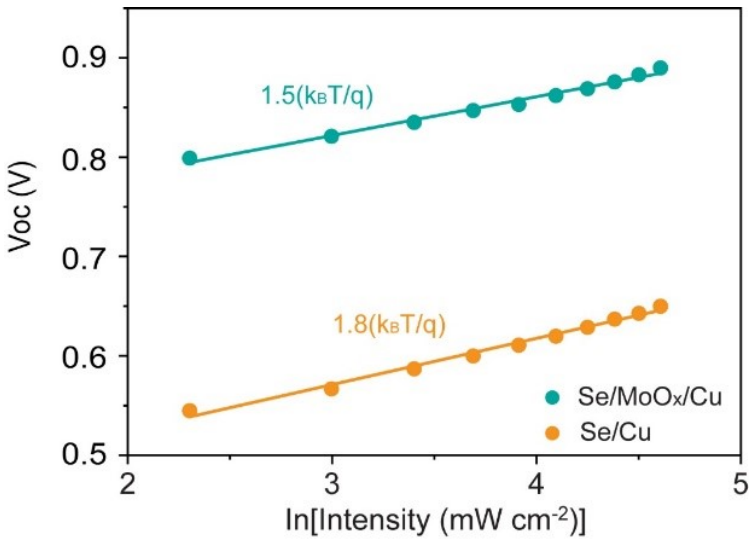

Fig. S5. V_{oc}-light intensity dependence of Se/Cu and Se/MoO_x/Cu devices.

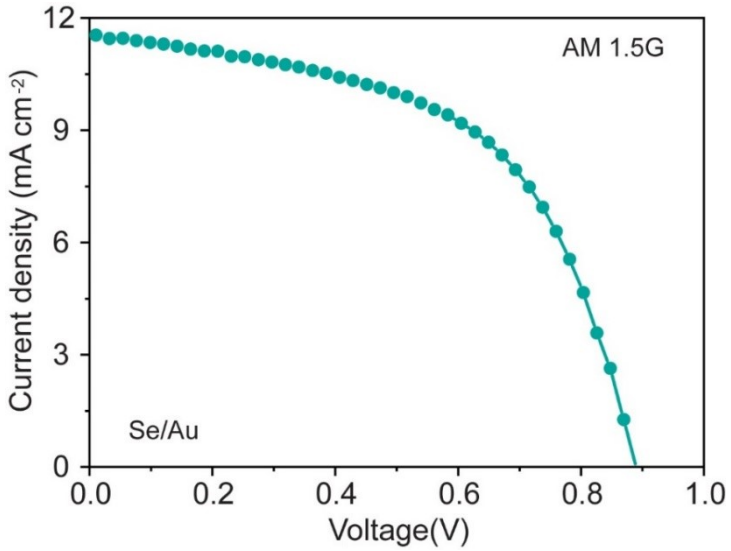

Fig. S6. J-V curve of Se/Au device under standard one-sun illumination (100 mW cm^{-2}).

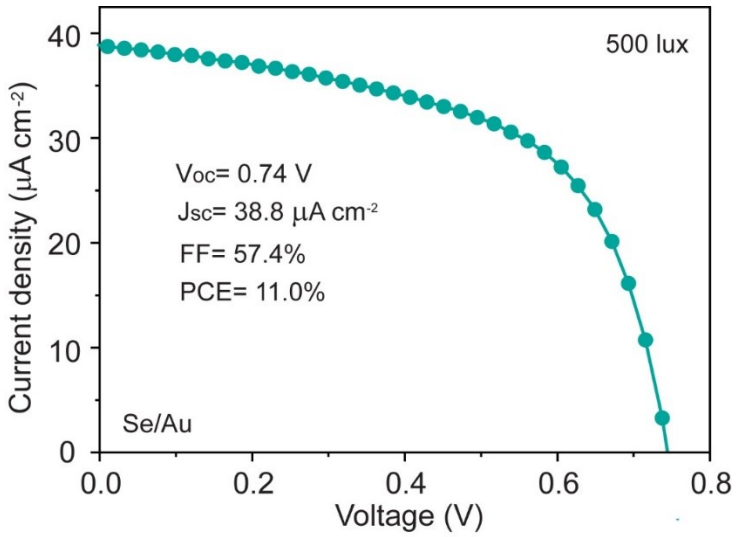

Fig. S7. J-V curve of Se/Au device under indoor illumination at 500 lux.

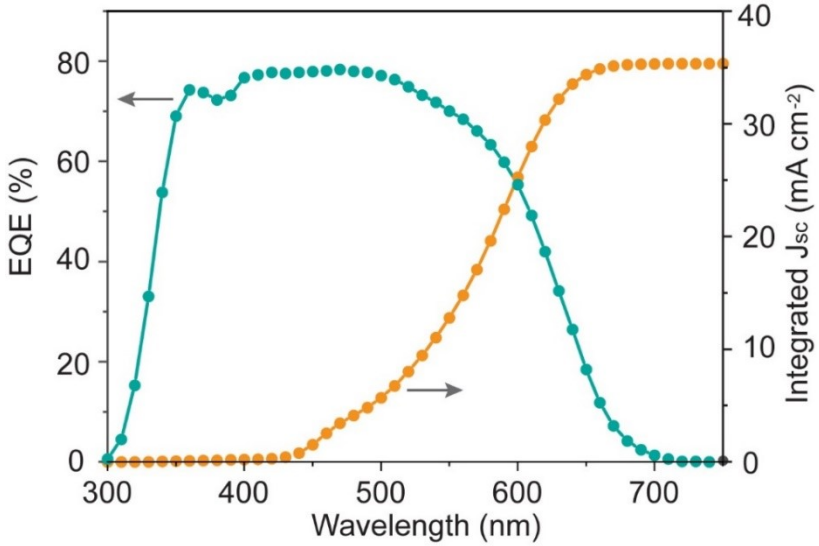

Fig. S8. EQE spectra of Se/MoO_x/Cu device and integrated current density of the device under indoor illumination at 500 lux.

Table S1. Materials cost of Se photovoltaic devices.[4,16-19]

Component	Raw material	Price ($/kg)	Weight (g/m^{-2})	Material cost ($/$m^{-2}$)
Front glass	3 mm glass (with AR)	1.25	8000	10.00
FTO	FTO	330	3.48	1.15
TiO_2	Titanium diisopropoxide bis(acetylacetonate) (75 wt. % in isopropanol)	70	50	3.50
Se	Se	33	9.62	0.32
Au	Au	63400	1.55	98.30
Ag	Ag	798	0.84	0.67
Cu	Cu	9.6	0.72	0.007
MoO_x	MoO_x	24	0.07	0.002

Table S2. Summary of photovoltaic parameters of Se/MoO_x/Cu devices with different thicknesses of MoO_x.

Thickness	Voc (V)	Jsc (mA cm^{-2})	FF (%)	PCE (%)
5 nm	0.84	11.0	51.7	4.8
10 nm	0.87	11.2	54.0	5.3
15 nm	0.89	11.4	53.6	5.4
20 nm	0.86	11.1	53.9	5.1
30 nm	0.85	10.9	51.8	4.8

Table S3. Summary of photovoltaic parameters of Se devices with and without a MoO_x layer of 15 nm.

devices	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF (%)	PCE (%)
Se/Au	0.89	11.5	55.0	5.6
Se/MoO_x/Au	0.90	11.9	54.1	5.8
Se/Cu	0.65	10.1	48.4	3.2
Se/MoO_x/Cu	0.89	11.4	53.6	5.4

Table S4. Materials and incident light source dependent performance of IPV devices.

Active Material	Light Source	Luminance (Lux)	PCE (%)
a-Si	LED	500	9.6[5]
CIGS	Halogen	500	10.2[6]
GaAs	LED	580	19.4[7]
DSC	LED	1000	28.9[8]
$CH_3NH_3PbI_3$	FL	1000	35.2[9]
$(CsFAMA)Pb(I_{1-x}Br_x)_3$	LED	1000	40.2[10]
$Cs_3Sb_2I_9$	LED	1000	9.2[11]
$Cs_3Sb_2Cl_xI_{9-x}$	FL	1000	4.9[12]
TPD-3F-51K:IT-4F	FL	1000	21.8[13]
P3HT:ICBA	LED	500	13.4[14]
BDT-2T-ID:PNP	LED	200	16.0[15]
Se(Au)	LED	500	11.0
Se(Cu)	LED	500	10.4

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