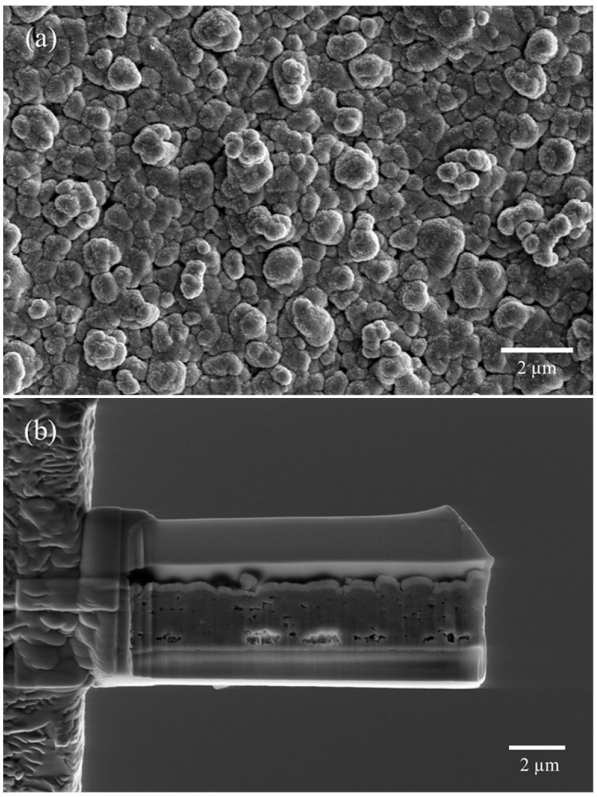

Figure S1. SEM images of SLG/FTO/CIGS/CdS/i-ZnO/AZO PV cell: (**a**) top surface and (**b**) FIB lamella preparation for cross-sectional imaging.

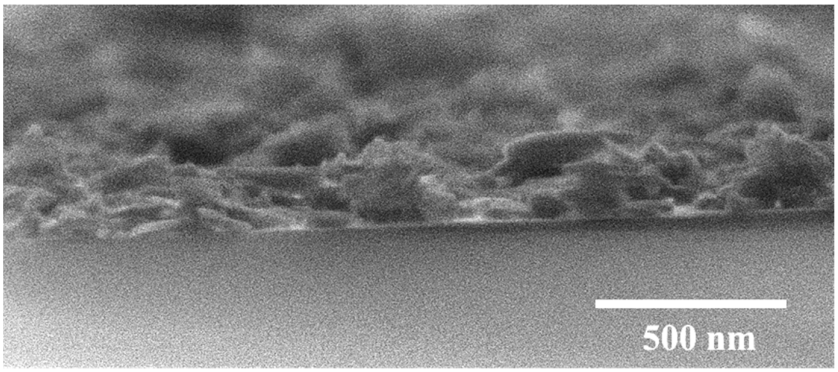

Figure S2. Cross-sectional image of spray-coated i-ZnO layer.

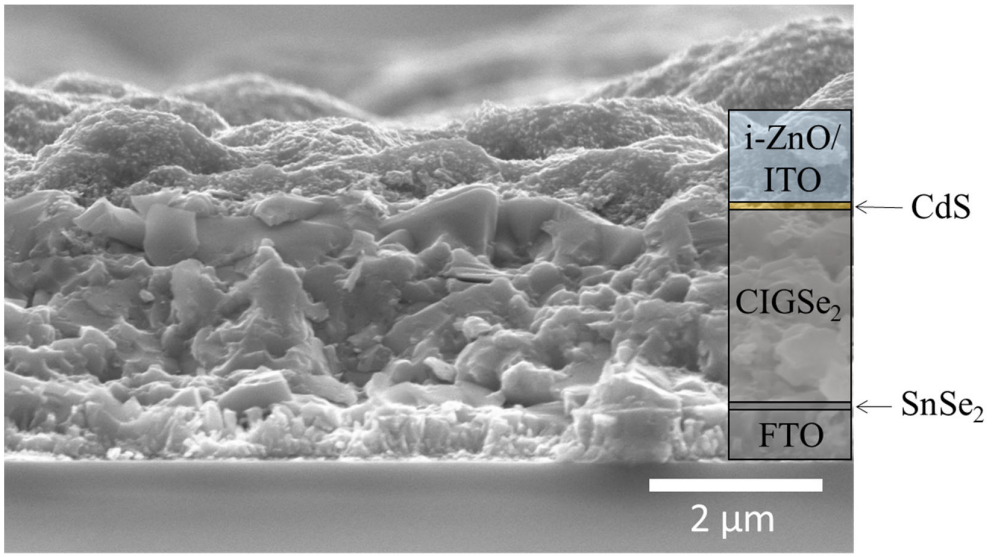

Figure S3. Cross-sectional SEM imaging of the all-non-vacuum processed CIGS PV cell.

Table S1. Photovoltaic parameters of PV cells fabricated from screen-printed photoabsorber layer and sputtered i-ZnO and AZO layers.

PV cell	Efficiency (%)	FF (%)	J_{SC} (mA cm^{-2})	V_{OC} (V)
1	4.9	39.2	36.0	0.33
2	3.6	52.1	18.4	0.36
3	3.6	50.8	19.7	0.34
4	6.6	50.2	36.7	0.34
5	4.3	49.5	24.0	0.35
6	4.5	44.5	28.6	0.34
7	4.8	37.8	36.5	0.33
8	3.8	39.2	28.5	0.33
9	4.1	34.0	33.8	0.34
10	4.6	35.3	36.6	0.34
Average	4.5	43.3	29.9	0.34
Standard Deviation	0.9	7.0	7.2	0.01

Table S2. Photovoltaic parameters of the PV cells fabricated by screen-printing of photoabsorber layer, spray-coated i-ZnO, and sputtered ITO layer.

PV cell	Efficiency (%)	FF (%)	J_{SC} (mA cm^{-2})	V_{OC} (V)
1	5.6	69.0	20.3	0.39
2	4.2	62.3	17.5	0.38
3	5.3	56.7	24.5	0.37
4	5.5	57.2	23.9	0.39
5	4.1	61.9	16.7	0.39
6	4.5	54.6	20.6	0.39
7	4.3	52.3	20.4	0.39
8	4.5	56.5	20.3	0.38
9	4.3	50.9	20.6	0.40
10	4.5	55.0	20.0	0.39
Average	4.7	57.6	20.5	0.39
Standard Deviation	0.6	5.4	2.4	0.01

Table S3. Photovoltaic parameters of PV cells fabricated by screen-printing of photoabsorber layer, and spray-coated i-ZnO and ITO layers.

PV cell	Efficiency (%)	FF (%)	J_{SC} (mA cm^{-2})	V_{OC} (V)
1	1.6	71.9	6.6	0.34
2	1.5	78.1	5.2	0.36
3	1.4	76.8	5.2	0.33
4	1.4	77.8	5.0	0.36
5	1.6	79.9	5.3	0.36
6	1.7	70.6	7.2	0.32
7	1.5	72.5	6.6	0.31
8	1.7	71.4	7.4	0.31
9	1.8	73.8	7.6	0.32
10	2.2	67.5	9.4	0.34
Average	1.6	74.0	6.6	0.34
Standard Deviation	0.2	4.0	1.4	0.02