Electronic supplementary information

Magnetron sputtered Cu doped SnS thin films for improved photoelectrochemical and heterojunction solar cells

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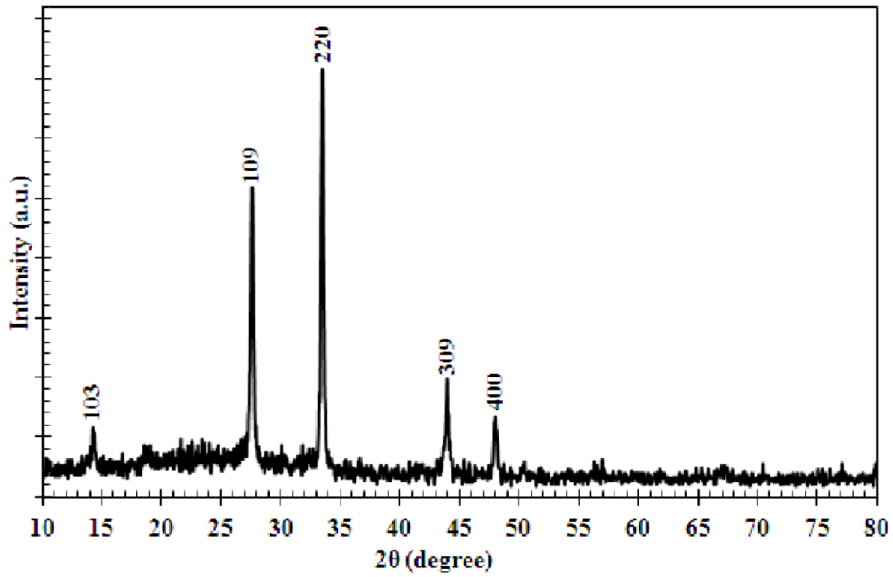


Fig. S1: The XRD spectra of In_2S_3 revealed a tetragonal unit cell crystallized in I41 symmetry (JCPDS: 73-1366). The estimated lattice constants are *a*=4.63 Å**,** *b*=4.63 Å**,** *c*=32.07 Å with the crystallite size of 37 nm.

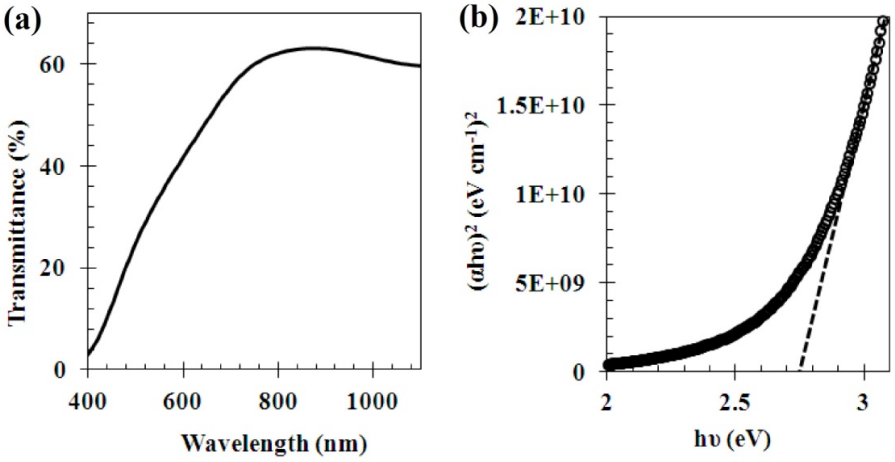
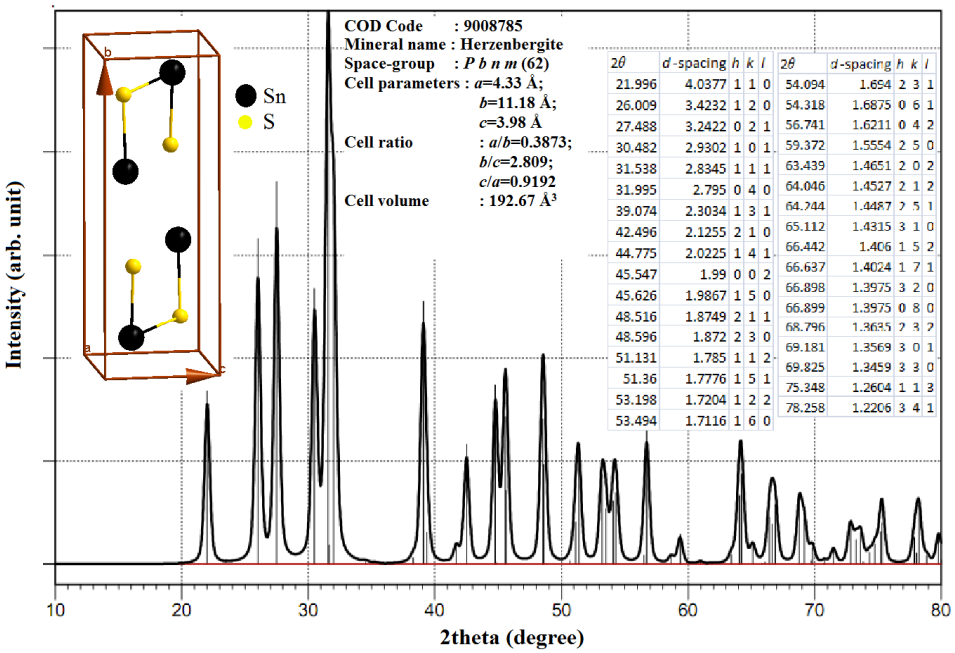


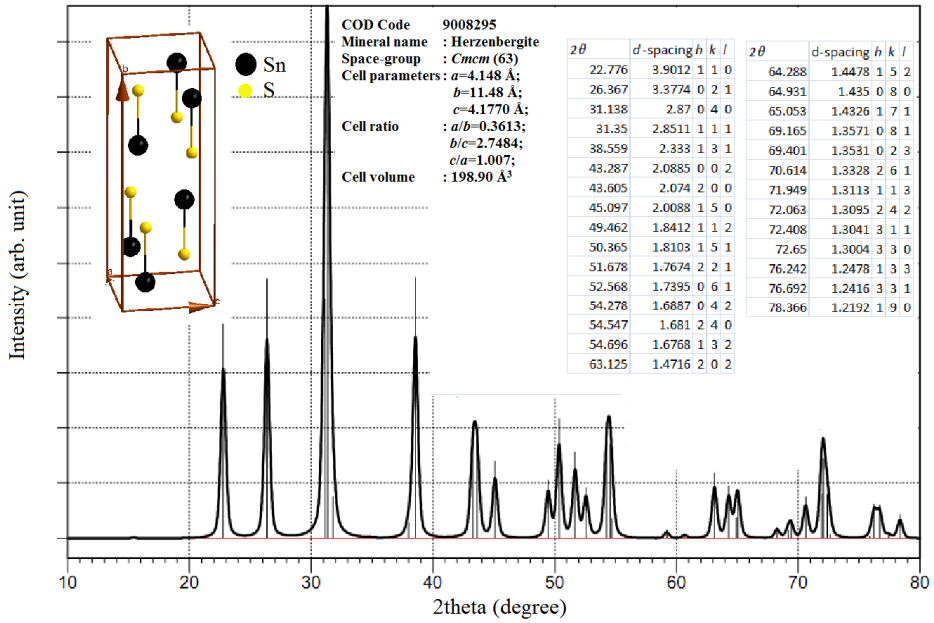
Fig. S2: Optical characterization of sprayed In_2S_3 thin film on glass substrate (a) transmittance and (b) TauC plot. The direct optical band gap of 2.75 eV was estimated from TauC plot.



2θ	d-spacing	h	k	l
21.996	4.0377	1	1	0
26.009	3.4232	1	2	0
27.488	3.2422	0	2	1
30.482	2.9302	1	0	1
31.538	2.8345	1	1	1
31.995	2.795	0	4	0
39.074	2.3034	1	3	1
42.496	2.1255	2	1	0
44.775	2.0225	1	4	1
45.547	1.99	0	0	2
45.626	1.9867	1	5	0
48.516	1.8749	2	1	1
48.596	1.872	2	3	0
51.131	1.785	1	1	2
51.36	1.7776	1	5	1
53.198	1.7204	1	2	2
53.494	1.7116	1	6	0

2θ	d-spacing	h	k	l
54.094	1.694	2	3	1
54.318	1.6875	0	6	1
56.741	1.6211	0	4	2
59.372	1.5554	2	5	0
63.439	1.4651	2	0	2
64.046	1.4527	2	1	2
64.744	1.4487	2	5	1
65.112	1.4315	3	1	0
66.442	1.406	1	5	2
66.637	1.4024	1	7	1
66.898	1.3975	3	2	0
66.899	1.3975	0	8	0
68.796	1.3635	2	3	2
69.181	1.3569	3	0	1
69.825	1.3459	3	3	0
75.348	1.2604	1	1	3
78.258	1.2206	3	4	1

Fig. S3: XRD spectra of SnS material. It is generated by Pseudo-Voigt function for the SnS crystal structure of COD code 96-900-8285. The unit cell, lattice parameters and table of reflection are shown as insets.



2θ	d-spacing	h	k	l
22.776	3.9012	1	1	0
26.367	3.3774	0	2	1
31.138	2.87	0	4	0
31.35	2.8511	1	1	1
38.559	2.333	1	3	1
43.287	2.0885	0	0	2
43.605	2.074	2	0	0
45.097	2.0088	1	5	0
49.462	1.8412	1	1	2
50.365	1.8103	1	5	1
51.678	1.7674	2	2	1
52.568	1.7395	0	6	1
54.278	1.6887	0	4	2
54.547	1.681	2	4	0
54.696	1.6768	1	3	2
63.125	1.4716	2	0	2

2θ	d-spacing	h	k	l
64.288	1.4478	1	5	2
64.931	1.435	0	8	0
65.053	1.4326	1	7	1
69.165	1.3571	0	8	1
69.401	1.3531	0	2	3
70.614	1.3328	2	6	1
71.949	1.3113	1	1	3
72.063	1.3095	2	4	2
72.408	1.3041	3	1	1
72.65	1.3004	3	3	0
76.242	1.2478	1	3	3
76.692	1.2416	3	3	1
78.366	1.2192	1	9	0

Fig. S4: XRD spectra of SnS material. It is generated by Pseudo-Voigt function for the SnS crystal structure of COD code 96-900-8295. The unit cell, lattice parameters and table of reflection are shown as insets.

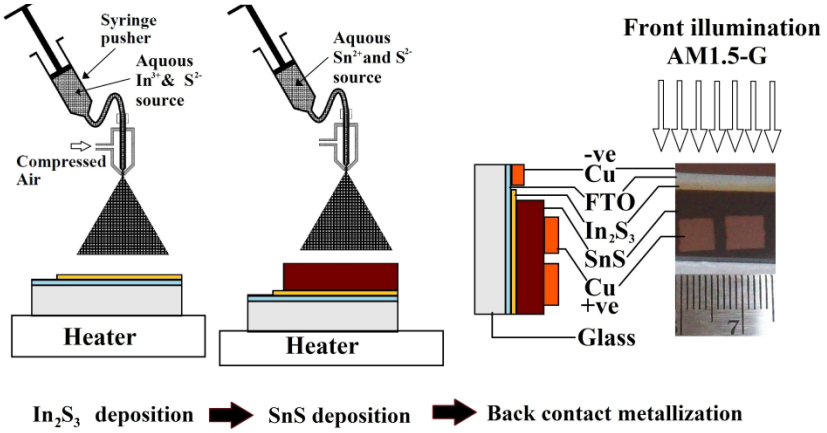


Fig. S5: Device fabrication scheme. The Superstrate configured SnS thin film solar cell was fabricated by inline approach. The Cu back contact was deposited at room temperature by thermal evaporation.

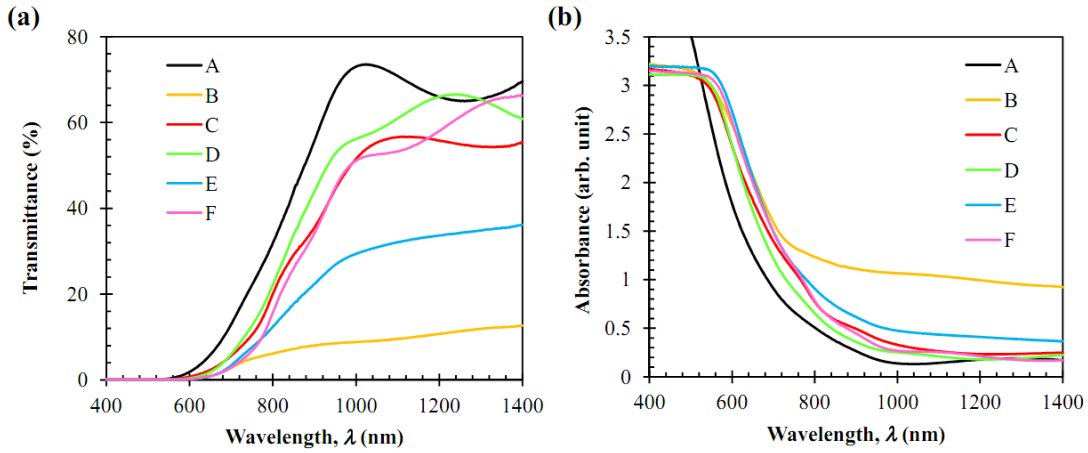


Fig. S6: Optical characterization of as sprayed and Cu doped SnS thin film on glass substrate (a) transmittance and (b) absorbance spectra.

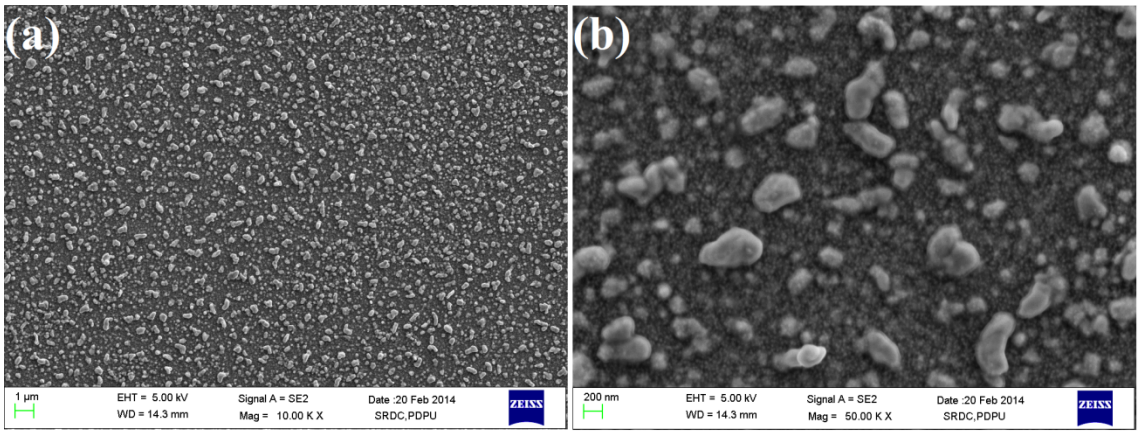


Fig. S7: The field enhanced scanning electron micrograph of Cu deposited on glass substrate by pulsed DC magnetron sputtering, at a magnification of (a) 10 kX and (b) 50 kX.

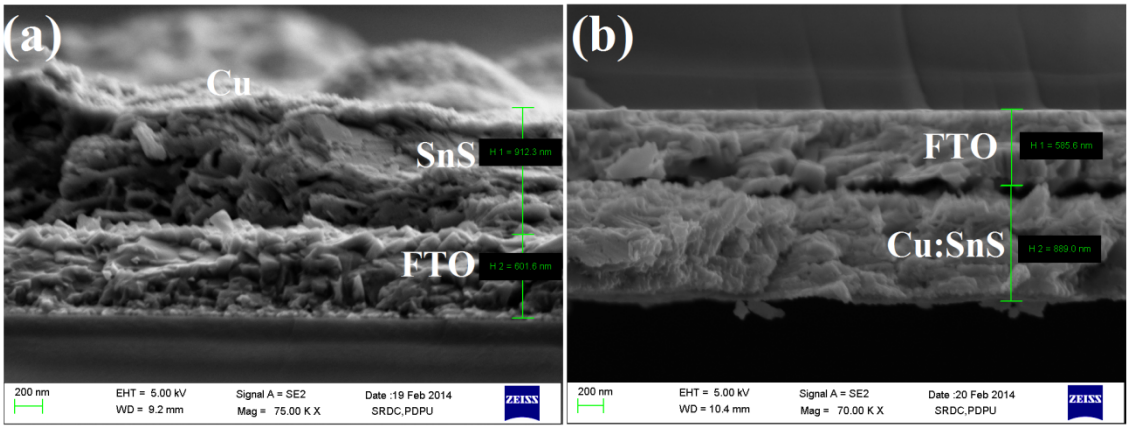


Fig. S8: The field enhanced scanning electron micrograph of cross section of as Cu deposited on the SnS layer on the FTO coated glass substrate (a) before and (b) after Cu diffusion.