

Supporting Information

Solid State Dye-Sensitized Solar Cells Based on $Zn_{1-x}Sn_xO$ Nanocomposite

Photoanodes

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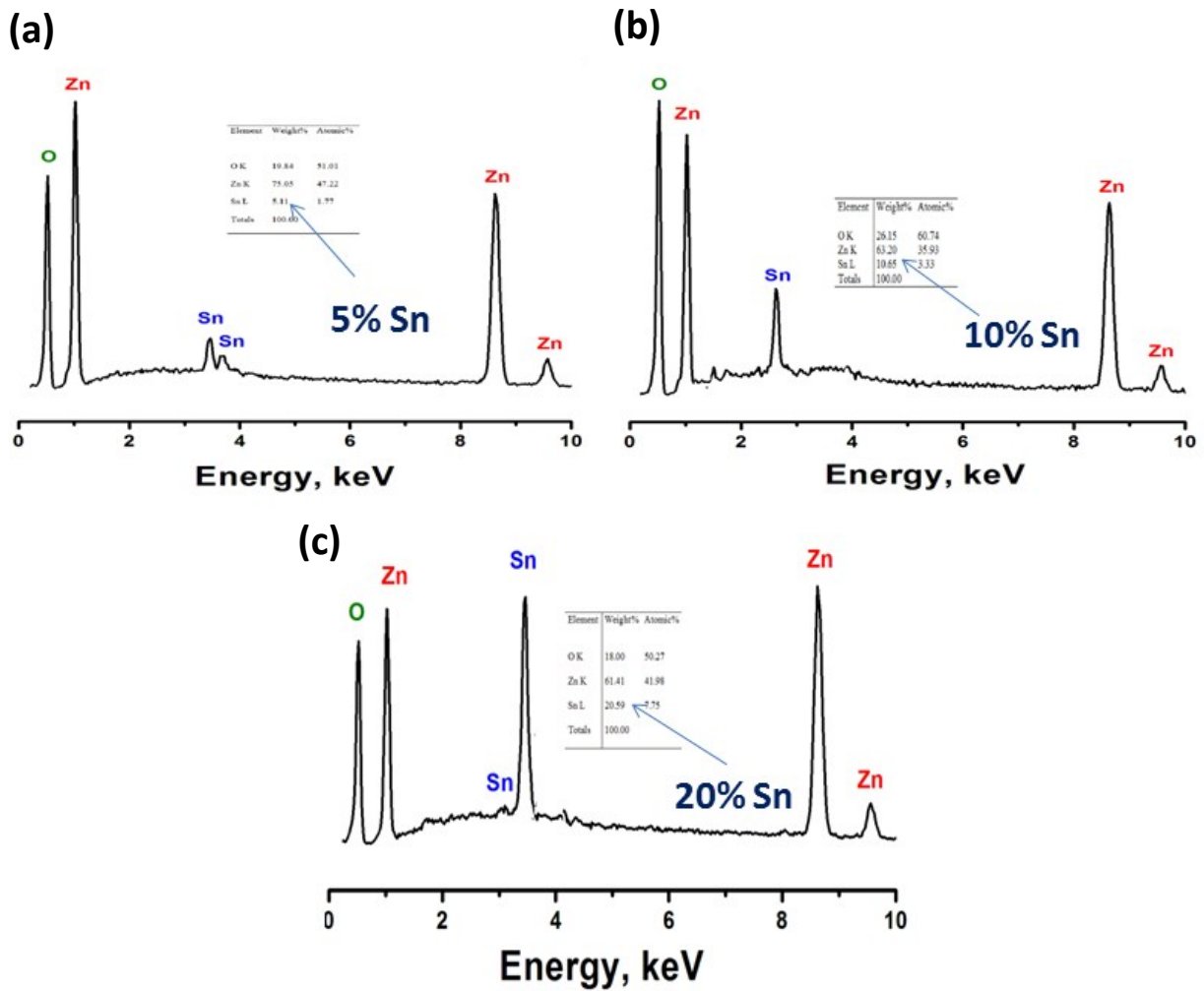


Figure S1: Energy dispersive X-ray spectroscopy (EDX) analysis data of the produced nanocomposites

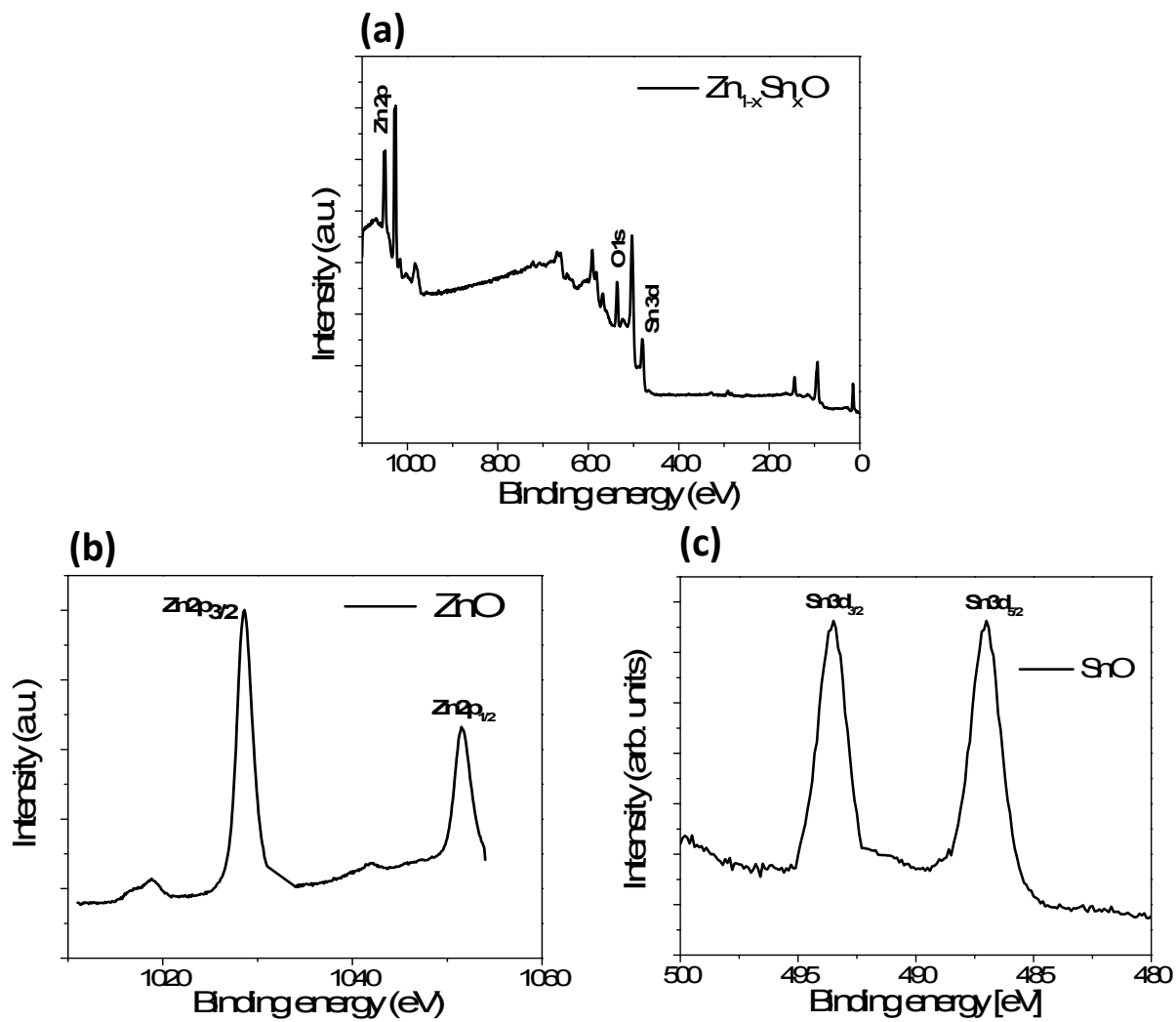


Figure S2: XPS of (a) wide range of $Zn_{1-x}Sn_xO$ nanocomposites, (b) and (c) narrow range of SnO and ZnO nanoparticles, respectively

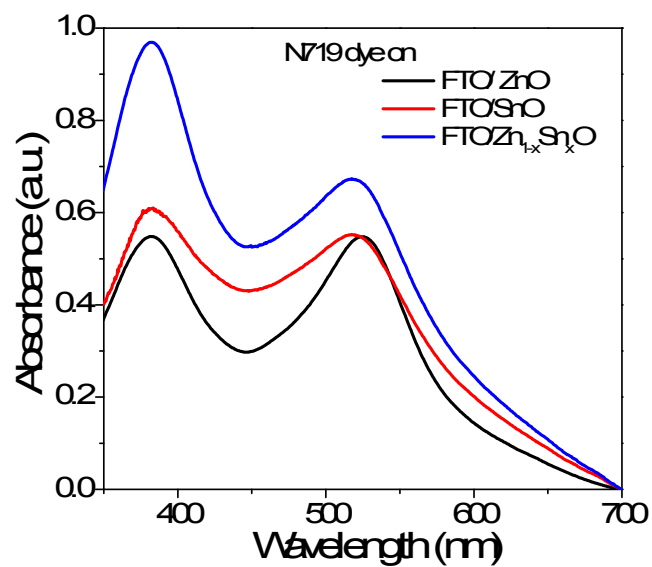


Figure S3: Optical absorbance of the dissolved-out dyes of the pure SnO, the pure ZnO and Zn_{1-x}Sn_xO nanocomposite, respectively loaded on Ru N719 dye.

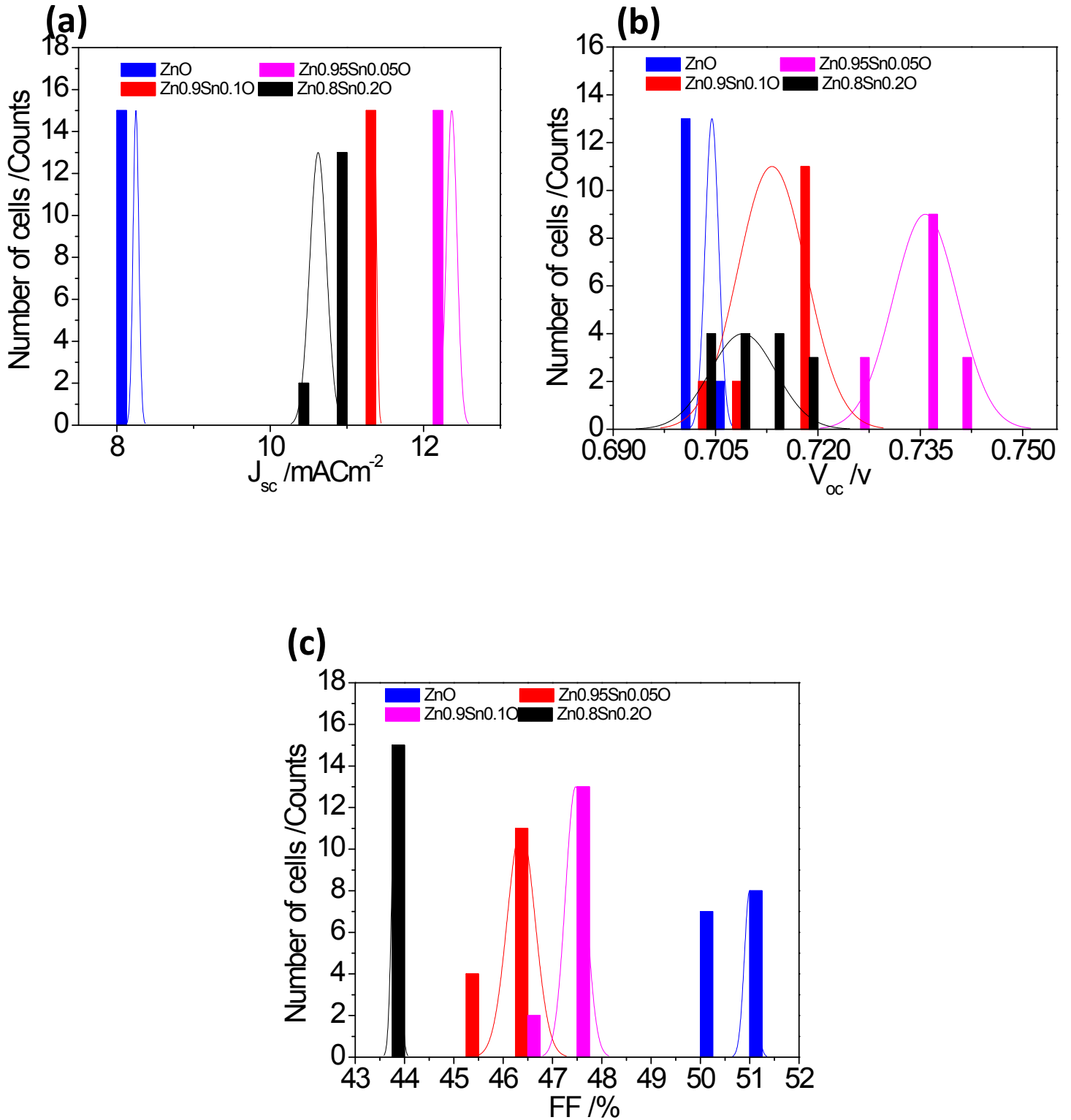


Figure S4. The J_{sc} , V_{oc} and FF distribution histogram (a, b and c), respectively of the pure ZnO (blue color), Zn_{0.95}Sn_{0.05}O (purple color), Zn_{0.9}Sn_{0.1}O (red color) and Zn_{0.8}Sn_{0.2}O (black color), respectively.

Table S1. Photovoltaic parameters of fifteen ss-DSSCs devices made of pure ZnO under simulated AM-1.5G illumination (power density 100 mW cm⁻²) with active area 0.25 cm².

# of cells	J _{sc} (mA/cm ²)	V _{oc} (V)	FF (%)	PCE (%)
1	8.31	0.706	51.10	3.00
2	8.30	0.705	51.00	2.98
3	8.25	0.705	50.99	2.97
4	8.26	0.704	50.99	2.97
5	8.26	0.705	50.98	3.00
6	8.25	0.706	50.98	2.97
7	8.27	0.704	51.11	2.98
8	8.21	0.705	51.10	2.95
9	8.22	0.703	51.00	2.99
10	8.23	0.705	51.00	2.96
11	8.30	0.703	51.10	2.98
12	8.19	0.704	50.90	2.93
13	8.19	0.704	50.95	2.94
14	8.24	0.703	51.09	2.96
15	8.24	0.705	50.69	2.99
average	8.25±0.03	0.704±0.001	50.99±0.10	2.98±0.02

Table S2. Photovoltaic parameters of fifteen ss-DSSCs devices made of $Zn_{0.95}Sn_{0.05}O$ under simulated AM-1.5G illumination (power density 100 mW cm^{-2}) with active area 0.25 cm^2 .

# of cells	$J_{sc}(\text{mA/cm}^2)$	$V_{oc} \text{ (V)}$	FF (%)	PCE (%)
1	12.45	0.740	46.70	4.30
2	12.40	0.735	46.50	4.23
3	12.35	0.735	46.56	4.22
4	12.45	0.740	46.60	4.29
5	12.40	0.736	45.99	4.19
6	12.38	0.739	46.25	4.23
7	12.39	0.736	46.67	4.26
8	12.40	0.725	46.62	4.19
9	12.43	0.729	46.57	4.21
10	12.36	0.728	46.37	4.17
11	12.35	0.737	45.95	4.18
12	12.25	0.739	45.93	4.16
13	12.25	0.738	46.45	4.20
14	12.25	0.739	46.34	4.20
15	12.39	0.740	45.96	4.21
average	12.36 ± 0.06	0.736 ± 0.001	46.36 ± 0.28	4.22 ± 0.04

Table S3. Photovoltaic parameters of fifteen ss-DSSCs devices made of $Zn_{0.9}Sn_{0.1}O$ under simulated AM-1.5G illumination (power density 100 mW cm^{-2}) with active area 0.25 cm^2 .

# of cells	$J_{sc}(\text{mA/cm}^2)$	$V_{oc} \text{ (V)}$	FF (%)	PCE (%)
1	11.40	0.719	47.60	3.90
2	11.35	0.715	47.55	3.86
3	11.40	0.716	47.56	3.88
4	11.30	0.715	47.50	3.84
5	11.33	0.705	47.55	3.81
6	11.34	0.706	47.58	3.81
7	11.36	0.705	47.58	3.81
8	11.38	0.706	46.99	3.78
9	11.33	0.715	46.95	3.80
10	11.34	0.716	47.48	3.86
11	11.36	0.715	47.59	3.87
12	11.38	0.718	47.52	3.88
13	11.38	0.718	47.50	3.88
14	11.35	0.715	47.55	3.86
15	11.37	0.715	47.55	3.87
average	11.36 ± 0.03	0.713 ± 0.0005	47.47 ± 0.21	3.85 ± 0.04

Table S4. Photovoltaic parameters of fifteen ss-DSSCs devices made of $Zn_{0.8}Sn_{0.2}O$ under simulated AM-1.5G illumination (power density 100 mW cm^{-2}) with active area 0.25 cm^2 .

# of cells	$J_{sc}(\text{mA/cm}^2)$	$V_{oc} \text{ (V)}$	FF (%)	PCE (%)
1	10.76	0.719	43.90	3.40
2	10.75	0.705	43.85	3.32
3	10.74	0.705	43.88	3.32
4	10.75	0.703	43.87	3.32
5	10.75	0.715	43.88	3.37
6	10.68	0.706	43.85	3.31
7	10.50	0.706	43.85	3.25
8	10.55	0.706	43.89	3.27
9	10.58	0.703	43.90	3.27
10	10.48	0.708	43.85	3.25
11	10.46	0.710	43.75	3.25
12	10.59	0.710	43.70	3.29
13	10.53	0.715	43.68	3.29
14	10.58	0.712	43.75	3.30
15	10.66	0.712	43.76	3.32
average	10.62 ± 0.11	0.709 ± 0.005	43.82 ± 0.07	3.30 ± 0.04