

Electronic Supplementary Information

UV-Induced Improvement in ZnO Thin Film Conductivity: A New *in situ* Approach

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1. Listing of ZnO Thin-Film Samples:

417 °C – Dark

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-2.37E+18	27.64	0.095	435	71
	-1.59E+18	30.40	0.129	379	70
Average	-1.98E+18	29.02	0.112	407	70.5
<i>Stand. Dev.</i>	<i>3.86E+17</i>	<i>1.38</i>	<i>0.017</i>	<i>28</i>	<i>0.5</i>

417 °C – *in situ* UV

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-1.63E+18	35.59	0.108	389	72
	-1.97E+18	36.35	0.087	427	71
	-1.59E+18	32.41	0.121	371	75
Average	-1.73E+18	34.78	0.105	396	72.7
<i>Stand. Dev.</i>	<i>1.71E+17</i>	<i>1.71</i>	<i>0.014</i>	<i>23</i>	<i>1.7</i>

376 °C – Dark

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-2.25E+18	23.62	0.117	389	75
	-2.21E+18	18.48	0.153	411	74
	-1.88E+18	26.93	0.124	395	75
	-2.63E+18	15.00	0.158	355	75
	-2.05E+18	19.36	0.157	366	76
	-1.70E+18	18.75	0.197	387	76
	-1.47E+18	13.03	0.325	426	73
	-1.64E+18	14.47	0.262	400	75
	-1.22E+18	23.34	0.219	421	75
	-1.28E+18	25.49	0.192	430	76
	-1.50E+18	20.76	0.202	395	73
	-1.23E+18	21.78	0.232	417	74
	-1.34E+18	25.46	0.183	483	73
	-1.38E+18	17.58	0.257	403	73
	-1.10E+18	17.97	0.316	350	71
Average	-1.66E+18	20.13	0.206	402	74.3
Stand. Dev.	4.38E+17	4.12	0.061	32	1.4

376 °C – *in situ* UV

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-2.01E+18	34.53	0.090	393	71
	-1.50E+18	34.87	0.120	413	72
	-1.92E+18	41.20	0.079	362	75
	-1.91E+18	31.10	0.105	396	72
	-2.00E+18	34.40	0.091	381	75
	-1.71E+18	35.06	0.104	422	74
	-3.05E+18	42.43	0.048	424	74
	-1.72E+18	38.61	0.094	397	73
	-2.75E+18	40.45	0.056	362	71
	-3.02E+18	34.76	0.060	383	73
	-2.50E+18	34.50	0.072	319	73
	-1.75E+18	35.49	0.100	334	74
	-1.34E+18	36.37	0.128	388	75
	-1.24E+18	39.88	0.126	362	73
	-1.54E+18	34.62	0.117	431	74
	-1.67E+18	44.31	0.084	408	72
	-1.50E+18	39.80	0.105	404	74
	-1.46E+18	41.25	0.104	401	75
Average	-1.92E+18	37.42	0.094	388	73.3
Stand. Dev.	5.37E+17	3.51	0.023	30	1.3

334 °C – Dark

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-1.86E+18	9.37	0.358	297	72
	-3.03E+18	13.10	0.157	293	74
	-2.70E+18	9.97	0.232	286	73
	-1.52E+18	6.80	0.602	346	71
Average	-2.28E+18	9.81	0.337	306	72.5
<i>Stand. Dev.</i>	<i>6.11E+17</i>	<i>2.24</i>	<i>0.169</i>	<i>24</i>	<i>1.1</i>

334 °C – *in situ* UV

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-3.63E+18	18.30	0.094	345	72
	-5.23E+18	24.48	0.049	280	74
	-3.57E+18	20.81	0.084	302	73
	-4.04E+18	21.28	0.073	270	72
Average	-4.11E+18	21.22	0.075	299	72.8
<i>Stand. Dev.</i>	<i>6.68E+17</i>	<i>2.20</i>	<i>0.017</i>	<i>29</i>	<i>0.8</i>

292 °C – Dark

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	NM	NM	146.8	322	79

292 °C – *in situ* UV

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	-2.77E+18	0.59	3.850	264	80
	-3.92E+18	0.70	2.272	245	81
Average	-3.34E+18	0.64	3.061	255	80.5
<i>Stand. Dev.</i>	<i>5.75E+17</i>	<i>0.06</i>	<i>0.789</i>	<i>10</i>	<i>0.5</i>

250 °C – Dark

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	NM	NM	(4840)	291	87

250 °C – *in situ* UV

	Carrier Concentration / cm ⁻³	Mobility / cm ² /Vs	Resistivity / Ω cm	Thickness / nm	Average Vis Transparency / %
	NM	NM	(118)	304	87

Carrier concentrations are reported as negative due to the electron being the majority carrier.

NM – Not measureable due to low conductivity of sample

() – Estimated from 2-point resistance measurement and thickness.

2. Numerical fitting of O(1s) x-ray photoelectron spectra:

Table SI.1 Fitted intensities for 3 components of O(1s) x-ray photoelectron spectra presented in Figure 10 and for a pair of films deposited at a substrate temperature of 376 °C with *in situ* UV irradiation and in the dark.

Sample	Area of Component @ ~530.5 eV		Area of Component @ ~531.8 eV		Area of Component @ ~532.7 eV	
	<i>Absolute</i>	<i>Normalized to Largest Peak</i>	<i>Absolute</i>	<i>Normalized to Largest Peak</i>	<i>Absolute</i>	<i>Normalized to Largest Peak</i>
376 °C Dark	9280.3	1	2435.6	.26245	1948.0	.20991
376 °C UV	9704.5	1	2229.3	.22972	1859.8	.19164
292 °C Dark	7621.7	1	1751.7	.22983	3489.3	.45781
292 °C UV	9518.7	1	2405.3	.25269	1638.3	.17211