Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C

Supporting Information to

Base-etch removal of a ligand shell in thin films of ZnO nanoparticles for electronic applications

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Table S1: Thickness values of spectroscopic ellipsometry measurements show the resistance of the ZnO layer annealed at 550 °C towards the base-etch solutions with different concentrations of KOH in isopropanol.

Base etch	d_{ZnO} [nm]	n_{ZnO}	d_{SiOx} [nm]	n_{SiOx}
as annealed	16.03	1.558	231.67	1.450
0.001M	14.86	1.558	231.45	1.448
0.01M	14.71	1.558	231.11	1.450
0.1M	15.08	1.558	231.95	1.450
1M	15.17	1.558	232.08	1.449

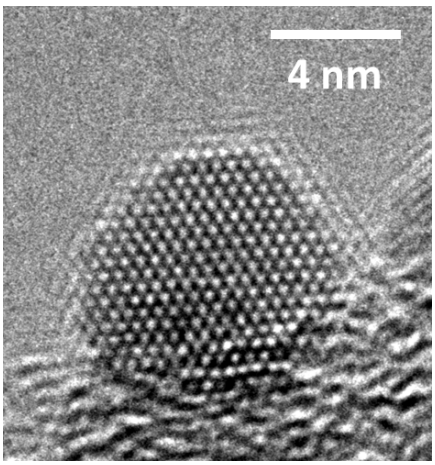

Fig. S1: High Resolution Transmission Electron Microscope image of the zinc oxide nanoparticles.

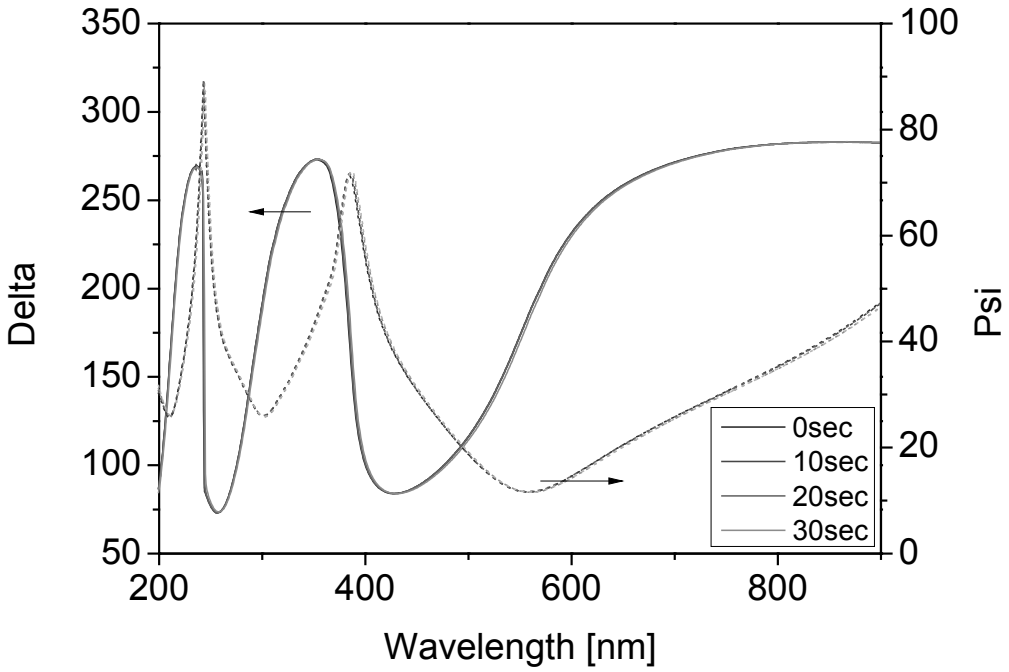

Fig. S2: Psi and Delta of spectroscopic ellipsometry measurements of films treated with the 0.01M base-etch for different durations. The little deviation shows that the films dried at 150 °C are not attacked by the base.

Table S2: Fitted data corresponding to Fig. S1.

Time [sec]	$\mathbf{d_{ZnO}}$ [nm]	$\mathbf{n_{ZnO}}$	$\mathbf{d_{SiOx}}$ [nm]	$\mathbf{n_{SiOx}}$
0	20.04	1.528	230.05	1.446
10	18.79	1.528	230.16	1.453
20	18.49	1.528	230.51	1.453
30	18.93	1.528	230.97	1.454

Table S3: Atomic concentration of the different species according to XPS analysis. [a] = zinc is used as the reference and set to 100 %.

	No treatment	0M solvent	0.01M solution
Zn[a] - *3s*	100 %	100 %	100 %
O - *1s*	109.1 %	114 %	117.5 %
C - *1s*	75.8 %	78.4 %	63.9 %

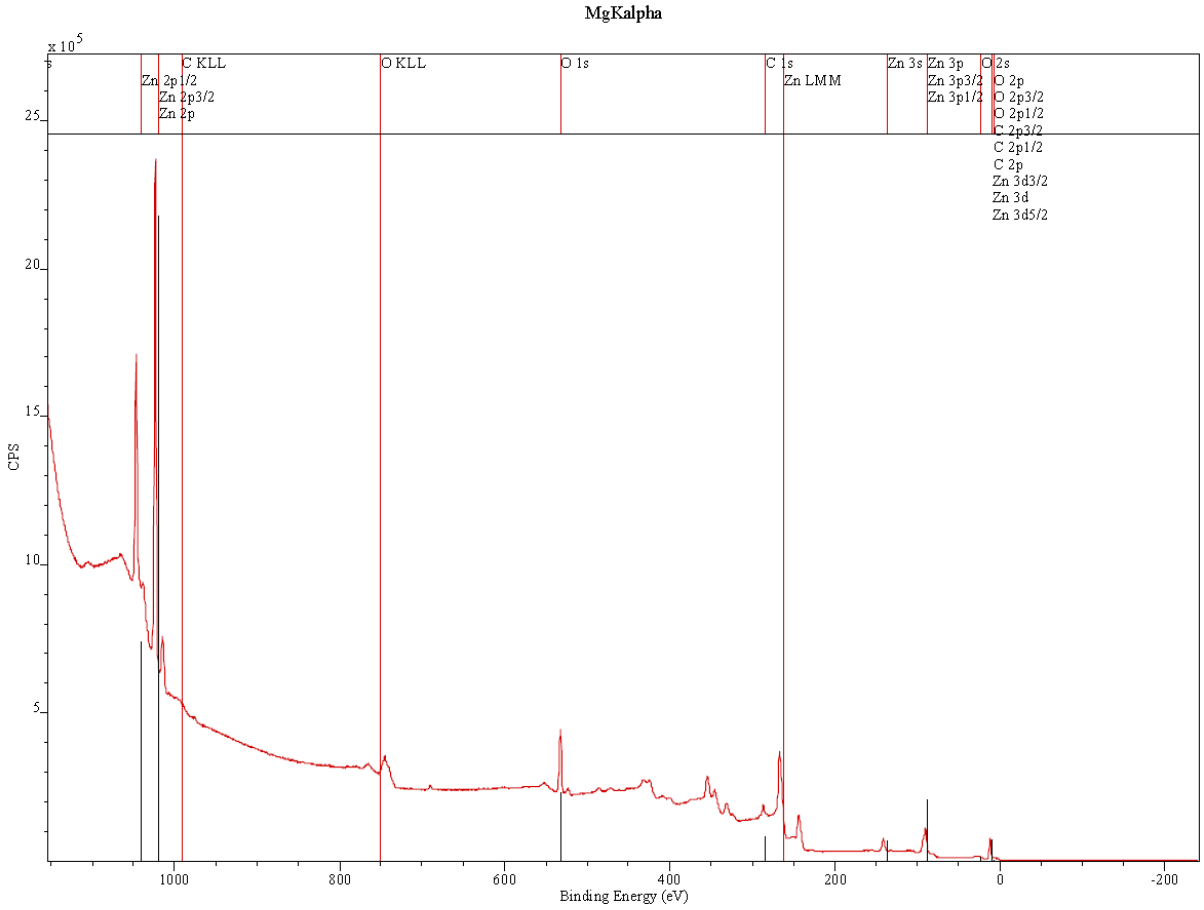

Fig. S3: Coarse XPS scan of a representative sample including the position of the peaks.

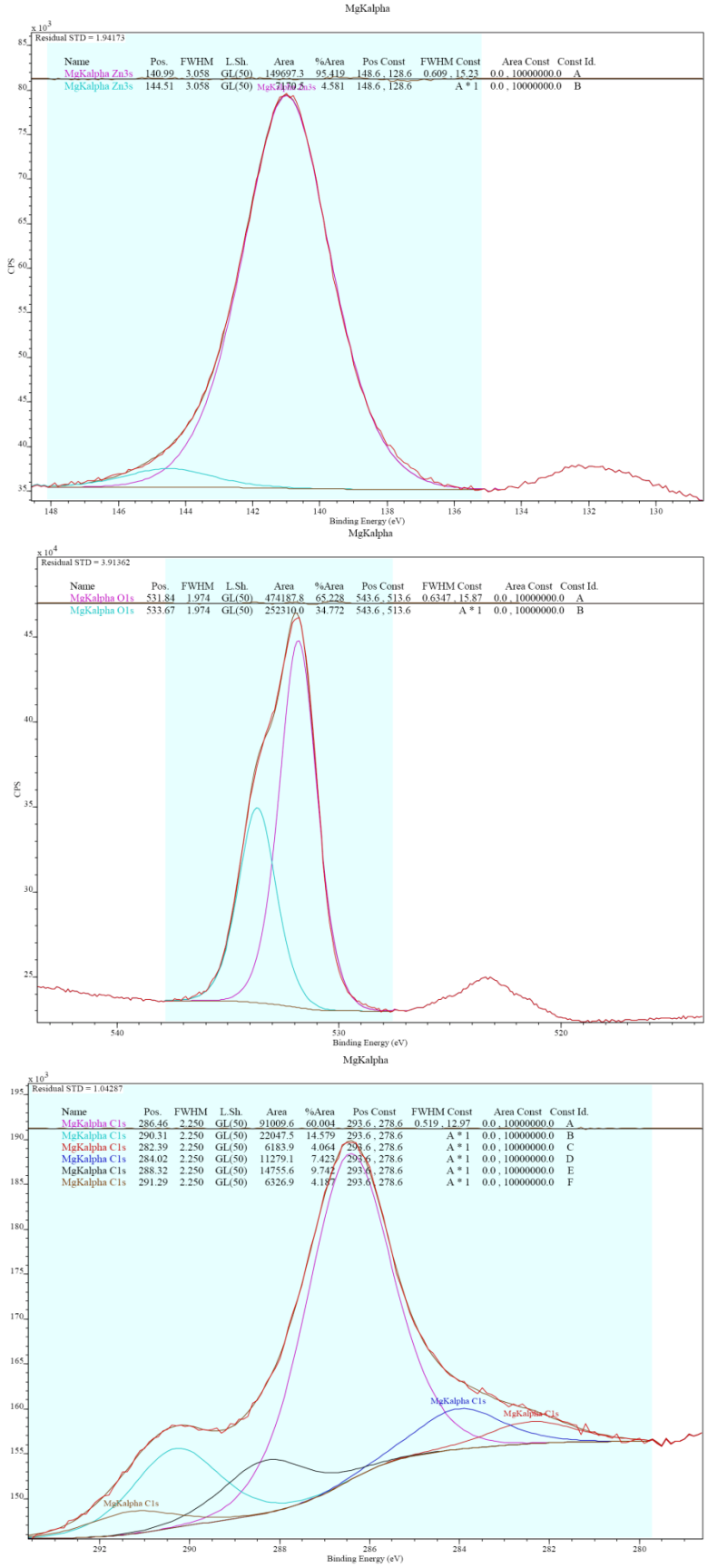

Fig. S4: Zn *3s* (top), O *1s* (center) and C *1s* (bottom) XPS spectra of the sample treated with isopropanol (0M), the other samples were analyzed accordingly. The area used for fitting the data is marked in light blue.

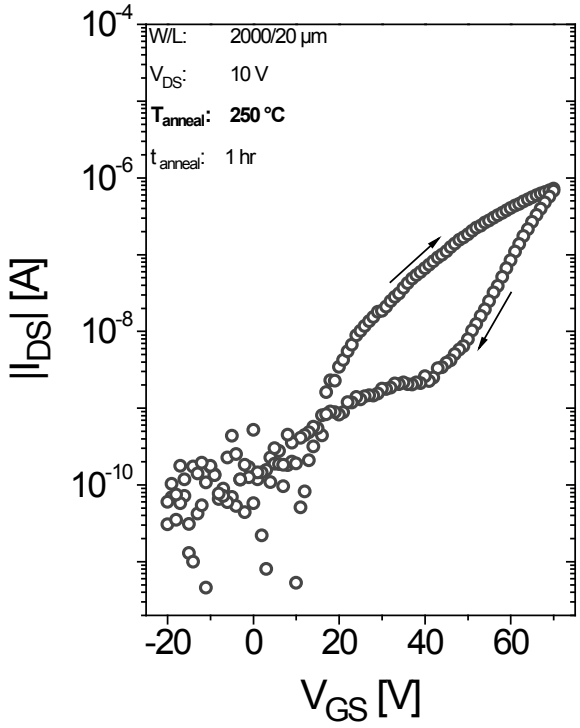

Fig. S5: Transfer characteristic of a sample treated with the 1M base etch and annealed at 250 °C. The film morphology corresponds to Fig. 4 (1M KOH solution).

Table S4: Device parameters of untreated, solvent treated (0M) and base-etch treated samples annealed at different temperatures. The respective transfer characteristics are displayed in Fig. 5. *W/L* = 2000 µm/20 µm; V_{GS} from -20 to 70 V; V_{DS}: μ_{lin} at 4 V. μ_{sat} at 10 V; d_{SiOx} = 230 nm.

Treatment [mol l^{-1}] - [°C]	V_{On} [V]	I_{On} [µA]	I_{On}/I_{Off}	μ_{lin} [cm² V^{-1} s^{-1}]	μ_{sat} [cm² V^{-1} s^{-1}]
None - 150	33	3.2×10^{-2}	1.6×10^{2}	-	3.2×10^{-5}
0 - 150	29	0.1	5.0×10^{2}	2.0×10^{-4}	1.0×10^{-4}
0.01 - 150	20	0.6	6.0×10^{3}	1.1×10^{-3}	5.4×10^{-4}
None - 250	20	0.25	1.3×10^{3}	5.5×10^{-4}	2.9×10^{-4}
0 - 250	16	1.0	1.7×10^{3}	2.0×10^{-3}	9.7×10^{-4}
0.01 - 250	13	6.0	1.2×10^{4}	0.015	4.0×10^{-3}
None - 350	10.5	3.4	6.8×10^{4}	8.0×10^{-3}	2.2×10^{-3}
0 - 350	9.5	9.4	1.3×10^{5}	0.026	7.3×10^{-3}
0.01 - 350	5	47	9.4×10^{5}	0.14	0.02

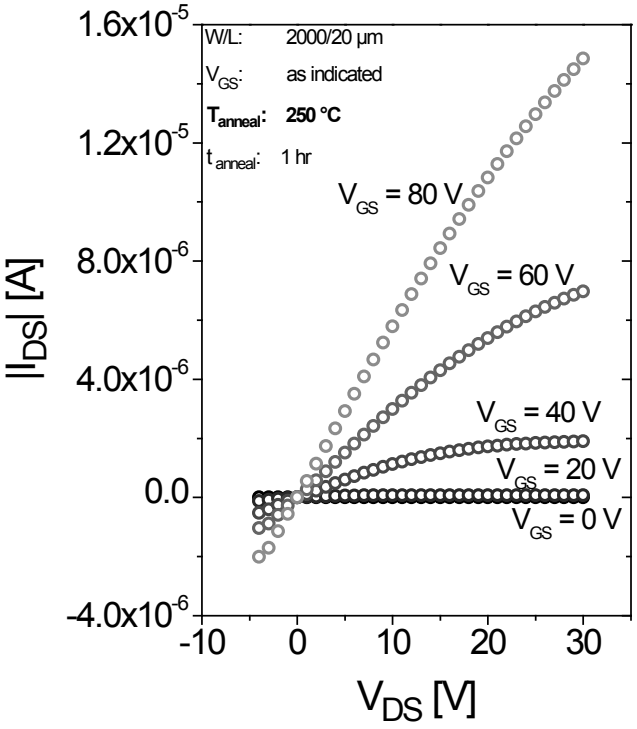

Fig. S6: Output characteristic of a device treated with the 0.01M base-etch and annealed at 250 °C.