Supplementary Materials

Electrical and Structural Properties of Semi-polar-ZnO/*a*-Al_2O_3 and Polar-ZnO/c-Al_2O_3 ZnO Films: A Comparative Study

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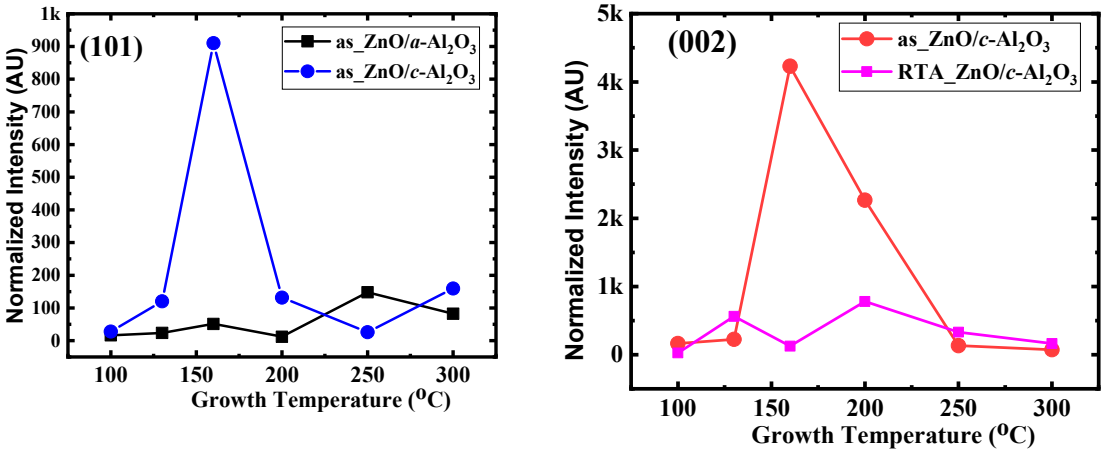


Figure S1. Normalized intensity variation of XRD peaks (integrals) with growth temperature (a) as grown and (b) annealed, $ZnO_{(101)}$/*a*-Al_2O_3 and $ZnO_{(002)}$/*c*-Al_2O_3 films

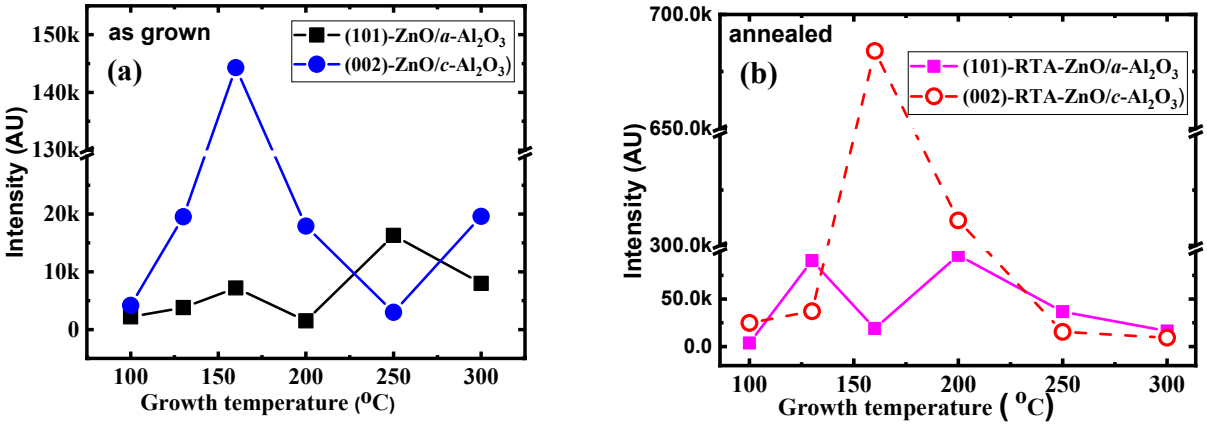


Figure S2. Intensity variation of XRD peaks (integrals) with growth temperature (a) as grown and (b) annealed, $ZnO_{(101)}$/*a*-Al_2O_3 and $ZnO_{(002)}$/*c*-Al_2O_3 films

Table S1. Crystallites size variation with T_g, for as grown and annealed ~150nm ZnO films on *a*-Al_2O_3 and *c*-Al_2O_3 substrates.

T_g degC	Grain(nm) (101)_as *a*-Al2O3	Grain(nm) (101)_RTP *a*-Al2O3	Grain(nm) (002)_as *a*-Al2O3	Grain(nm) (002)_RTP *a*-Al2O3	Grain(nm) (002)_as *c*-Al2O3	Grain(nm) (002)_RTP *c*-Al2O3	Grain(nm) (101)_as *c*-Al2O3	Grain(nm) (101)_RTP *c*-Al2O3
100	12.03	38.55	23.19	-	24.75	37.53	-	-
130	14.41	41.72	23.22	-	28.19	48.64	-	-
160	14.32	37.41	46.1	62.34	36.21	85.06	-	-
200	14.49	45.23	-	-	13.07	51.22	-	-
250	15.47	37.79	8.97	-	9.38	14.54	65.68	-
300	19.25	43.13	15.92	-	70.44	70.88	-	-

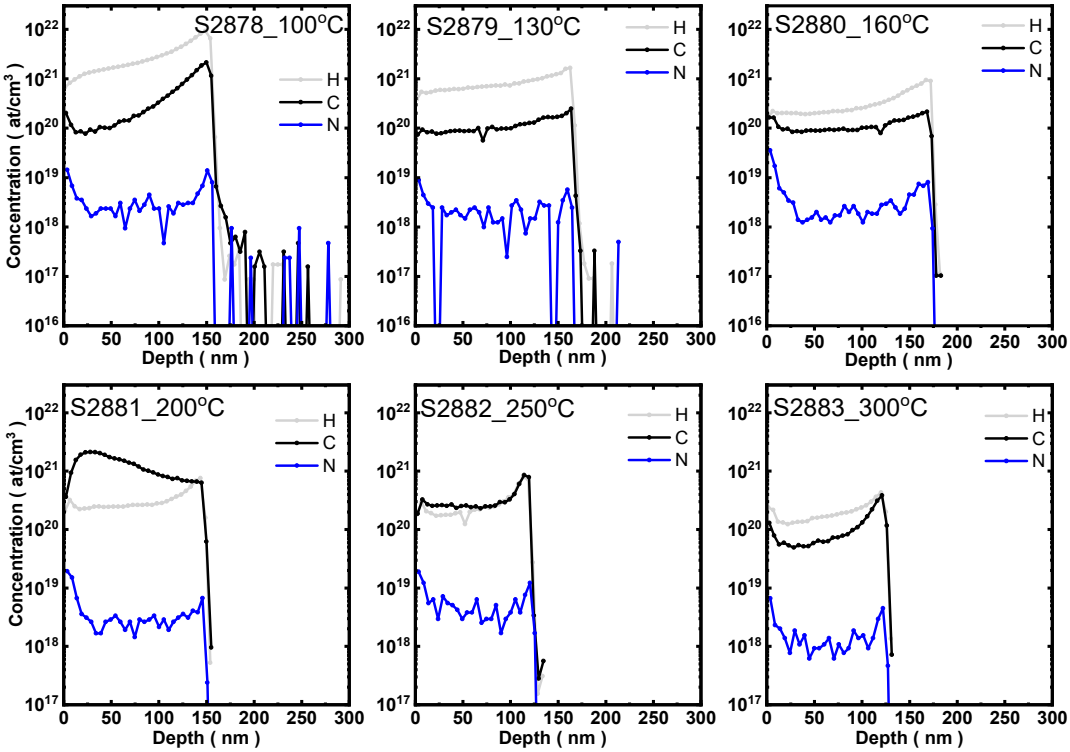
Table S2 Micro-strain variation with T_g, for as grown and annealed ~150nm ZnO films on *a*-Al_2O_3 and *c*-Al_2O_3 substrates.

T_g degC	microstrain (101) as_(10^{-3}) *a*-Al2O3	microstrain (101) RTP_(10^{-3}) *a*-Al2O3	microstrain (002) as_(10^{-3}) *a*-Al2O3	microstrain (002) RTP_(10^{-3}) *a*-Al2O3	microstrain (101) as_(10^{-3}) *c*-Al2O3	microstrain (101) RTP_(10^{-3}) *c*-Al2O3	microstrain (101) as_(10^{-3}) *c*-Al2O3	microstrain (101) RTP_(10^{-3}) *c*-Al2O3
100	1.05	2.18	3.52	-	1.11	2.61	-	-
130	4.84	1.52	2.95	-	0.82	4.63	-	-
160	5.78	1.79	2.25	1.82	3.40	1.10	-	-
200	6.08	1.55	-	-	10.48	2.45	-	-
250	5.52	2.08	16.19	-	19.03	6.51	1.38	
300	7.01	2.09	6.36	-	0.99	1.51	-	-

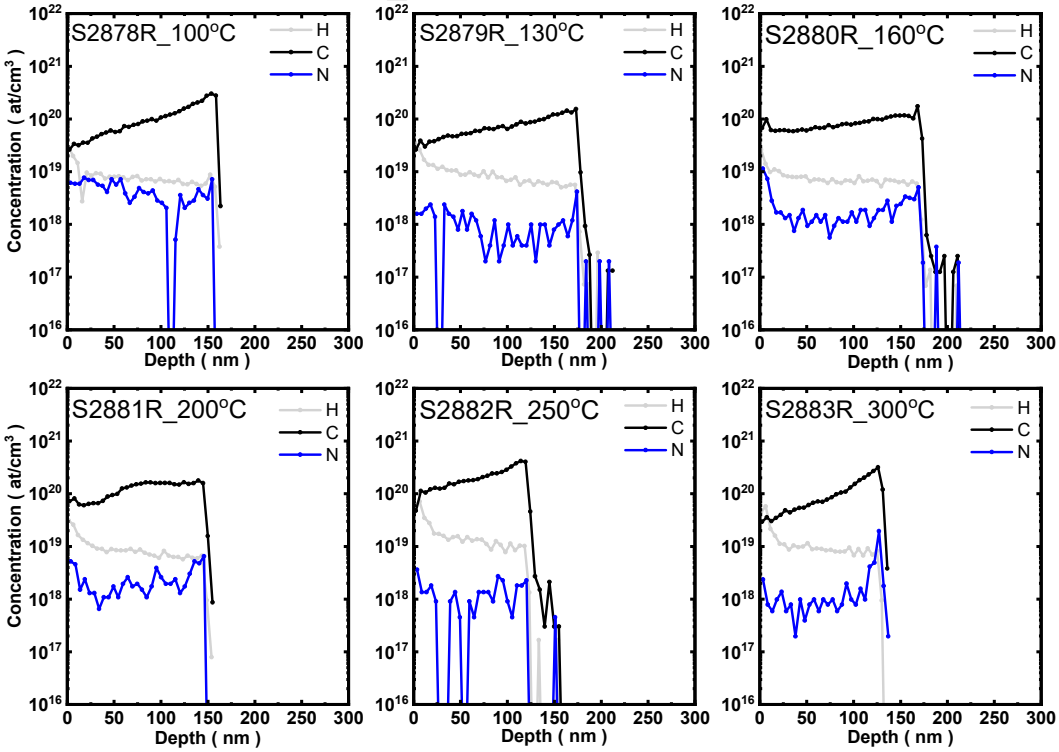
Table S3. Strain variation with Tg , for as grown and annealed ~150nm ZnO films on *a*-Al_2O_3 and *c*-Al_2O_3 substrates.

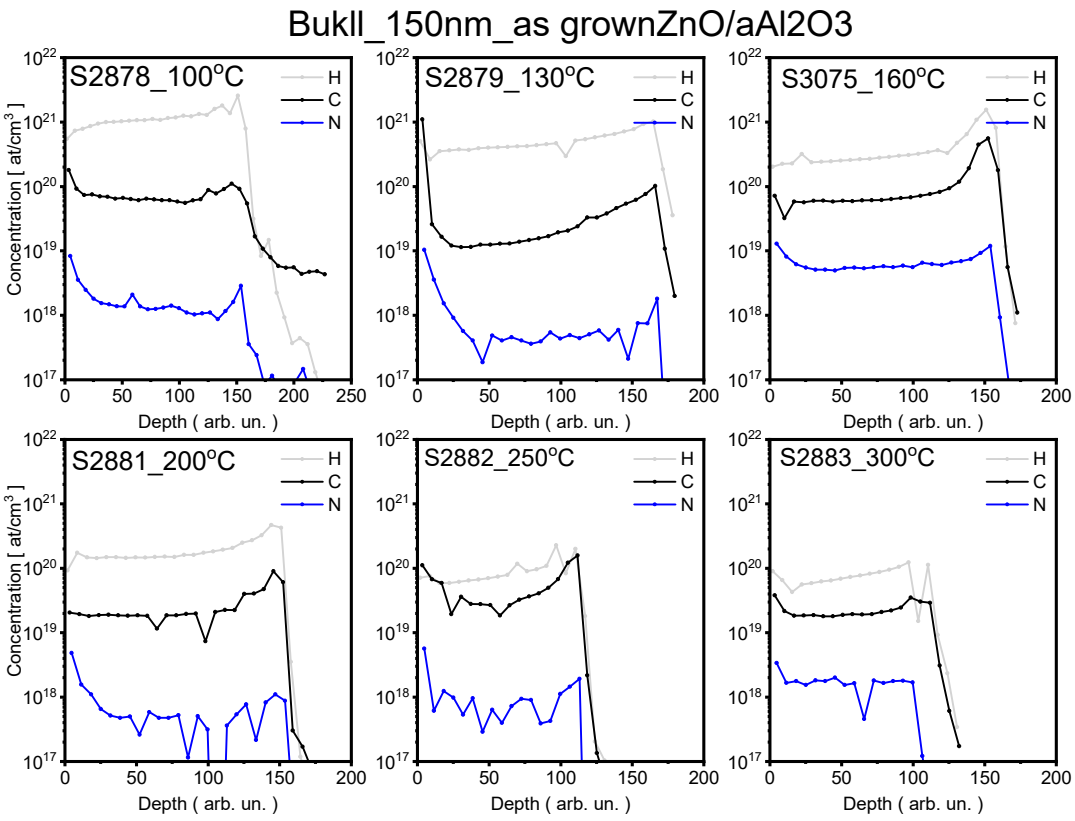
T_g degC	Strain% (101)_as *a*-Al2O3	Strain% (101)_RTP *a*-Al2O3	Strain% (002)_as *a*-Al2O3	Strain% (002)_RTP *a*-Al2O3	Strain% (002)_as *c*-Al2O3	Strain% (002)_RTP *c*-Al2O3	Strain% (101)_as *c*-Al2O3	Strain% (101)_RTP *c*-Al2O3
100	0.28	0.68	0.32	-	0.45	0.27	-	-
130	0.38	0.53	0.24	-	0.38	0.07	-	-
160	0.89	0.84	0.36	0.73	0.28	0.32	-	-
200	0.93	0.64	NA	-	1.11	0.23	-	-
250	0.69	0.70	0.16	-	1.13	1.21	4.64	-
300	0.97	0.68	0.61	-	0.21	0.32	-	-

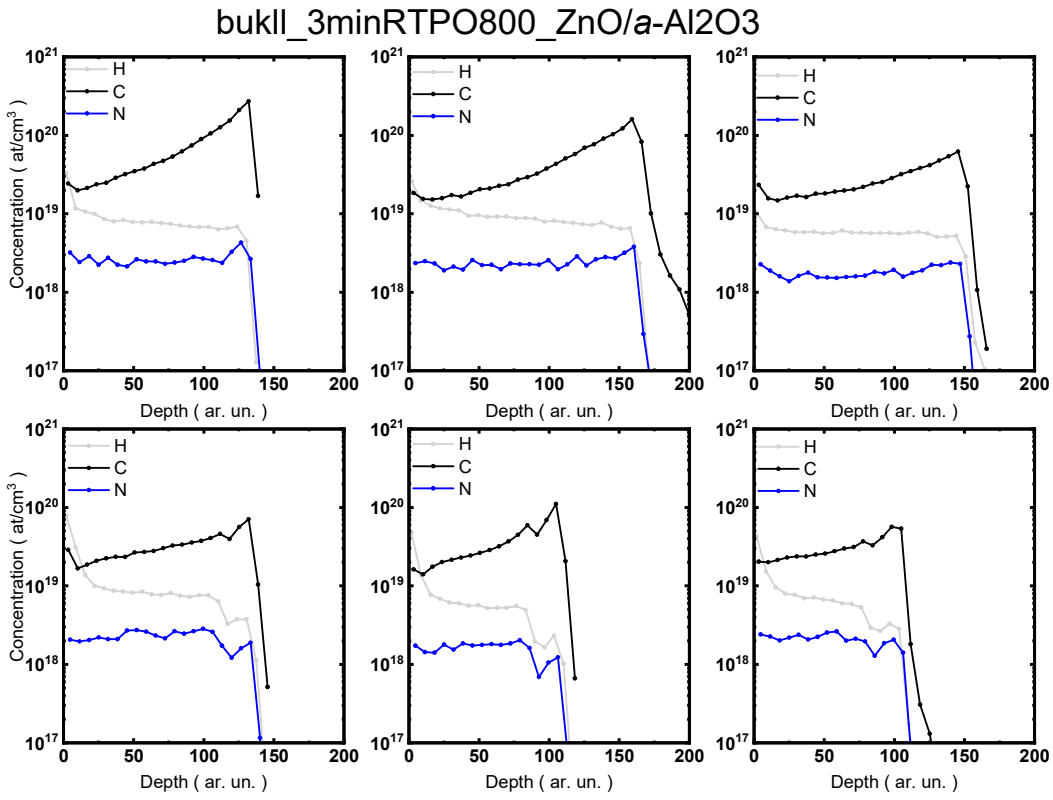
bukII_as grown ZnO/c-Al2O3



bukII_annealed ZnO/c-Al2O3




Bukll_150nm_as grownZnO/aAl2O3
S2878_100°C
S2879_130°C
S3075_160°C
S2881_200°C
S2882_250°C
S2883_300°C
H
C
N
Concentration [at/cm3]
Depth (arb. un.)


bukll_3minRTPO800_ZnO/a-Al2O3
H
C
N
Concentration (at/cm3)
Depth (ar. un.)

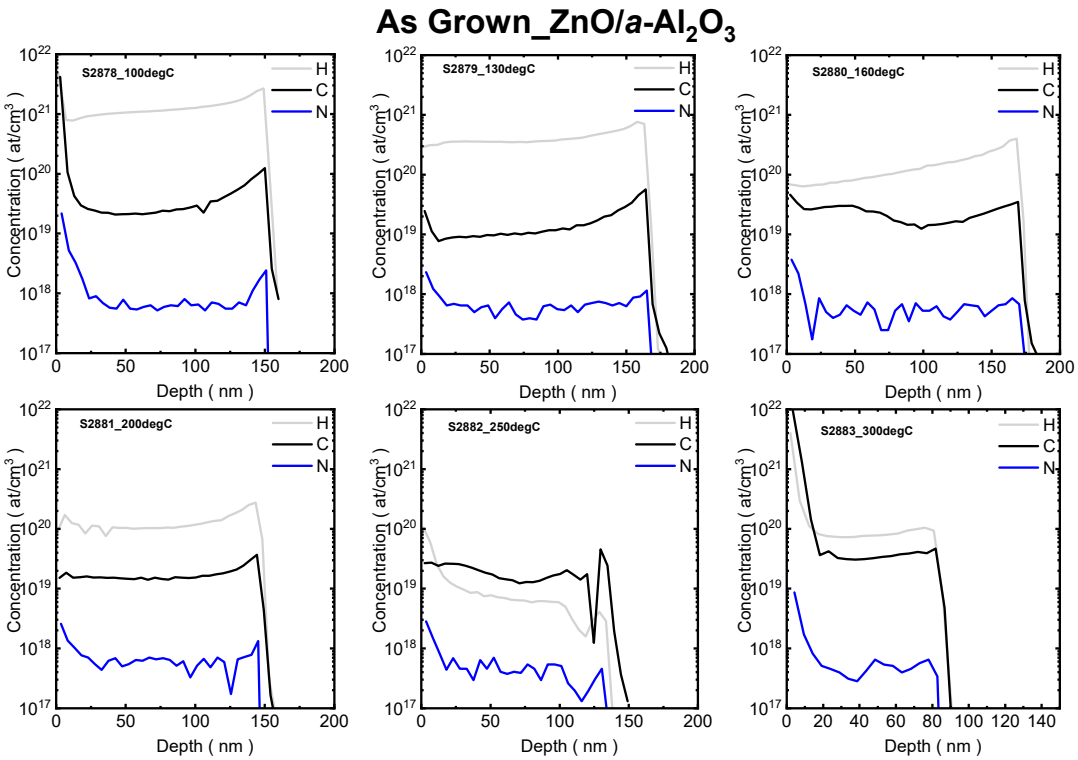


Figure S3. The results of SIMS measurements.

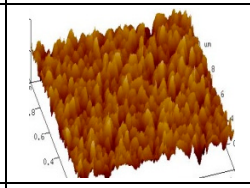
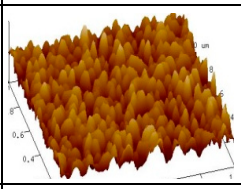
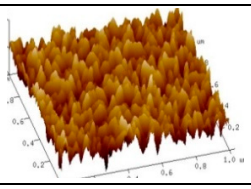
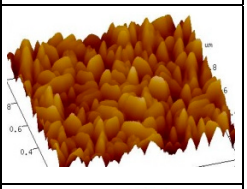
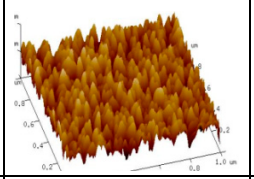
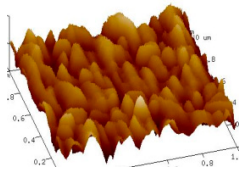
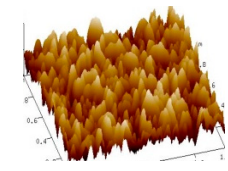
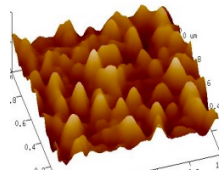
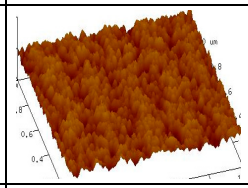
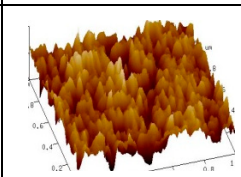
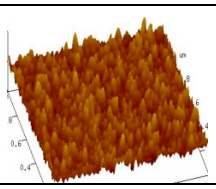
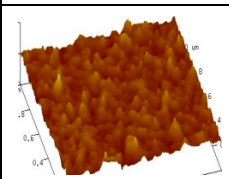
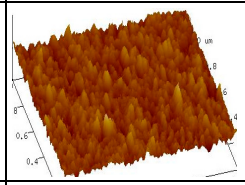
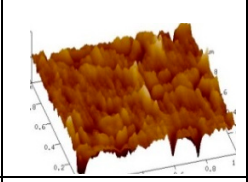
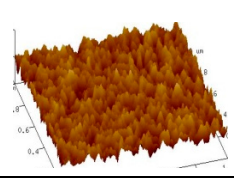
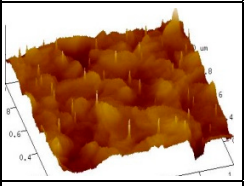
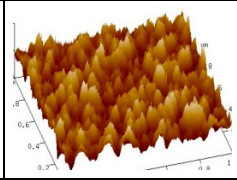
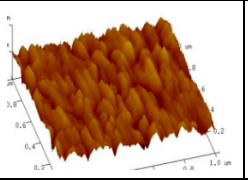
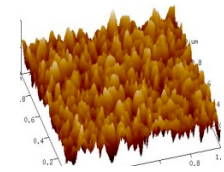
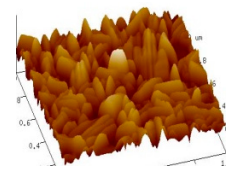
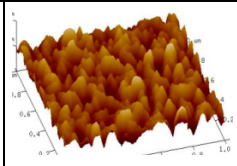
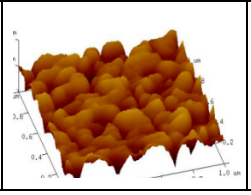
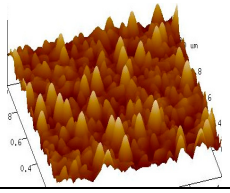
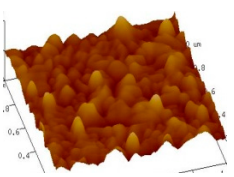
Growth Temp °C	As grown ZnO/*a*-Al_2O_3	Annealed ZnO/*a*-Al_2O_3	As grown ZnO/c-Al_2O_3	Annealed ZnO/*c*-Al_2O_3
100°C				
130°C				
160°C				
200°C				
250°C				
300°C				

Figure S4. AFM images.

Table S4. The roughness recorded using AFM image.

Growth temperature degC	Roughness(10µm) (Rq) _nm as-ZnO/*c*-Al2O3	Roughness(10µm) (Rq) _nm RTP-ZnO/*c*-Al2O3	Roughness(10µm) (Rq) _nm as-ZnO/*a*-Al2O3	Roughness(10µm) (Rq) _nm RTP-ZnO/*a*-Al2O3
100	6.21	5.1	4.41	5.11
130	7.51	6.01	5.22	4.8
160	2.98	1.25	2.35	2.84
200	1.52	0.968	1.16	1.33
250	2.37	3.74	2.1	2.56
300	8.62	5.93	5.22	4.67