

Supporting Data

Table A. Thermodynamic data used with SPECIES for CBD-ZnO systems.^{1,2}

	Zn ²⁺	H ⁺
OH ⁻	log K ₁ = 5.04 (-8.96)* log β ₂ = 11.1 (-16.9)* log β ₃ = 13.6 (-28.4)* log β ₄ = 14.8 (-41.2)* log K _{so} = -16.9 (11.1)*	
en	log K ₁ = 5.7 log β ₂ = 10.6 log β ₃ = 12.6	log K ₁ = 10.44 log β ₂ = 17.83
TEA	log K ₁ = 2.05 log β ₂ = 3.28	log K ₁ = 8.03
HMT ³	log K ₁ = 1.8	log K ₁ = 4.89
NH ₃	log K ₁ = 2.35 log β ₂ = 4.80 log β ₃ = 7.31 log β ₄ = 9.46	log K ₁ = 9.46
AcO ⁻	log K ₁ = 1.9 log β ₂ = 3.4 log β ₃ = 4.1	log K ₁ = 4.75
HCOO ⁻	log K ₁ = 0.70 log β ₂ = 1.08 log β ₃ = 1.20	log K ₁ = 3.75
Cl ⁻	log K ₁ = 0.46	log K ₁ = -6.1
NO ₃ ⁻	log K ₁ = 0.11 log β ₂ = -0.82 log β ₃ = -0.6 log β ₄ = -1.3	log K ₁ = -1.44
SO ₄ ²⁻	log K ₁ = 0.70 log β ₂ = 0.69 log β ₃ = 0.9 log β ₄ = 0.85 log β ₅ = 1.04	log K ₁ = 1.89

References

- ¹ L.D Pettit and K.J Powell, *SPECIES, Academic Software*, 1999.
- ² 'The IUPAC Stability Constants Database, Academic Software and IUPAC', 1997.
- ³ U.I Isaeva and B.I Imanakunov, *Inst. Neorg. Fiz. Khim.*, 1982, 4, 46.

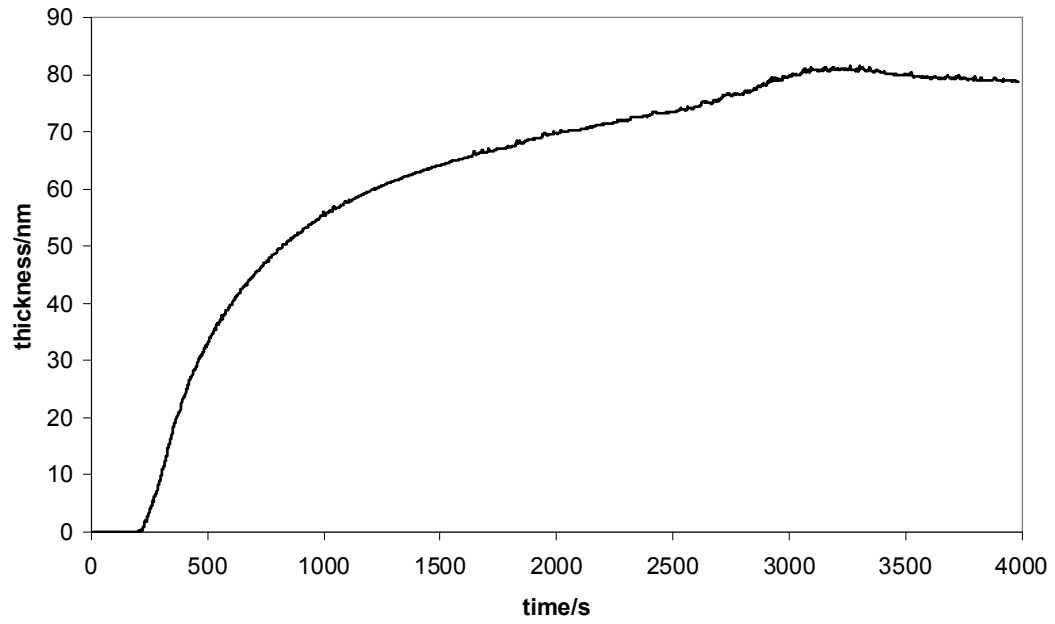


Figure A: Film thickness profile as a function of deposition time for Zn-en system.

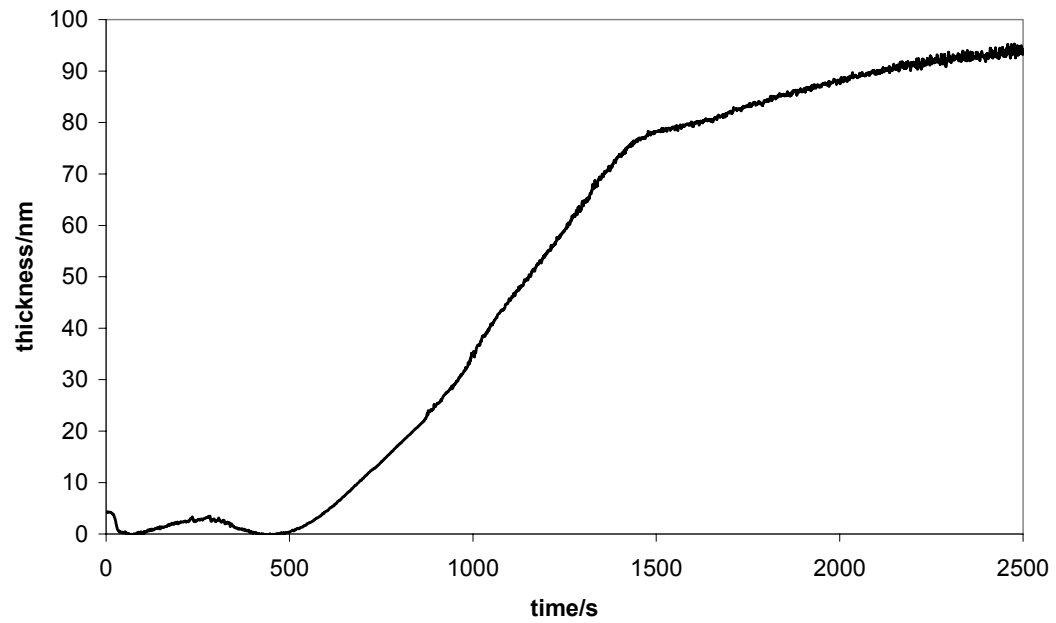


Figure B: Film thickness profile as a function of deposition time for Zn-TEA system.

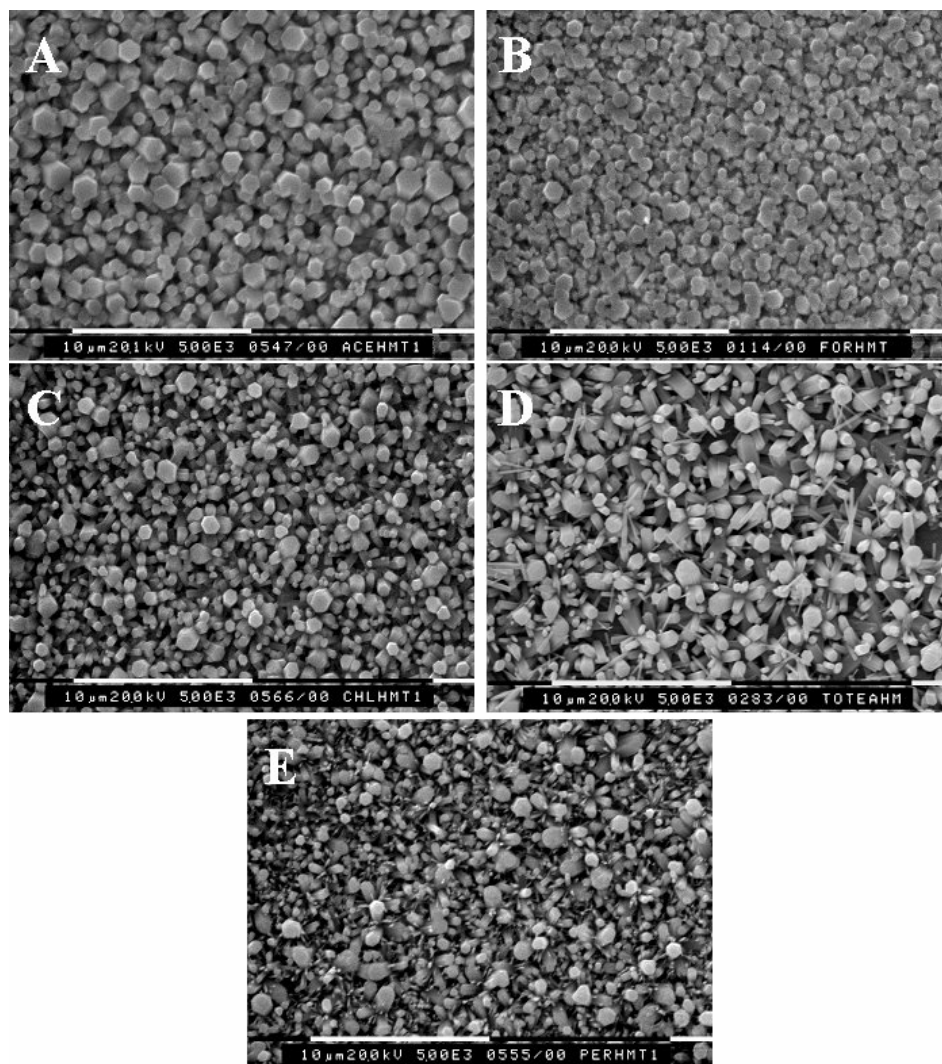


Figure C. SEM images of ZnO films on ZnO template layers from HMT baths ($0.025 \text{ mol dm}^{-3}$ zinc salt and $0.025 \text{ mol dm}^{-3}$ HMT, pH 5, $90 \text{ }^\circ\text{C}$, 1 h); *a.* $\text{Zn}(\text{CH}_3\text{COO})_2$; *b.* $\text{Zn}(\text{HCOO})_2$; *c.* ZnCl_2 ; *d.* $\text{Zn}(\text{NO}_3)_2$; *e.* $\text{Zn}(\text{ClO}_4)_2$. Films obtained from baths containing acetate, formate and chloride are more homogeneous than those containing perchlorate and nitrate.

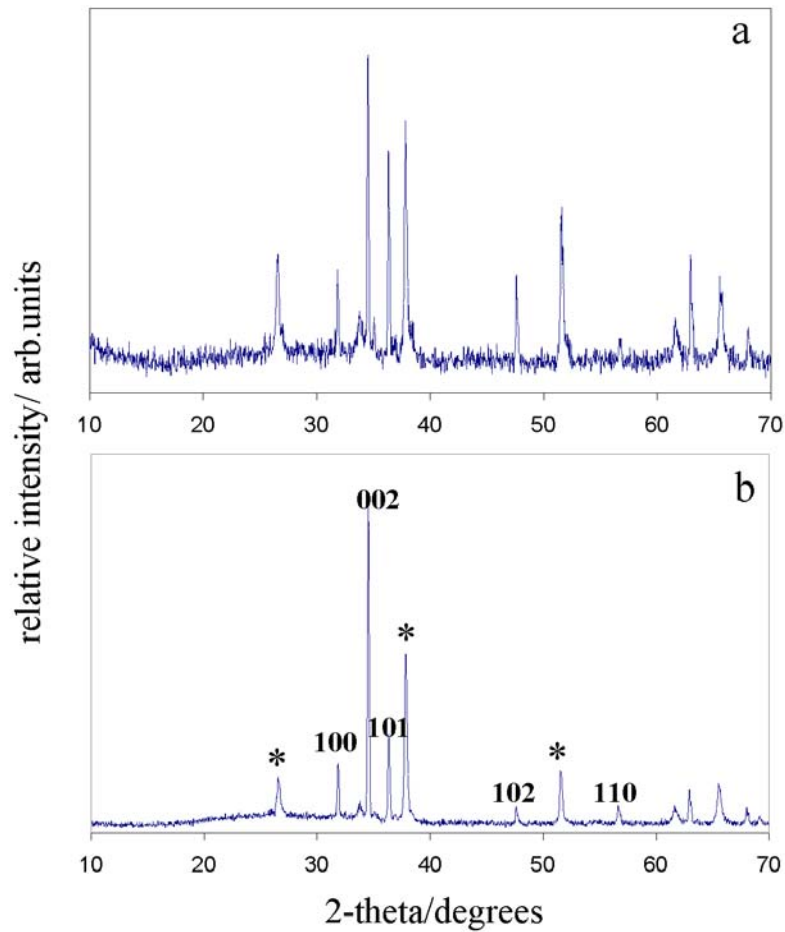


Figure D: X-ray diffraction studies of microcolumns ZnO grown on *a.* ZnO template layers on TO(F)-glass *b.* Au/TO(F)-glass. Peaks indexed as zincite (JCPDS 36-1451) with strong preferred orientation in the [002] direction *i.e.* along the *c*-axis of the wurtzite (HCP structure). *Signals arising from TO(F) glass.

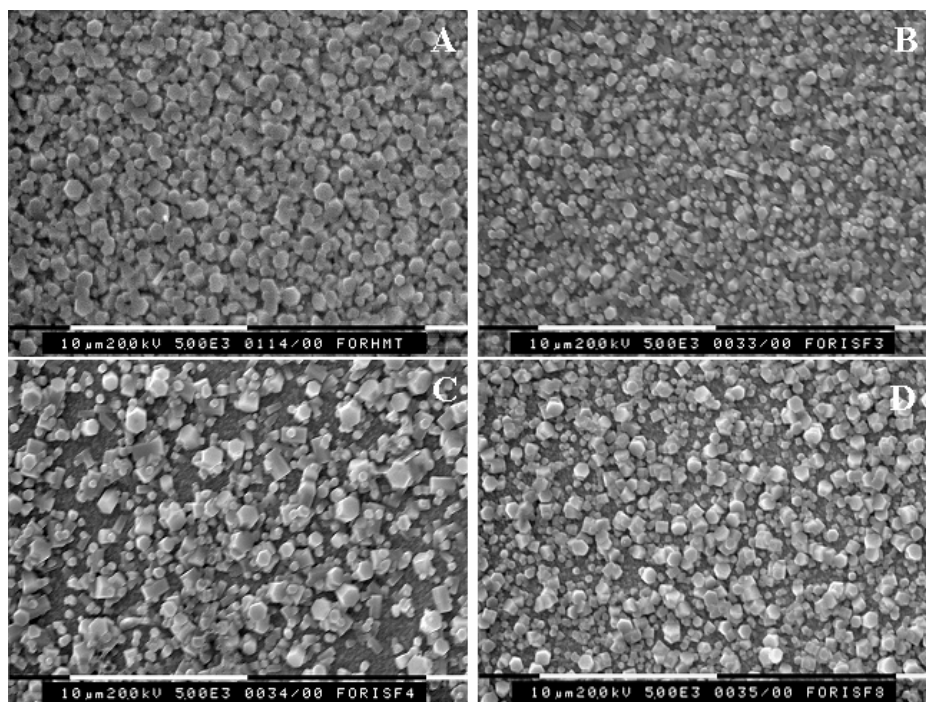


Figure E. SEM images showing the effect of increasing ionic strength on growth of ZnO films (on template layers) deposited from baths (pH 5, 1 hr) containing HMT ($0.025 \text{ mol dm}^{-3}$) and $\text{Zn}(\text{HCOO})_2$ ($0.025 \text{ mol dm}^{-3}$). The ionic strength was varied using [KCl]: *a.* 0 mol dm^{-3} ; *b.* 0.05 mol dm^{-3} ; *c.* $0.075 \text{ mol dm}^{-3}$; *d.* 0.3 mol dm^{-3} .

Table B. Rod dimensions of ZnO films deposited on microcrystalline ZnO templates for different deposition times.

time /min	average rod width / μm	average rod length/ μm
2	0.3	not determined
5	0.5	not determined
10	0.5	not determined
20	0.75	~1.25
30	0.75	~1.5
60	~1	~2

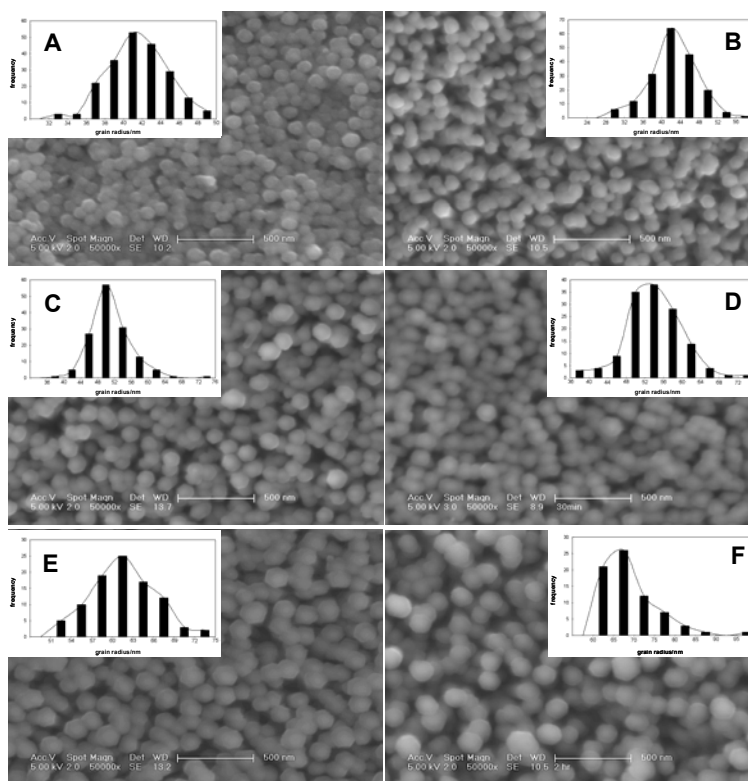


Figure F. SEM images and grain size distribution histograms of ZnO films from HMT baths ($0.025 \text{ mol dm}^{-3} \text{ Zn}(\text{CH}_3\text{COO})_2$ and $0.025 \text{ mol dm}^{-3}$ HMT) deposited on ZnO nanocrystalline template layers deposited for: *a.* 5 min; *b.* 10 min; *c.* 20 min; *d.* 30 min; *e.* 1 hr; *f.* 2hr.

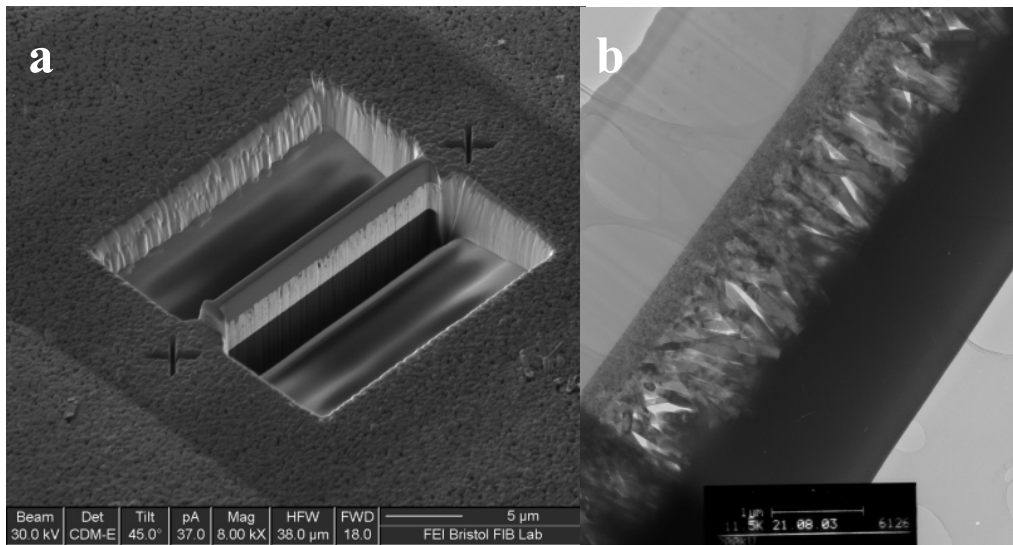


Figure G. *a.* Micrograph of ZnO thin film sample (deposited by Method 2) prepared by FIB methods (before final cut and lift out process) for HR-TEM. *b.* Cross sectional TEM (mag. x 11.5 K) of ZnO thin film sample (Method 1)