

Electronic Supporting Information:

ESI-Table 1: Controlled experimental conditions

Sr. No.	Reaction Conditions	Cerium nitrate	H ₂ O	Ethanol	EG	Substrate	Morphology
1	5mmol concentration, Hydrothermal Temperature 95 °C for 12 h	-	1	-	4	-	Urchin-like nanoneedles (SI- Figure 1a)
2		1	2	2	-	-	Nanorod/particle mixed (SI-Figure 1b)
3		1	4	-	-	-	Nanoparticle (SI-Figure 1c)
4		1	-	-	-	-	Nanorod/sphere (SI-Figure 1d)
5		-	1	-	-	Zn	Nanorods (Figure 6a)
6		1	-	-	Zn	Nanotubes with CeO ₂ nanoparticles(Figure 6b)	
7		1	-	4	Zn	Nanorod attached CeO ₂ particles (Figure 6c)	
8		Ultrasonication 1 h	1	-	-	-	Nanotubes (~ 50 nm) with randomly CeO ₂ particles (Figure 6d)

ESI-Fig. 1

Monte Carlo data

Assumptions used for all:

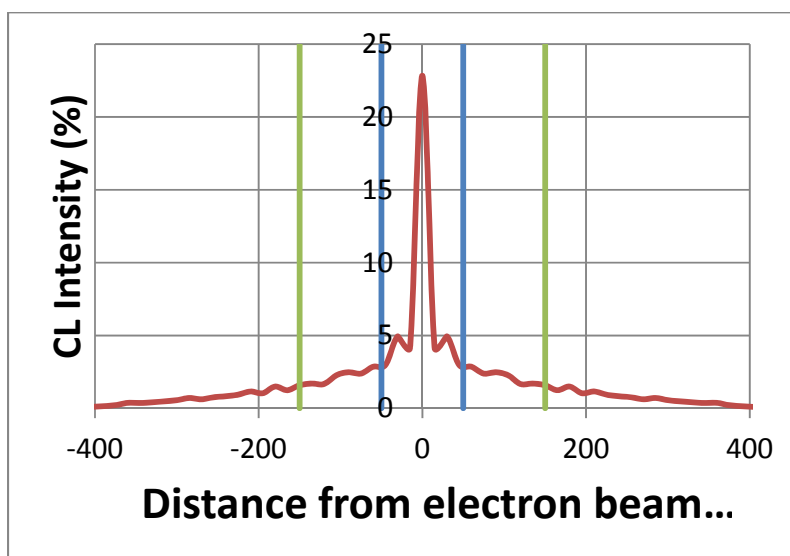
- 5nm probe diameter (focussing of the electron beam in a W-SEM)
- Accelerating voltage: 15kV
- # Electron trajectories simulated: 5×10^5

500nm ZnO nanowire

ZnO assumptions:

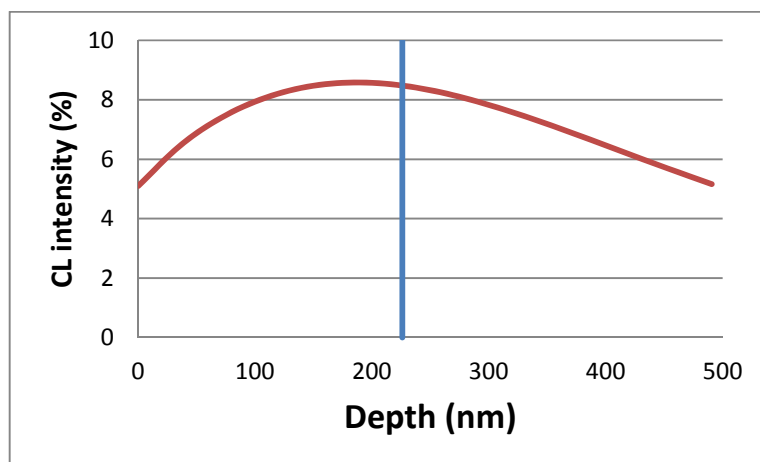
- 500nm wide sample (but with infinite depth)
- Minority carrier diffusion length 150nm
- Surface recombination 0.25 (where 0 = perfect sink and 1 = reflector)

CL Emission as a function of distance from the electron beam in the xy plane (surface)



Blue vertical lines show distance at which >50% limit of the CL intensity, green line shows >75% limit

CL Emission as a function of depth within the nanowire

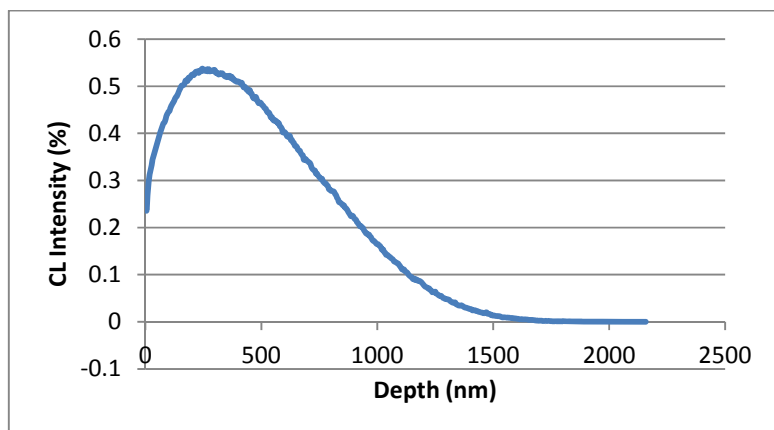


Blue vertical lines show distance at which >50% limit of the CL intensity

Bulk CeO₂

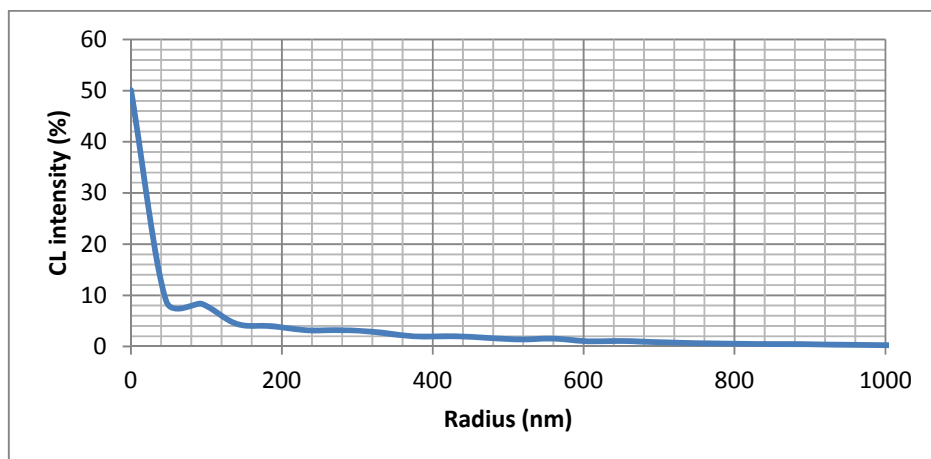
CL intensity as a function of depth

Penetration of the electron beam is large, 50% of CL emission comes from within the top 450nm:



CL intensity as a function of radius

Spread of the electron beam is large but >50% of CL emission is within 50nm of the position of the electron beam.

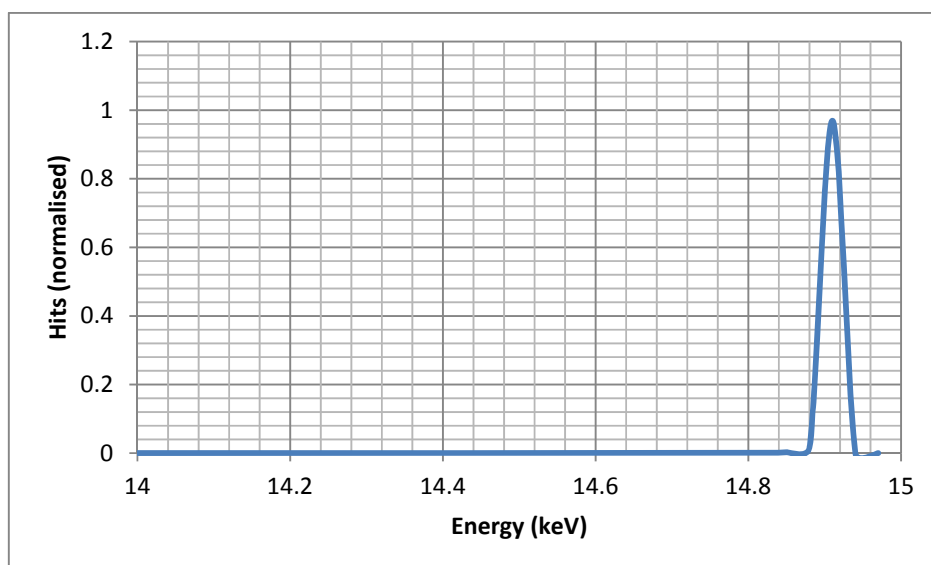


15nm CeO₂ particle

- 15nm deep sample
- Minority carrier diffusion length 5nm
- Surface recombination 0.25 (where 0 = perfect sink and 1 = reflector)

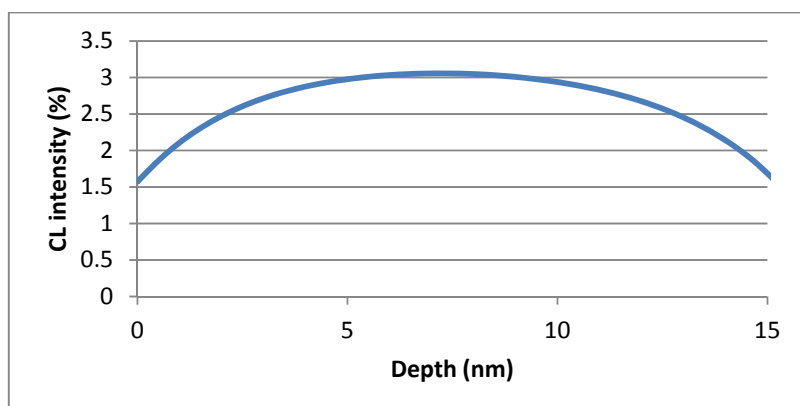
Transmitted energy calculated to be: 99.1%

Energy distribution of transmitted electrons:



CL Emission as a function of depth within the CeO₂ nanoparticle:

Reasonably uniform emission from within the particle



ESI-Fig. 2

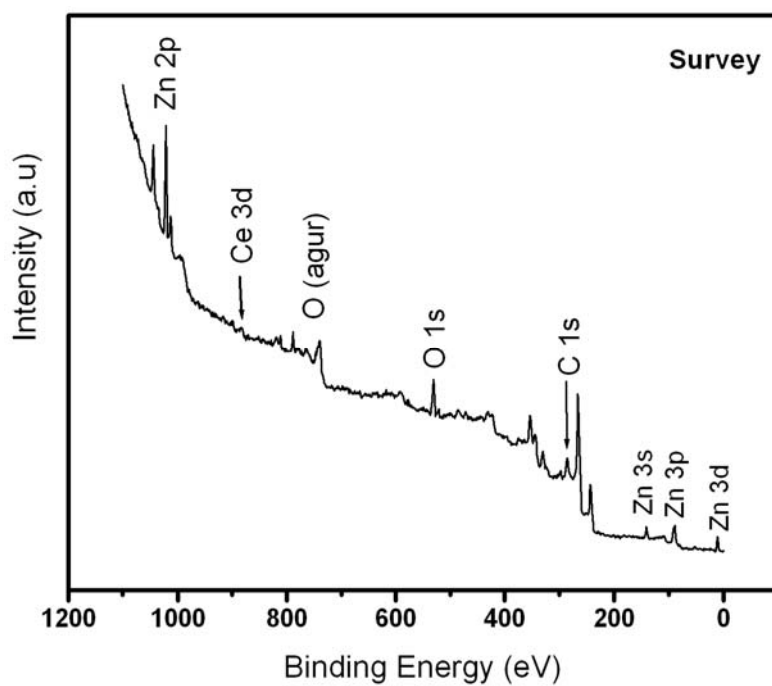


Fig. 2 XPS survey of as-synthesized CeO₂-ZnO nanocomposites

ESI-Fig. 3

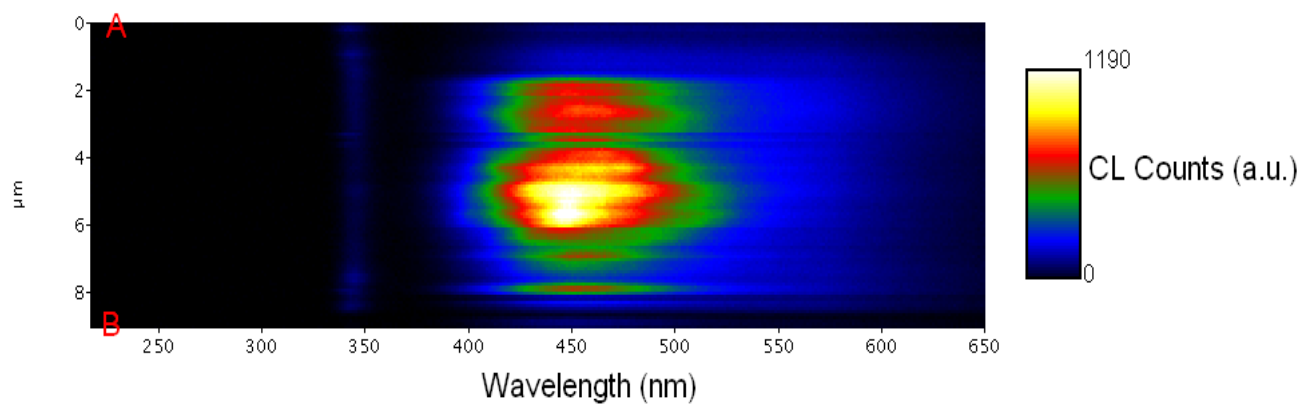


Fig. 3 2D view of 100 spectra over a 9 μm length i.e. a spectrum recorded every 90 nm which corresponds approximately to the spatial resolution.

ESI-Fig. 4

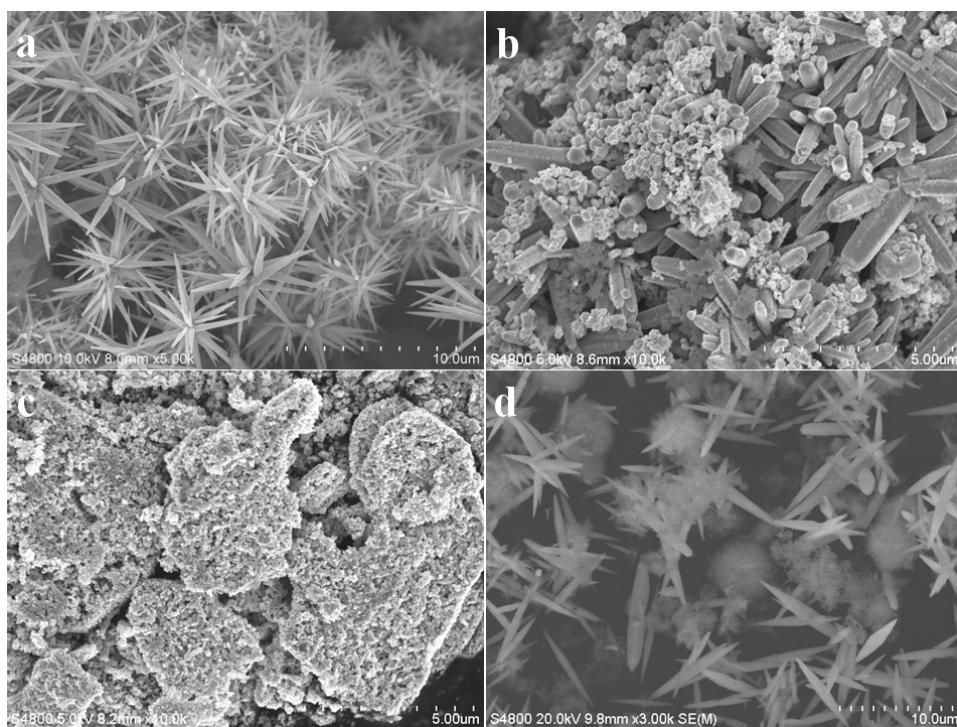


Fig. 4 FESEM micrographs of (a) ZnO nanostructured in mixture of EG: H₂O (3:1), (b) CeO₂-ZnO nanocomposite in mixture of H₂O: ethanol: EG (1:2:2), (c) CeO₂-ZnO nanocomposite in mixture of H₂O: ethanol (1:3) and (d) CeO₂-ZnO nanocomposite in H₂O.