Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

ZnS/ZnO@CNT and ZnS@CNT nanocomposites by gas phase conversion of ZnO@CNT. A systematic study of their photocatalytic properties.

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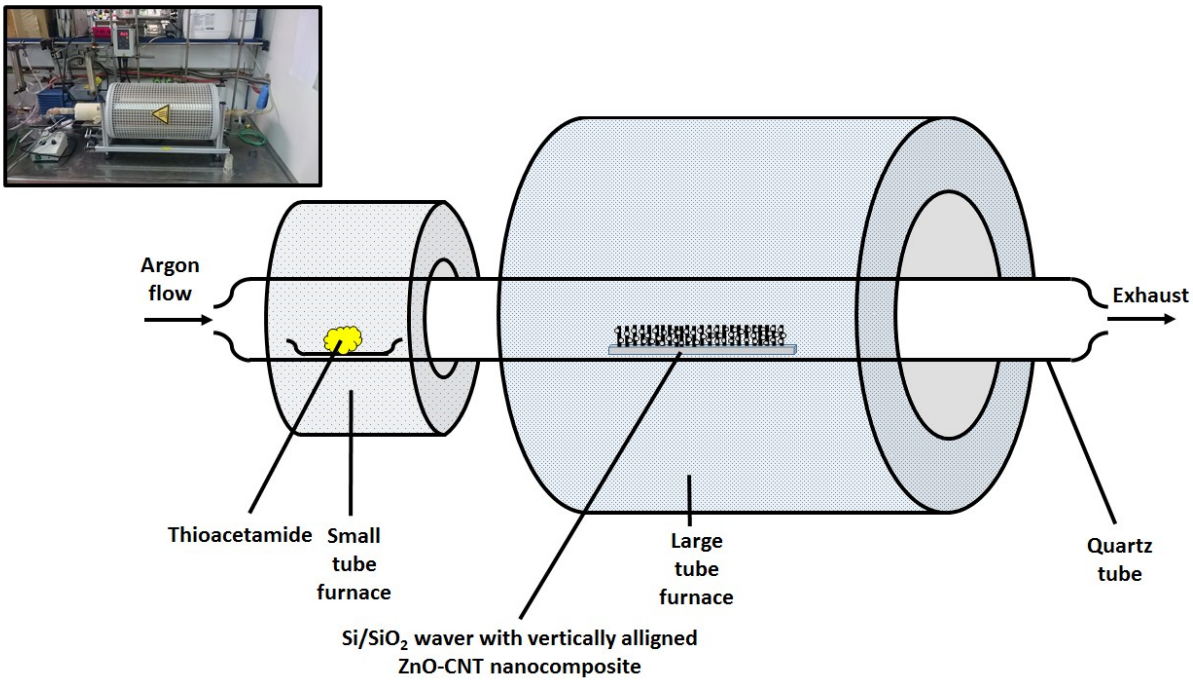


Figure S1. Experimental setup for the gas-phase conversion of the ZnO@CNT nanocomposite using thioacetamide as sulfur precursor.

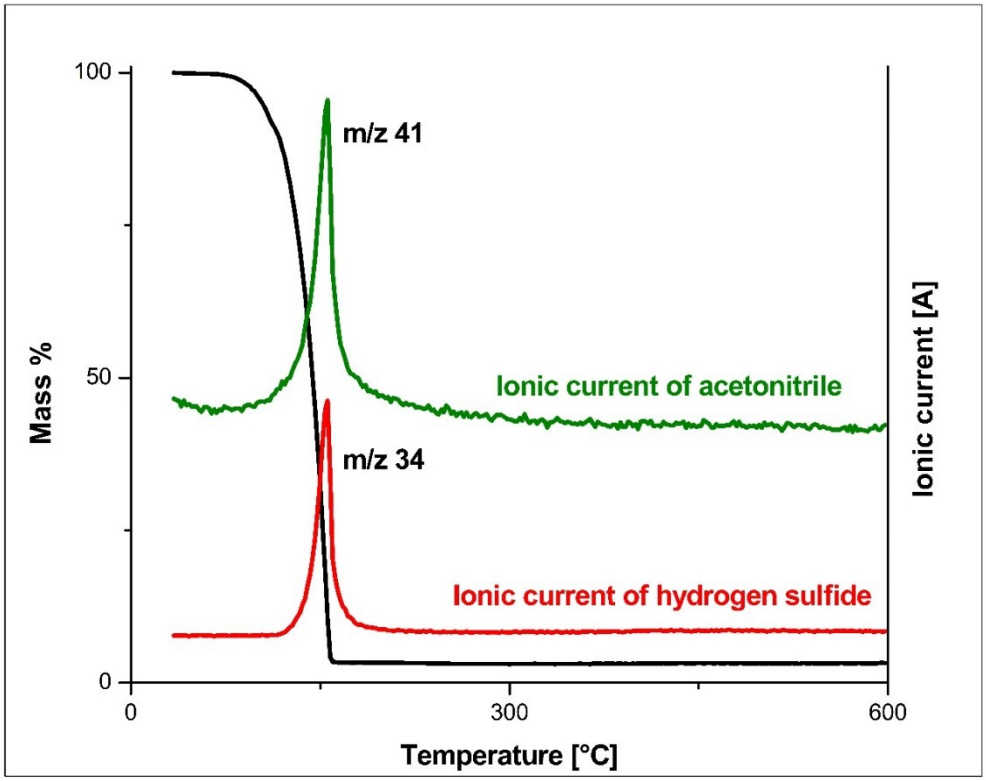


Figure S2. TGA-MS of thioacetamide precursor under argon as inert atmosphere showing the ionic current of the decomposition products hydrogen sulfide and acetonitrile.

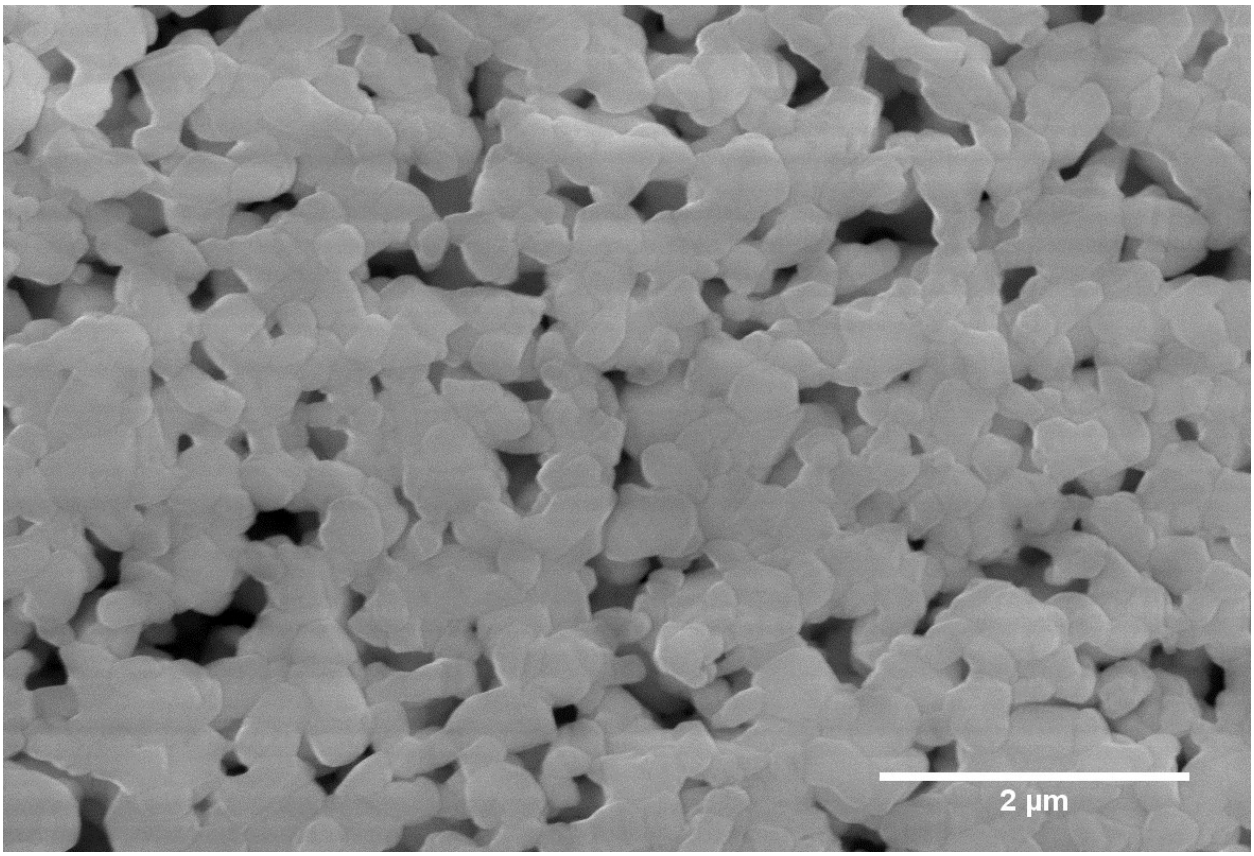


Figure S3. SEM of ZnS@CNT nanocomposite formed from ZnO@CNT through reaction with hydrogen sulfide at 950°C for 5min.

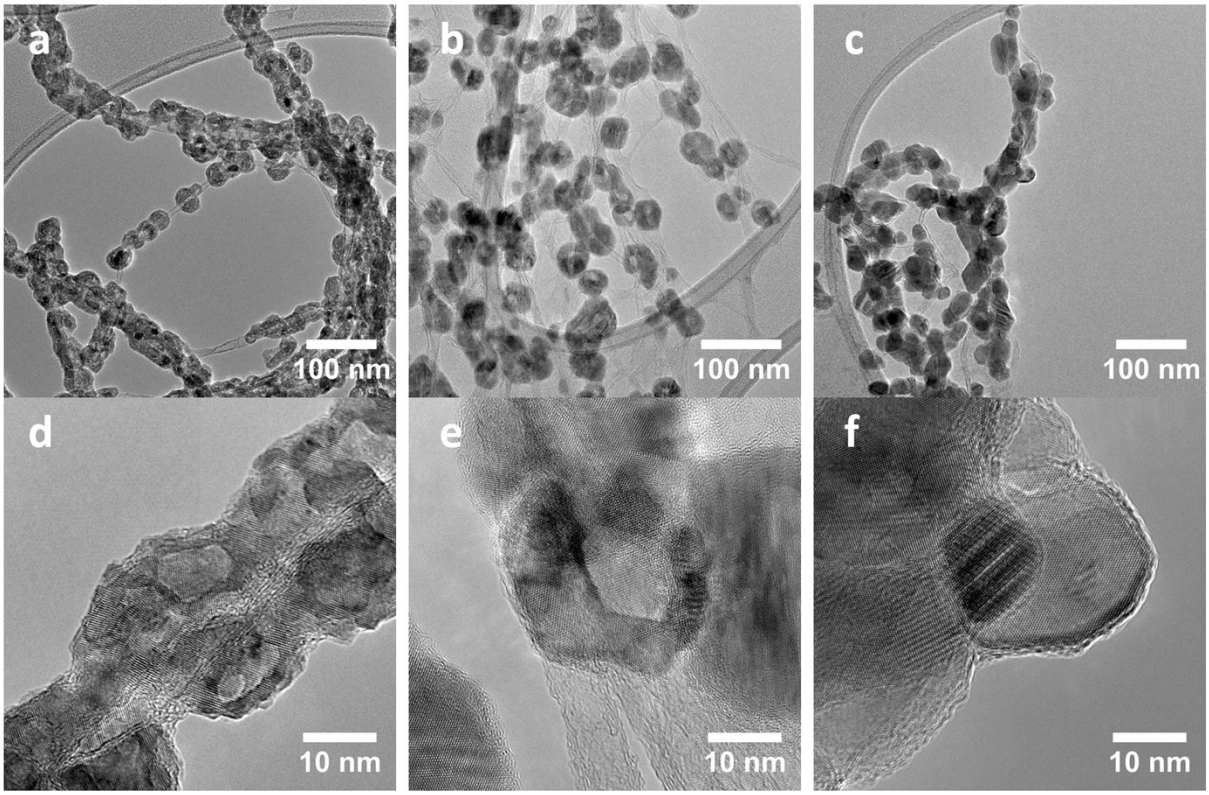


Figure S4. TEM images of (a) ZnS/ZnO@CNT nanocomposite synthesized at 350°C for 5 min, (b) ZnS@CNT nanocomposite synthesized at 500°C for 5 min and (c) ZnS@CNT nanocomposite synthesized at 750°C for 5 min. HRTEM of (d) ZnO@ZnS particles tethered onto a CNT showing the void formation in the nanoparticle, (e) ZnS particle (500°C-5 min) tethered onto a CNT showing the void formation in the nanoparticle and (f) ZnS particle (750°C-5 min) tethered onto a CNT showing the formation of solid particles.

Table S1. EDX elemental microanalysis of ZnO@CNT nanocomposite after reacting with hydrogen sulfide under different argon flow rates.

Parameters	**Element**	**Atomic %**	
		200 sccm	**600 sccm**
350°C/5min	**Zn**	51.95	52.63
	S	30.01	30.18
	O	18.04	17.18
500°C/5min	**Zn**	48.03	49.61
	S	45.29	45.82
	O	6.67	4.57

Table S2. EDX elemental microanalysis of ZnO@CNT nanocomposite after reacting with hydrogen sulfide at different temperatures and reaction time.

Temperature	Element	Atomic %		
		1 min	5 min	30 min
300°C	**Zn**	---	58.04	57.84
	S	---	10.65	11.69
	O	---	31.31	30.47
350°C	**Zn**	51.30	52.63	---
	S	21.39	30.18	---
	O	27.31	17.18	---
400°C	**Zn**	50.41	50.37	---
	S	43.33	42.18	---
	O	6.26	7.45	---
500°C	**Zn**	49.22	51.12	47.91
	S	45.16	43.29	45.54
	O	5.62	5.59	6.55
650°C	**Zn**	48.26	49.07	57.22
	S	45.60	45.43	38.69
	O	6.13	5.50	4.09
950°C	**Zn**	---	51.53	61.45
	S	---	48.47	38.55
	O	---	---	---

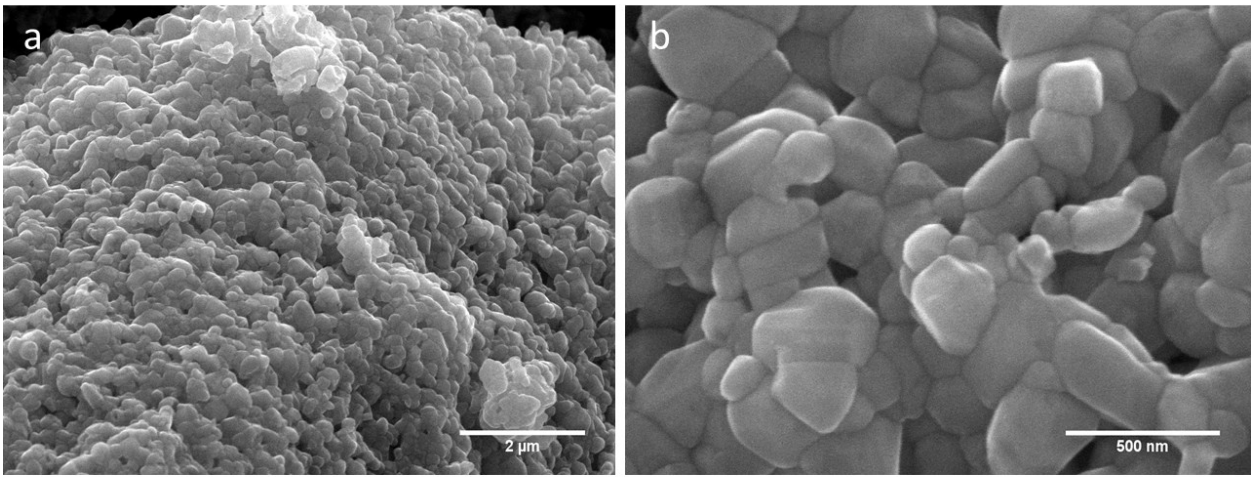
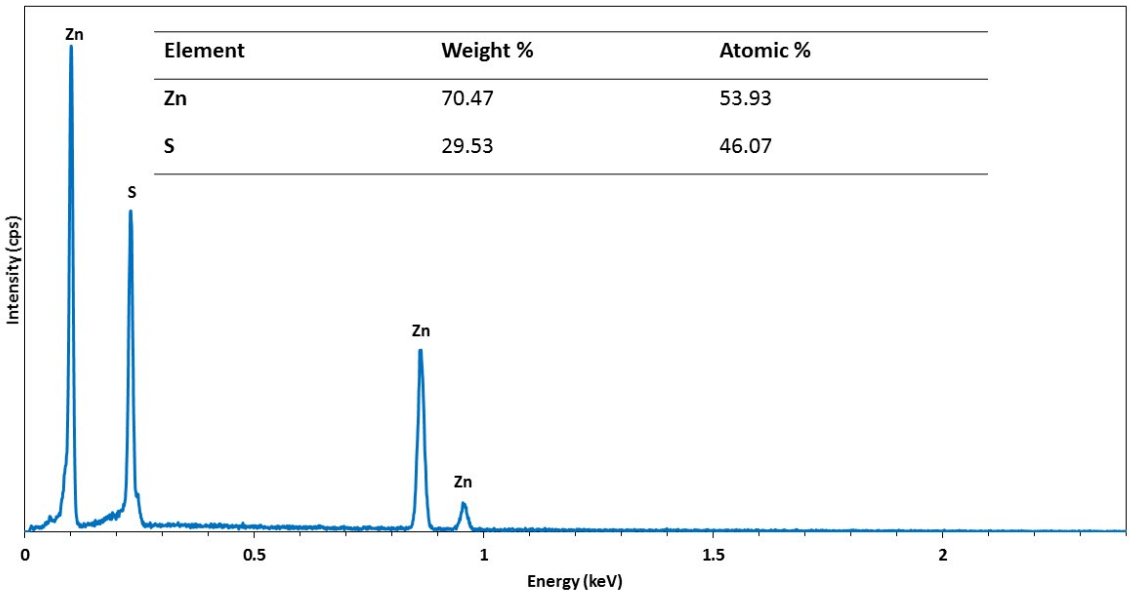


Figure S5. SEM of ZnS nanopowder synthesized by conversion of ZnO nanopowder with hydrogen sulfide at 750°C for 1h (a) low magnification, (b) high magnification.



Element	Weight %	Atomic %
Zn	70.47	53.93
S	29.53	46.07

Figure S6. EDX elemental microanalysis of the ZnS nanopowder synthesized through conversion of ZnO nanopowder by hydrogen sulfide at 750°C for 1 h.

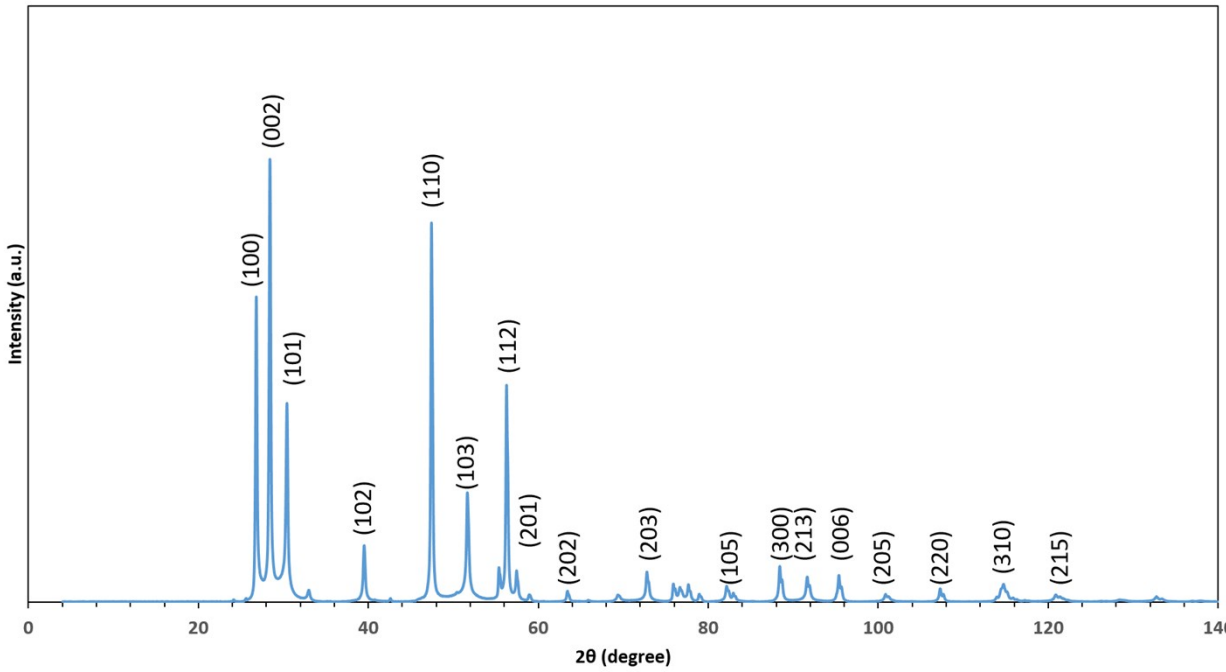


Figure S7. XRD diffraction pattern obtained for the ZnS nanopowder synthesized through conversion of ZnO nanopowder by hydrogen sulfide at 750°C for 1 h showing the main reflexes for ZnS wurtzite structure.

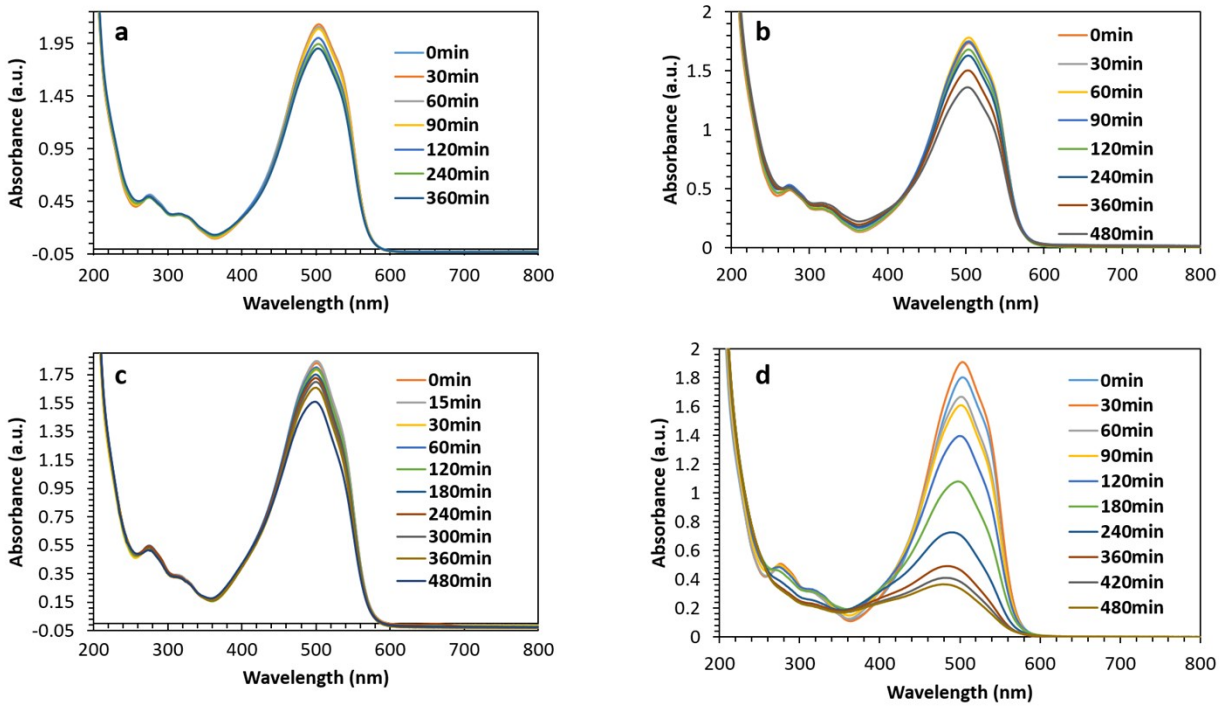


Figure S8. UV-VIS absorption spectra of methyl orange during photocatalysis under simulated sunlight (a) without photocatalyst (photolysis), (b) with 1 mg pristine CNT, (c) with 1 mg ZnO@CNT nanocomposite (20 nm particle size) and (d) with 1 mg ZnS@CNT nanocomposite (20 nm particle size) obtained at 750°C for 5 min.

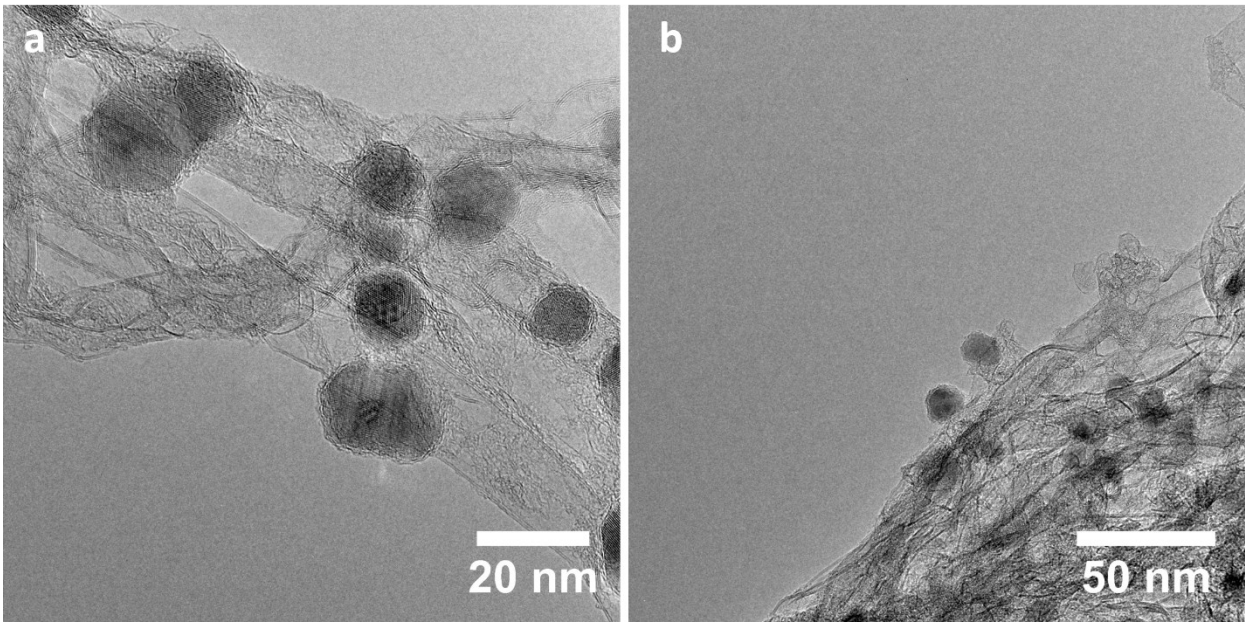


Figure S9. TEM image for the ZnS@CNT nanocomposite synthesized at 750°C for 5 min (a) before and (b) after photocatalysis.