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Synthesis of SnO_2, Zn-doped SnO_2 and Zn_2SnO_4 Nanostructure-based Hierarchical Architectures by using Deep Eutectic Precursors and their Photocatalytic Application

Fatemeh Zahmatkeshani,[a] and Maryam Tohidi[a]*

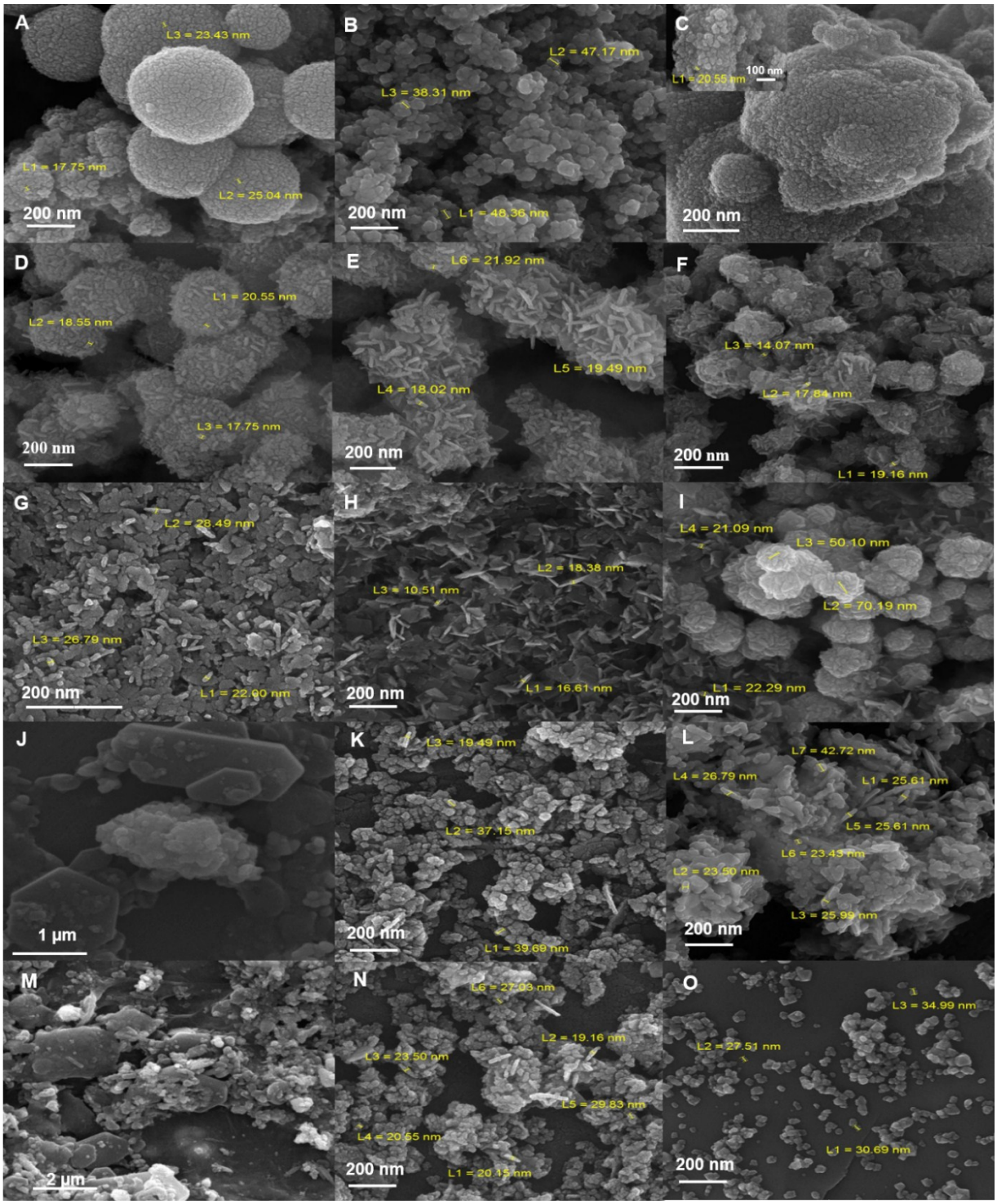


Figure S1. FESEM images of synthesized Zn containing SnO_2 structures in H_2O with different pH containing (A) ZS0-1-120 (1/1), (B) ZS0-1-140 (1/1), (C) ZS0-1-180 (1/1), (D) ZS0-2-120 (1/1), (E) ZS0-2-140 (1/1), (F) ZS0-2-180 (1/1), (G) ZS0-4-180 (1/1), (H) ZS0-4-220 (1/1) and (I) ZS0-4-220 (1/1) with different magnification, (J) ZS0-7-140 (1/1), (K) ZS0-7-180 (1/1), (L) ZS0-7-220 (1/1), (M) ZS0-10-140 (1/1), (N) ZS0-10-180 (1/1) and (O) ZS0-10-220 (1/1).

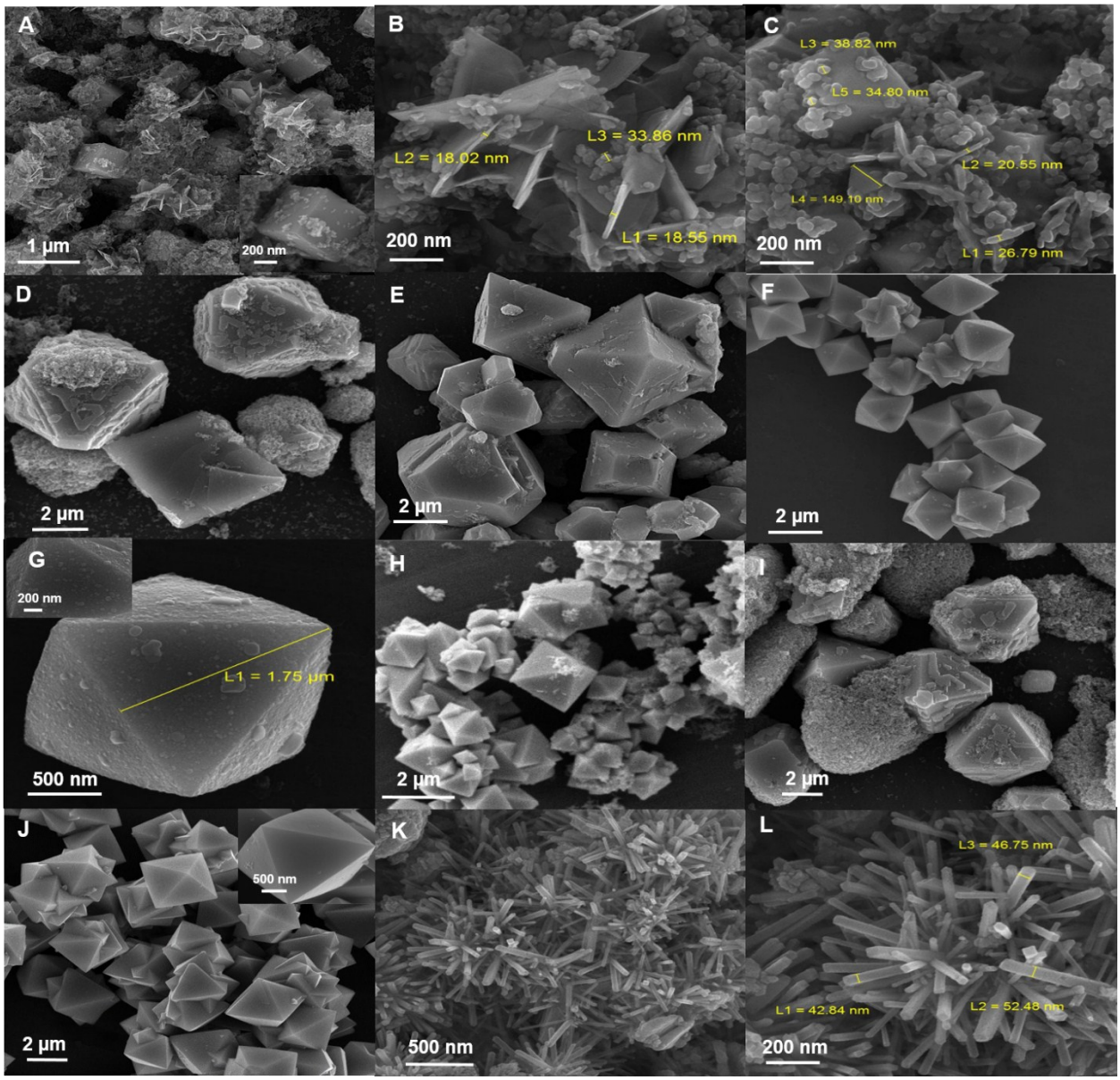


Figure S2. FESEM images of synthesized Zn containing SnO_2 structures in H_2O with different pH containing (A) and (B) ZS0-11-180 (1/1) 11 with higher magnification, (C) ZS0-11-220 (1/1), (D) ZS0-12-120 (1/1), (E) ZS0-12-140 (1/1), (F) and (G) ZS0-12-180 (1/1) with higher magnification and (H) ZS0-12-220 (1/1), (I) ZS0-12.3-120 (1/1), (J) ZS0-12.3-180 (1/1), (K) and (L) ZS0-13-180 (1/1) with higher magnification.

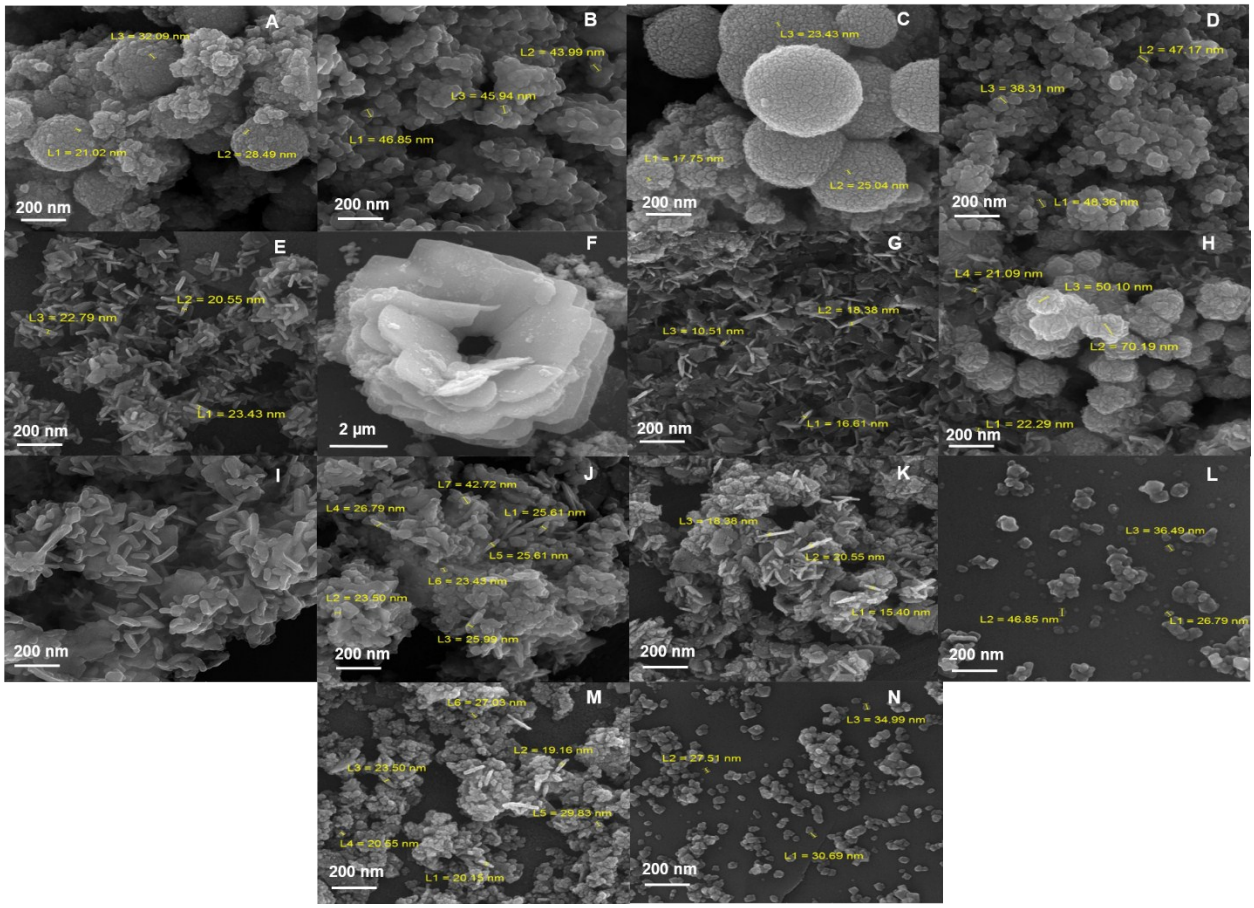


Figure S3. FESEM images of synthesized Zn containing SnO_2 structures in H_2O containing (A) ZS0-1-120 (1/10), (B) ZS0-1-140 (1/10), (C) ZS0-1-120 (1/1), (D) ZS0-1-140 (1/1), (E) and (F) ZS0-4-220 (1/10) with different magnification, (G) and (H) ZS0-4-220 (1/1) with different magnification, (I) ZS0-7-220 (1/10), (J) ZS07-220 (1/1), (K) ZS0-10-180 (1/10), (L) ZS0-10-220 (1/10), (M) ZS0-10-180 (1/1) and (N) ZS0-10-220 (1/1).

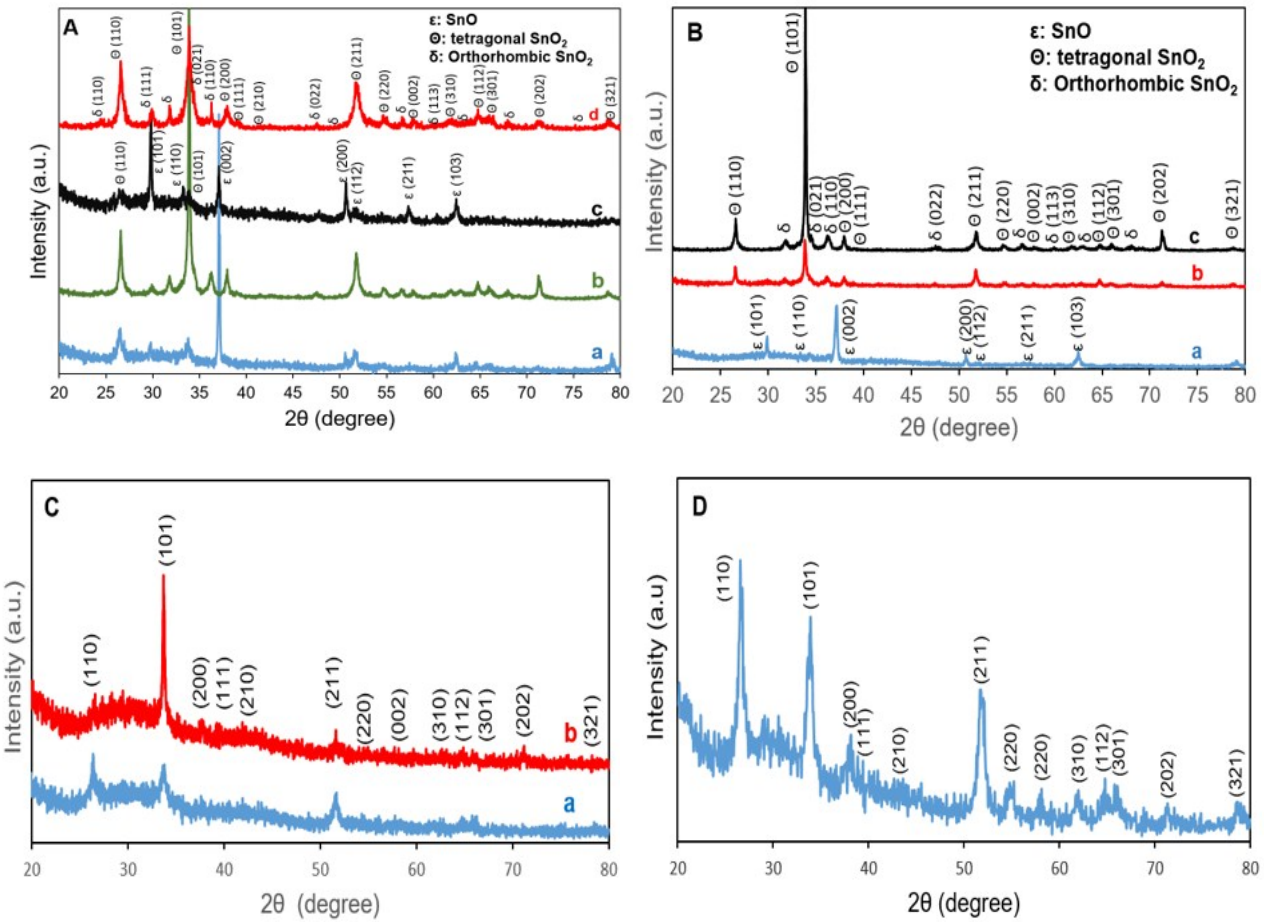
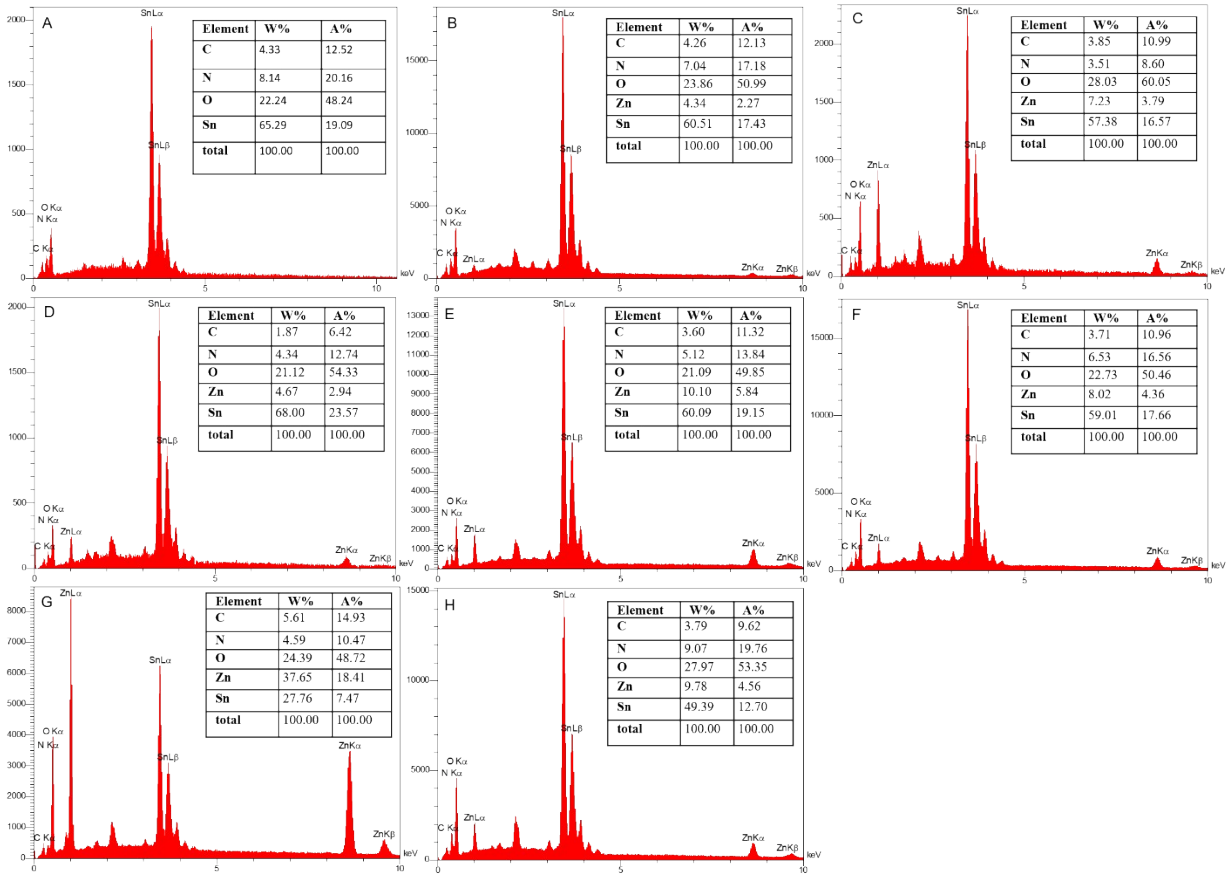


Figure S4. XRD patterns of A) ZS0-4-220 (1/1) (a), ZS1-4-220 (1/1) (b), ZS0-7-220 (1/1) (c) and ZS1-7-220 (1/1) (d), B) ZS0-10-220 (1/1) (a), ZS1-10-220 (1/1) (b) and ZS1-11-180 (1/1) (c), C) ZS1-12-120 (1/10) (a) and ZS1-12-180 (1/10) (b) and D) ZS1-13-180 (1/1).



Element	W%	A%
C	4.33	12.52
N	8.14	20.16
O	22.24	48.24
Sn	65.29	19.09
total	100.00	100.00

Element	W%	A%
C	4.26	12.13
N	7.04	17.18
O	23.86	50.99
Zn	4.34	2.27
Sn	60.51	17.43
total	100.00	100.00

Element	W%	A%
C	3.85	10.99
N	3.51	8.60
O	28.03	60.05
Zn	7.23	3.79
Sn	57.38	16.57
total	100.00	100.00

Element	W%	A%
C	1.87	6.42
N	4.34	12.74
O	21.12	54.33
Zn	4.67	2.94
Sn	68.00	23.57
total	100.00	100.00

Element	W%	A%
C	3.60	11.32
N	5.12	13.84
O	21.09	49.85
Zn	10.10	5.84
Sn	60.09	19.15
total	100.00	100.00

Element	W%	A%
C	3.71	10.96
N	6.53	16.56
O	22.73	50.46
Zn	8.02	4.36
Sn	59.01	17.66
total	100.00	100.00

Element	W%	A%
C	5.61	14.93
N	4.59	10.47
O	24.39	48.72
Zn	37.65	18.41
Sn	27.76	7.47
total	100.00	100.00

Element	W%	A%
C	3.79	9.62
N	9.07	19.76
O	27.97	53.35
Zn	9.78	4.56
Sn	49.39	12.70
total	100.00	100.00

Figure S5. The EDX spectra of (A) S0-2-140, (B) ZS0-2-140 (1/1), (C) ZS1-10-220 (1/1), (D) ZS1-11-180 (1/1), (E) ZS1-12-120 (1/10), (F) ZS1-12-180 (1/10), (G) ZS1-12-180 (1/1) and (H) ZS1-13-220 (1/1). Zn peak observed in Zn containing SnO_2 structures besides Sn and O. C and N peaks can be related to Ch component of DES precursors on the surface. Note that some other spectral lines observed in the EDX spectrum originate from the Au sputtering and substrate.

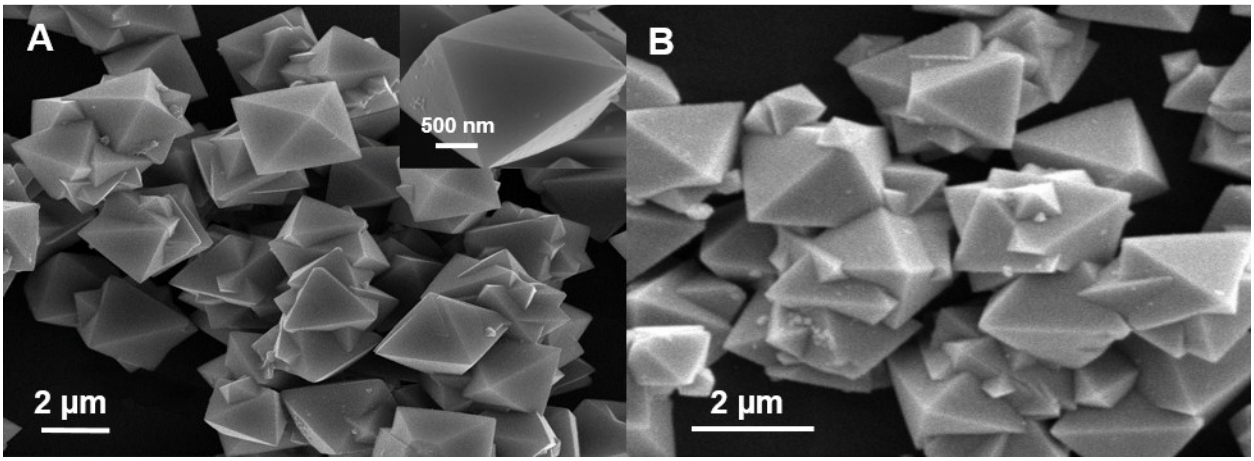


Figure S6. FESEM and SEM images of (A) ZS0-12.3-180 (1/1) and (B) ZS1-12.3-180 (1/1), respectively.

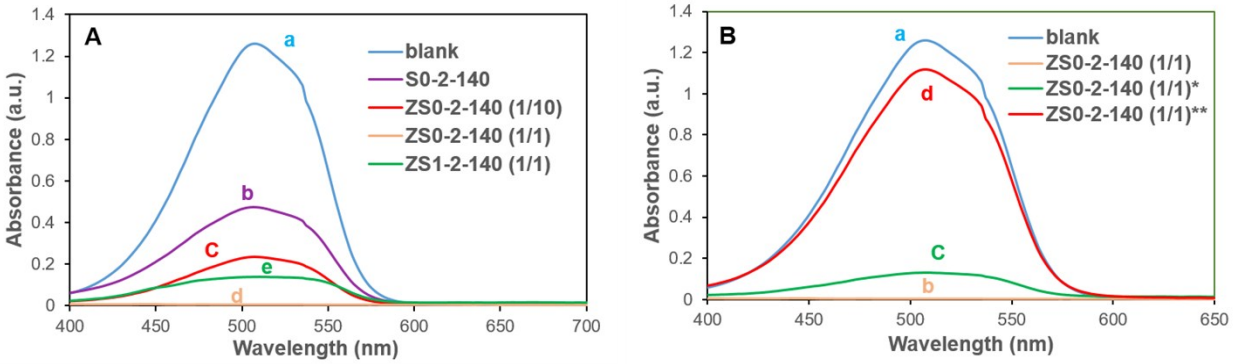


Figure S7. Variations of the adsorption spectra of the MO dye solution (a) in the presence of (A) S0-2-140 (b), ZS0-2-140 (1/10) (c), ZS0-2-140 (1/1) (d) and ZS1-2-140 (1/1) (d) and (B) ZS0-2-140 (1/1) (b), ZS0-2-140 (1/1)* (c) and ZS0-2-140 (1/1)** (d).

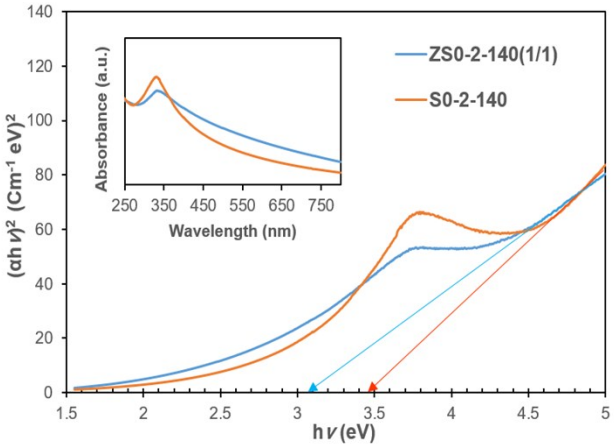


Figure S8. Band-gap and UV-Vis spectra of S0-2-140 and ZS0-2-140 (1/1).

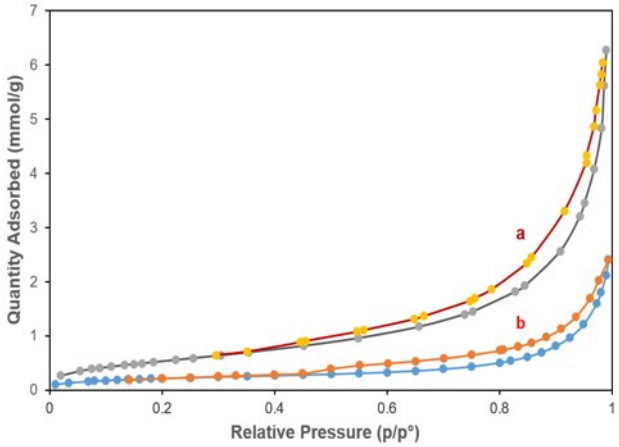


Figure S9. N_2 adsorption-desorption isotherms of (a) ZS0-2-140 (1/1) and (b) ZS0-2-140 (1/1)*.

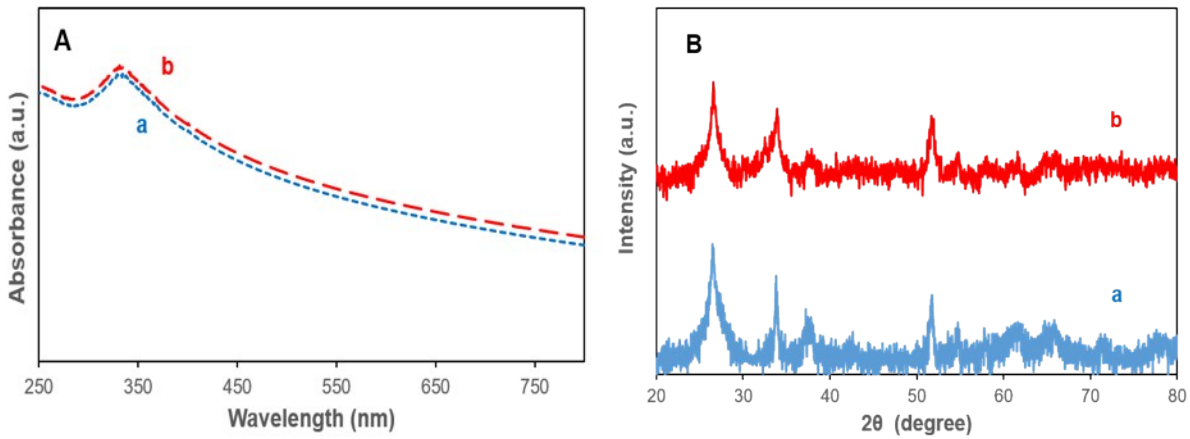


Figure S10. (A) UV-Vis spectra and (B) XRD of ZS0-2-140 (1/1) before (a) and after (b) photocatalytic process.