

Magnetron Sputtering as a Solvent-Free Method for Fabrication of Nanoporous ZnO Thin Films for Highly Efficient Photocatalytic Organic Pollution Degradation

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Photolysis of hydrogen peroxide

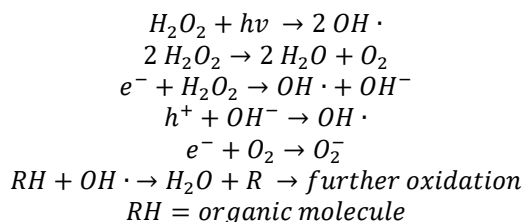


Figure S1. Mechanism of photolysis of hydrogen peroxide.

Thickness of the films

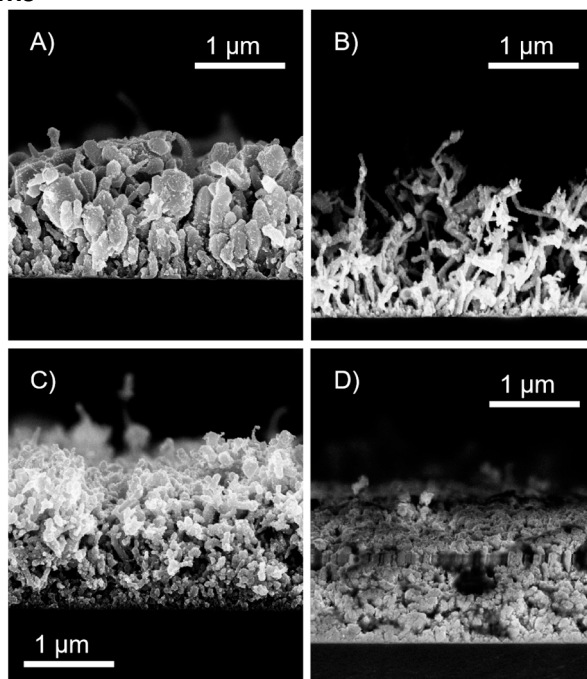


Figure S2. SEM cross-section images of samples A, B, C and D.

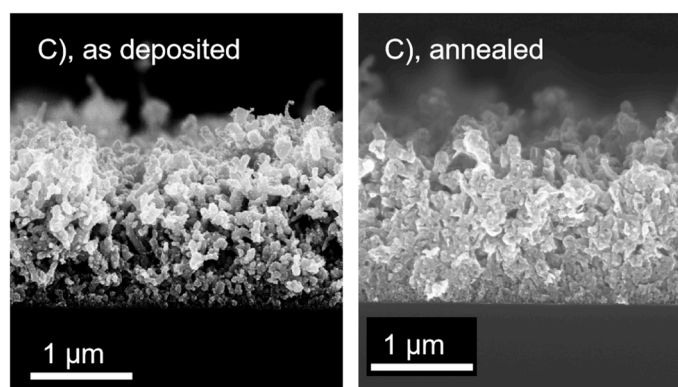


Figure S3. SEM cross-section of sample C as-deposited and after annealing showing no significant change in thickness.

Photocatalysis measurement

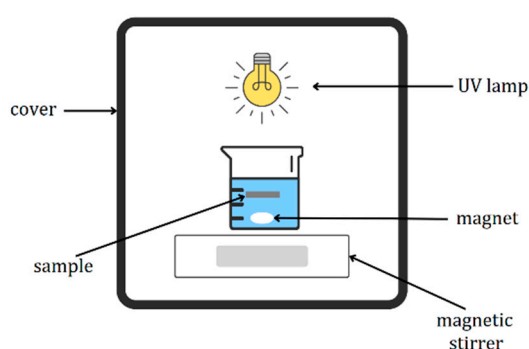


Figure S4. Schematic drawing of the photocatalysis stand.

Emission of ZnO thin films

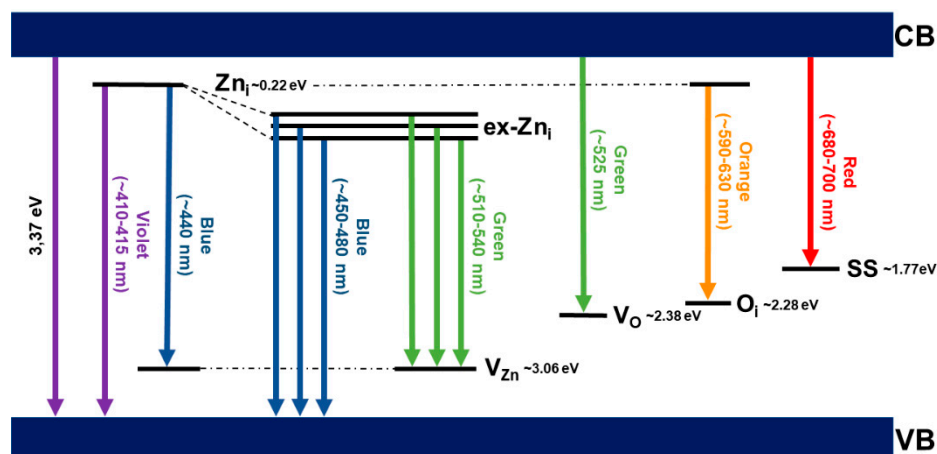


Figure S5. Mechanism for visible emission of ZnO thin films.

Calculation of the core size of a single crystallite

The crystallite size of the prepared samples was calculated using Scherrer's formula:

$$D = \frac{K\lambda}{\beta \cos \theta}$$

where K is shape factor, λ is wavelength of the X-ray, β is the peak width at half maximum, and θ is the Bragg's angle of reflection.

Table S1. Comparison of the core size of the obtained ZnO thin films.

Oxidation temperature (°C)	Core size (nm)			
	Sample A	Sample B	Sample C	Sample D
None (Zn)	35.02 ± 4.08	28.91 ± 3.84	27.56 ± 1.94	21.56 ± 1.24
400	21.05 ± 5.87	16.57 ± 3.54	20.00 ± 5.55	16.58 ± 4.82
600	34.49 ± 6.84	22.97 ± 3.77	29.31 ± 8.06	28.92 ± 7.62
800	43.01 ± 6.32	35.35 ± 3.82	43.78 ± 1.56	47.72 ± 9.55

Calculation of the percentage degradation of methylene blue over time for thin layers of ZnO with different morphologies as a photocatalyst

The percentage of photocatalytic degradation was calculated using the following equation:

$$\text{Percentage photodegradation} = \frac{C_0 - C}{C_0} * 100\%,$$

where C_0 is the initial concentration of dye before photo irradiation and C is the concentration of dye after photo irradiation.

Table S2. Comparison of methylene blue percentages degradation over time for catalysts - porous ZnO films with different morphologies annealed at different temperatures.

Sample A	nm	d%	Sample B	nm	d%	Sample C	nm	d%	Sample D	nm	d%
Ref.	663	-	Ref.	663	-	Ref.	663	-	Ref.	663	-
400°C	662	2	400°C	659	24	400°C	661	18	400°C	660	20
600°C	654	37	600°C	660	29	600°C	654	39	600°C	656	32
800°C	661	7	800°C	642	55	800°C	660	35	800°C	657	37

Calculation of photocatalysis efficiency on 1 mg of photocatalyst - ZnO thin films with different morphology

Table S3. Comparison of photocatalysis efficiency methylene blue on 1mg photocatalyst - ZnO thin films with different morphologies annealed at different temperatures.

Sample A	Mmol/mg	Sample B	Mmol/mg	Sample C	Mmol/mg	Sample D	Mmol/mg
Ref.	-	Ref.	-	Ref.	-	Ref.	-
400°C	$1.564 \cdot 10^{-6}$	400°C	$1.867 \cdot 10^{-5}$	400°C	$1.408 \cdot 10^{-5}$	400°C	$1.564 \cdot 10^{-5}$
600°C	$2.893 \cdot 10^{-5}$	600°C	$2.268 \cdot 10^{-5}$	600°C	$3.049 \cdot 10^{-5}$	600°C	$2.502 \cdot 10^{-5}$
800°C	$5.474 \cdot 10^{-6}$	800°C	$4.301 \cdot 10^{-5}$	800°C	$2.737 \cdot 10^{-5}$	800°C	$2.893 \cdot 10^{-5}$