Supporting Information

One-pot synthesis of monodisperse Zn coordination polymer micro/nanostructures and their transformation to mesoporous ZnO photocatalyst

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Experimental details

Synthesis of Zn-CPs. All chemicals were obtained commercially and used as received without further purification. In a typical procedure, 3,5-pyridinedicarboxylic acid (H_2pydc, 0.1 mmol) and NaOH (0.2 mmol) were dissolved in the mixed solvent of THF (7.5 mL) and deionized water (6.5 mL) and stirred for a few minutes to prepare the solution of Na_2pydc. Then, 1 mL aqueous solution of $Zn(NO_3)_2$ (0.1 M) was dropped into above Na_2pydc solution and a white precipitate was formed immediately. After 10 min of stirring, the precipitate was collected by centrifugation, washed with ethanol for three times, and dried at 60 ^oC for 6 h. The obtained sample was defined as Zn-CP-1.

The synthesis procedures of Zn-CP-2 and Zn-CP-3 are similar to that of Zn-CP-1 except that the Na_2pydc solution was prepared with the mixed solvent of DMSO/H_2O (7.5 mL/6.5 mL) and 1,4-dioxane/H_2O (15 mL/8 mL), respectively.

Synthesis of ZnO micro/nanostructures. ZnO samples were obtained by the calcination of Zn-based CPs in air at 500 ^oC for 1 h with a heating rate of 1 ^oC min^{-1}. The samples obtained from Zn-CP-1, Zn-CP-2 and Zn-CP-3 were named as ZnO-1, ZnO-2 and ZnO-3, respectively.

Characterization of Zn-CP and ZnO samples. Scanning electron microscope (SEM) images were taken with a JEOL JSM-7500F scanning electron microscope. Transmission electron microscopy (TEM) images were obtained with JEM-2010FEF transmission electron microscope operating at 200 kV. Powder X-ray diffraction (PXRD) was performed on a Rigaku D/max-2500 diffractometer with Cu Kα radiation (λ=0.15406 nm) at 40 kV and 100 mA. Elemental analysis (C, H, and N) was carried out with a Perkin-Elmer 240C analyzer. Thermogravimetric analysis (TGA) was operated on a Rigaku standard TG-DTA analyzer from ambient temperature to 700 °C with a heating rate of 10 °C min^{-1} in the air, and an empty Al_2O_3 crucible was used as the reference. Fourier transform infrared spectroscopy (FT-IR) was measured using a MAGNA-560 Fourier transform infrared spectrometer with nujol mull method. N_2 adsorption-desorption isotherm measurement was operated on a V-Sorb2800P surface area and pore size analyzer.

Photocatalytic degradation experiments. Rhodamine B (RhB) was used as the substrate to characterize the photocatalytic activities of the as-prepared ZnO powders. 40 mg of ZnO sample was dispersed into 80 mL aqueous solution of RhB (5 mg L^{-1}). The suspension was sonicated for 20 min and stirred in dark for another 30 min to ensurethe establishment of an adsorption–desorption equilibrium. Then, the suspension was exposed to the irradiation of a 500 W Xenon light source and sampled periodically. The degradation process of RhB was characterized with its absorption at 552 nm (measured by a UV-2450 spectrophotometer).

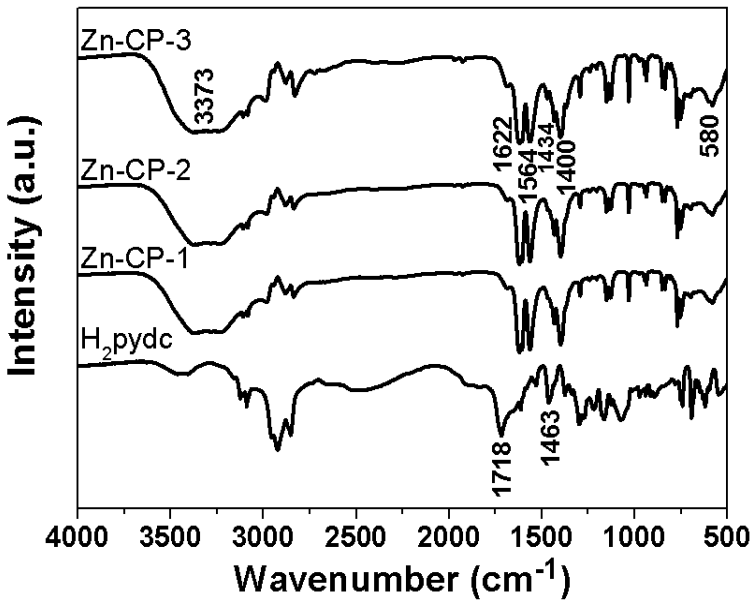

Fig. S1 FT-IR spectra of the as-prepared Zn-CPs and H_2pydc ligand.

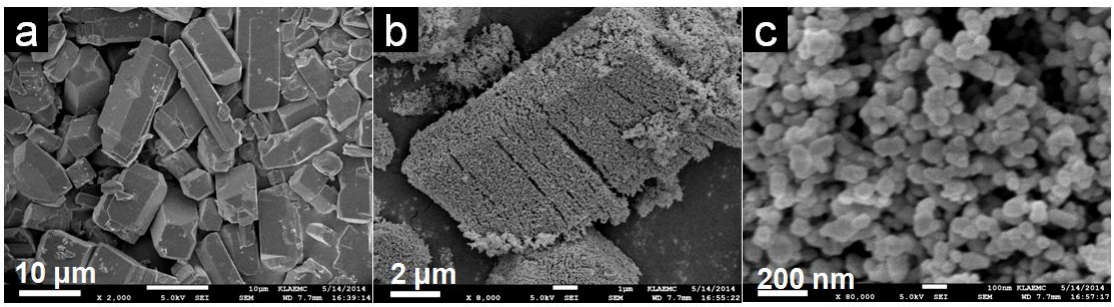

Fig. S2 SEM images of CP bulk crystals (a) and ZnO-bulk (b, c).

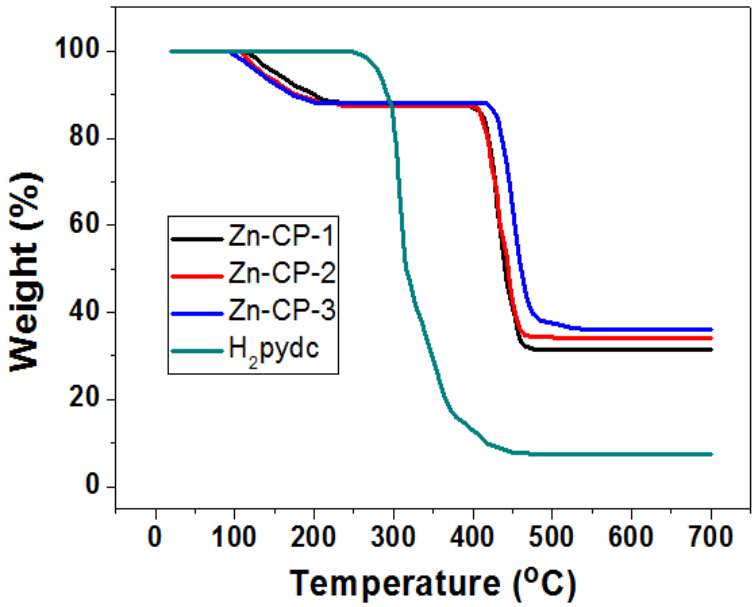

Fig. S3 TGA curves of the as-prepared Zn-CPs and H_2pydc ligand.

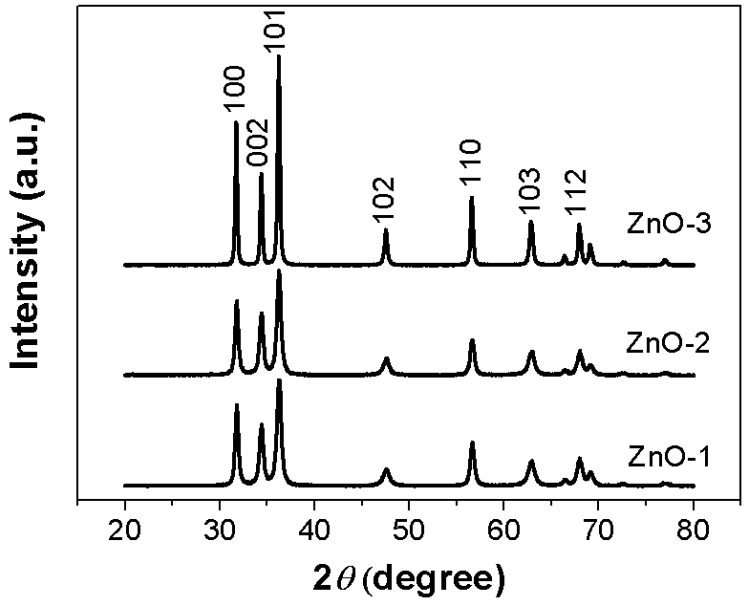

Fig. S4 PXRD patterns of the as-prepared ZnO micro/nanostructures.

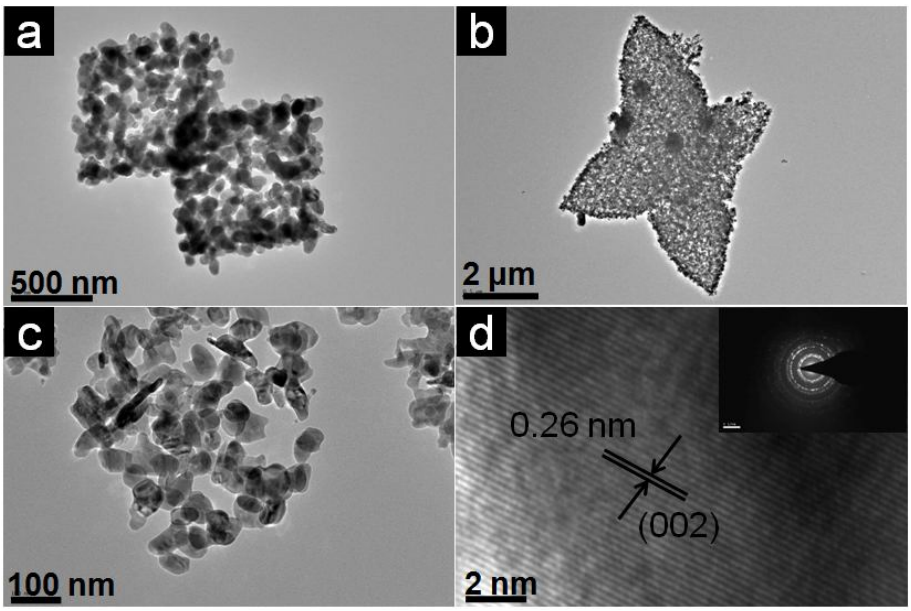

Fig. S5 TEM images of the as-prepared ZnO micro/nanostructures: (a) ZnO-1, (b) ZnO-2, (c) ZnO-3. (d) The typical HRTEM image and SAED pattern (inset) of ZnO-2, the adjacent lattice fringe distance of 0.26 nm corresponds to the (002) facet of wurtzite.

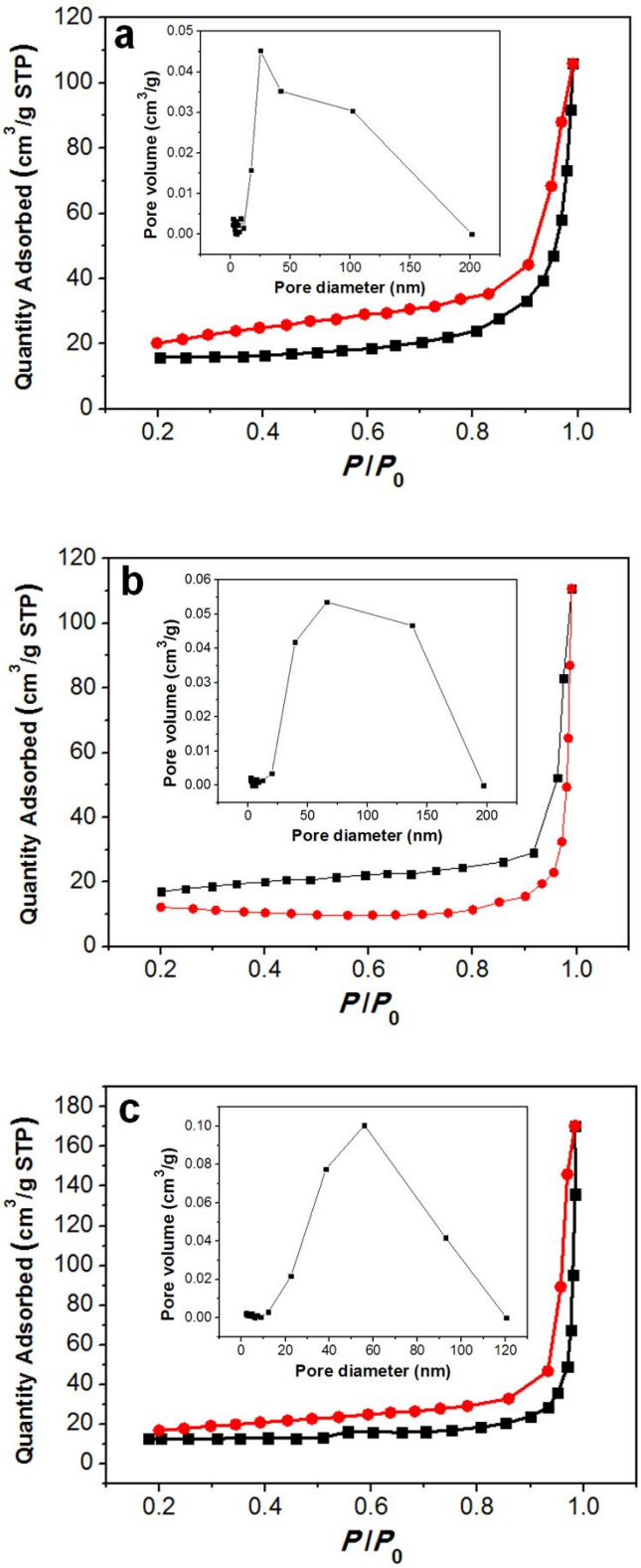

Fig. S6 N_2 adsorption-desorption isotherms of the as-prepared ZnO micro/nanostructures: (a) ZnO-1, (b) ZnO-2, (c) ZnO-3. Inset: the BJH pore-size distribution curves.

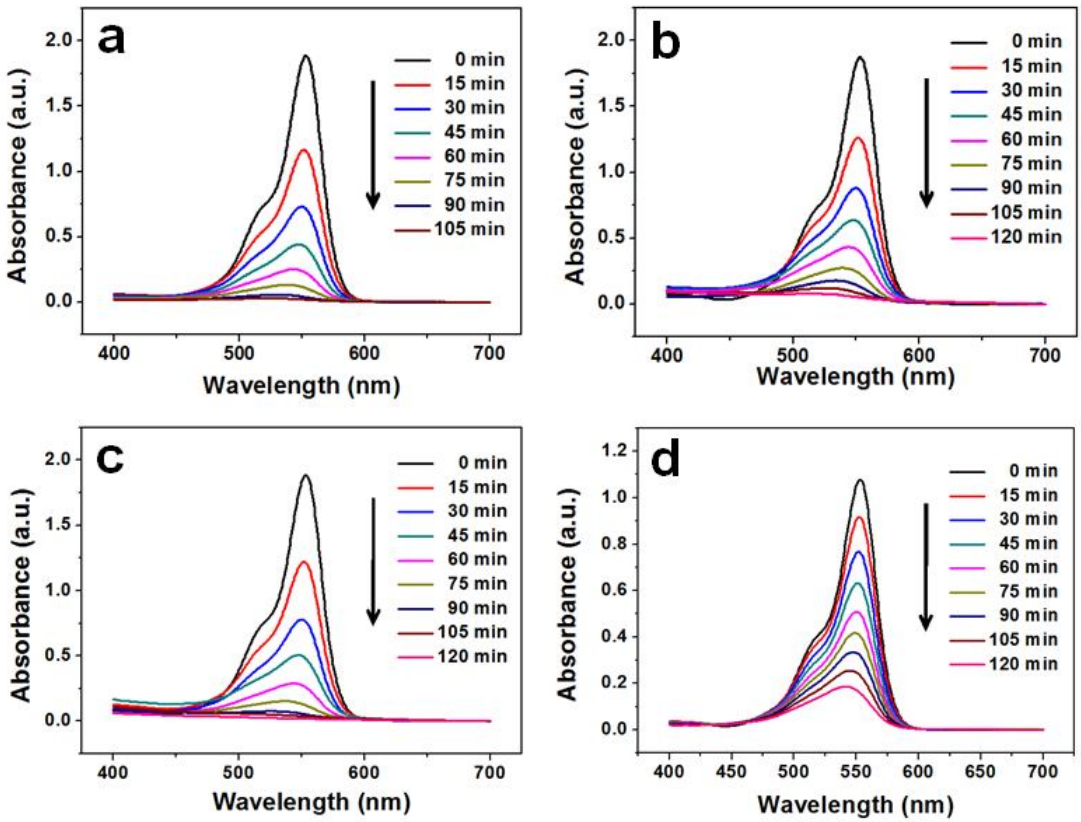

Fig. S7 UV-Vis absorbance spectra of the RhB solution during the degradation process with different ZnO samples: (a) ZnO-1, (b) ZnO-2, (c) ZnO-3, (4) ZnO-bulk.

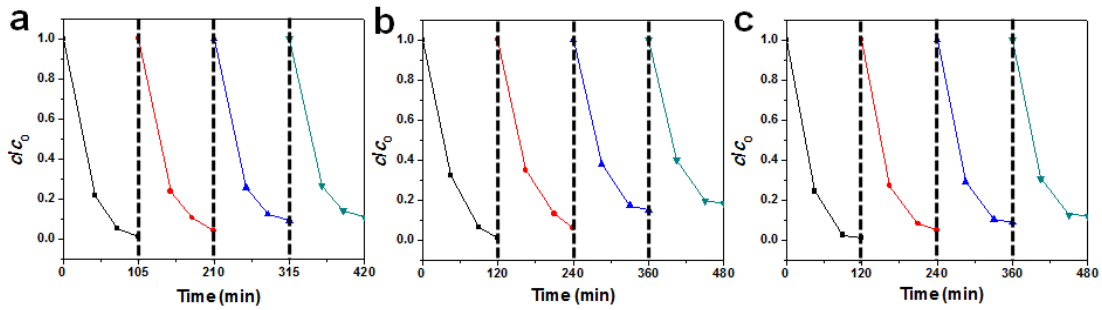

Fig. S8 Cyclic photodegradation of RhB with as-prepared ZnO samples as photocatalysts, 0.5 g L^{-1} ZnO, 5 mg L^{-1} RhB. (a) ZnO-1, (b) ZnO-2, (c) ZnO-3.

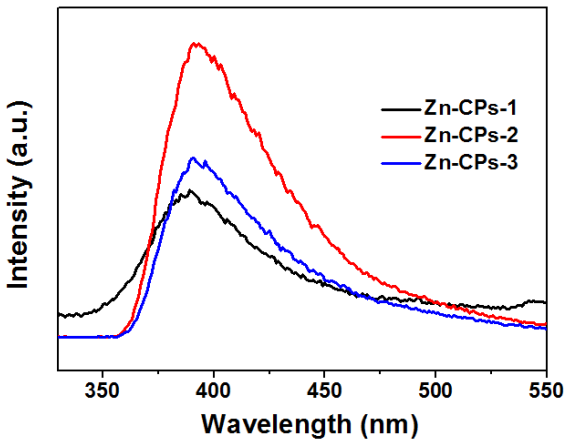

Fig. S9 Solid-state photoluminescent spectra of Zn-CP-1−3, λ_{ex} = 300 nm.

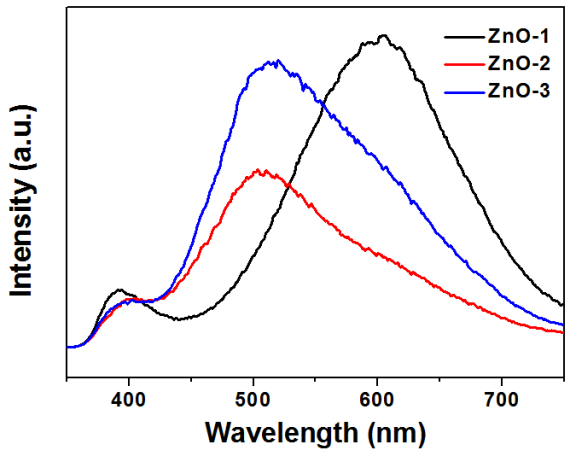

Fig. S10 Solid-state photoluminescent spectra of ZnO-1−3, λ_{ex} = 320 nm.

Table S1 EA results of the as-prepared Zn-CPs.

Zn-CPs	C%	H%	N%
Zn-CP-1	31.16	3.05	5.14
Zn-CP-2	31.54	3.13	5.29
Zn-CP-3	31.78	3.39	5.53
Zn(pydc)·2H_2O	31.31	3.38	5.22

Table S2 Weight loss percentages for the as-prepared Zn-CPs.

Zn-CPs	Weight (%)	
	25−250 ^oC	25−700 ^oC
Zn-CP-1	12	68.7
Zn-CP-2	12.5	65.8
Zn-CP-3	12.2	63.9
Zn(pydc)·2H_2O	13.42	69.69