

## Supporting Information

### **Metal-organic frameworks derived porous carbon mediated ZnO-nano-ZnO core-shell structure with excellent photocatalytic activity**

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## 1. Chemicals:

Zinc acetate dehydrate ( $\text{Zn}(\text{CO}_2\text{CH}_3)_2 \cdot 2\text{H}_2\text{O}$ ), Methyl alcohol ( $\text{CH}_3\text{OH}$ ), Sodium hydroxide ( $\text{NaOH}$ ), 1,2-Dimethylimidazole ( $\text{C}_5\text{H}_8\text{N}_2$ ), Methylene blue (MB), Ethanol absolute ( $\text{C}_2\text{H}_6\text{O}$ ) and N,N-dimethylformamide (DMF) were purchased from Macklin (Shanghai Macklin Biochemical Technology Co., Ltd) and used without further purification.

## 2. Materials synthesis

### 2.1 Synthesis of ZnO nanorods

1.0975 g  $\text{Zn}(\text{CO}_2\text{CH}_3)_2 \cdot \text{H}_2\text{O}$  was dispersed in 10 mL methyl alcohol. 1.0 g NaOH was dissolved in 20 mL methyl alcohol. Then the two solutions were mixed together and moved to the magnetic stirrer, and the mixed solution was stirred vigorously for 10 min at room temperature. The above solution was transferred to a 50 mL teflon-lined autoclave and heated at  $150^\circ\text{C}$  for 24 hours. The sediment was collected by centrifugation, washed twice each with deionized water and absolute ethanol, and dried overnight at  $60^\circ\text{C}$ .

### 2.2 Synthesis of ZnO@ZIF

0.3 g ZnO and 1, 2-dimethylimidazole were dispersed in 30 mL absolute ethanol, and the mass ratios of ZnO and 1, 2-dimethylimidazole were 1:0.25, 1:0.5, 1:1, 1:2, 1:5, 1:8, respectively. The above solution was transferred to a magnetic stirrer and stirred vigorously at room temperature for 24 h. The precipitate was collected by centrifugation, washed with absolute ethanol for several times, and dried at  $60^\circ\text{C}$ .

### 2.3 Synthesis of ZnO-nZnO@PC

Put the above ZnO@ZIF samples into the tubular furnace and pass through the Ar, then pass through the gas for half an hour before heating. It was then heated at  $650^\circ\text{C}$  for two hours. The heating rate is  $5^\circ\text{C}/\text{min}$ .

## 3. Characterization.

The powder X-ray diffraction (XRD) patterns were recorded on a D/max 2500 VL/PC diffractometer (Japan) equipped with graphite monochromatized Cu  $K\alpha$  radiation ( $\lambda = 1.54060 \text{ \AA}$ ). Corresponding work voltage and current is 40 kV and 100 mA, respectively. Fourier transform infrared spectroscopy was analyzed by a Nicolet iS10 instrument from Thermo, USA. The transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) images were

recorded on JEM-2100F apparatus at an accelerating voltage of 200 kV. The atomic structure was characterized by transmission electron microscopy (TEM) with 200 kV ARM-200CF (JEOL, Tokyo, Japan) equipped with double spherical aberration corrector. The UV–Vis absorption and diffused reflectance spectra were recorded using a Cary 5000 UV-Vis spectrometer (Viarian, USA) with BaSO<sub>4</sub> as a reflectance standard. The X-ray photoelectron spectroscopy (XPS) spectra were analyzed by a Thermo Fisher Scientific corporation Escalab 250Xi instrument. Steady photoluminescence (PL) emission spectra were tested by luminescence spectrophotometer (QM-400, PTI).

#### **4. Photocatalytic measurements.**

The photocatalytic activity of the samples was evaluated by degrading the aqueous solution of Rhodamine B (RhB), under the visible light irradiation with 300 W Xe lamp. Normally, 30 mg of the sample was suspended in the dye aqueous solution (30 mL, 20 mg/L) for 30 min in the dark to achieve the adsorption-desorption equilibrium. Then, 2ml of the suspension was collected and centrifuged every 10 min after illumination. The concentration of the residual dye was measured with an ultraviolet- visible spectrophotometer.

#### **5. Electrochemical measurements**

All the electrochemical measurements were conducted by Bio-Logic SP150 electrochemical station using three-electrode system at room temperature with a glassy carbon electrode (3 mm in diameter), (sheet resistance 20–25  $\Omega^{-2}$ ) as the working electrode, a platinum wire as the auxiliary electrode, and an Ag/AgCl electrode as the reference electrode. For the electrochemical measurements, 4 mg of the catalysts were dispersed in 2 mL of 9:1 v/v water/Nafion by sonication to form a homogeneous ink. Typically, 5  $\mu$ L well-dispersed catalysts were covered on the glassy carbon electrode and then dried in an ambient environment for measurements. The electrocatalyst was prepared with a catalyst loading of 0.14 mg cm<sup>-2</sup>. The electrochemical impedance spectroscopy (EIS), and Mott-Schottky (M-S) was in 0.5 M Na<sub>2</sub>SO<sub>4</sub> aqueous solution. EIS was performed at an impressed voltage of -0.3 eV, for voltage ranging from -2.5 V to 2.5 V. M-S was measured for a scan voltage ranging from -1 V to 1V at 500-2000 Hz.

## 6. Supporting Figure

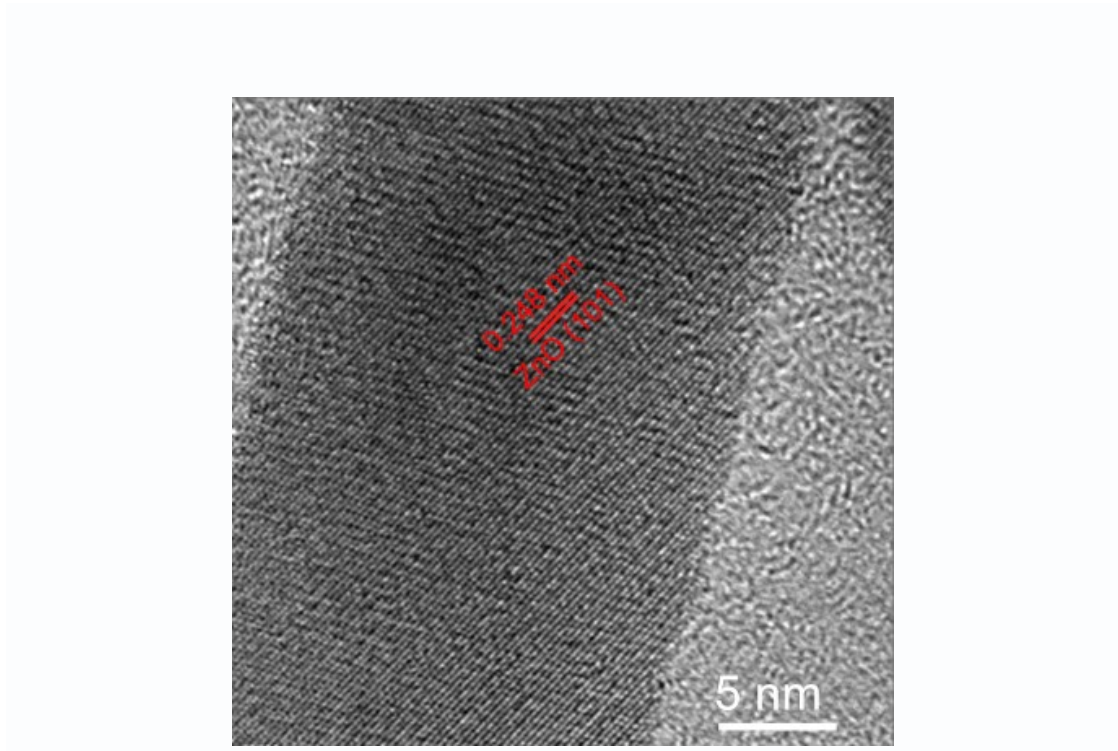


Fig. S1. HRTEM images of ZnO.