

Pt-porous ZnO nanoribbon hybrid materials with enhanced catalytic performance

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Experimental Section:

Synthesis of sub 3 nm Pt nanoparticles.

Typically, 10 mL K_2PtCl_4 aqueous solution (0.02 mM), 0.11 g PVP and 10 mL ethylene glycol are mixed together. After stirring for 15 min at room temperature, the mixture is hydrothermal treated at 130 °C for 3 hours. After cooling down to room temperature naturally, the as-obtained products are collected by the help of acetone and finally re-disperse in 40 mL water for further use.

Synthesis of $\text{Pt-Zn}_5(\text{CO}_3)_2(\text{OH})_6$:

1 mmol $\text{Zn}(\text{oAc})_2$ and 1 mmol L-lysine are dissolved in 7 mL water. Then 3 ml Pt colloid solution is added. Finally, the mixture is put into a Teflon autoclave and heated at 140 °C for 12 hours. After cooling down to room temperature naturally, the products are collected by centrifugation and dried at 60 °C overnight.

Synthesis of Pt-ZnO nanoribbon:

The above obtained $\text{Pt-Zn}_5(\text{CO}_3)_2(\text{OH})_6$ power is further heated at 450 °C for 2 hours at a heating rate of 2 °C /min.

Synthesis of ZnO nanorod:

ZnO nanorods are synthesized according to the well-established HMT-assisted hydrothermal method.^{13, 21} 80 mL of 0.01 M aqueous solution of $\text{Zn}(\text{NO}_3)_2$ and HMT was put into a Teflon autoclave with a volume of 100 ml and heated at 95 °C for 5 h.

Photocatalytic Measurement:

50 mg of as-prepared nanocatalyst is added to 100 mL of 0.01 mM methyl orange (MO) aqueous solution. The mixture is treated under UV irradiation with a Xe arc lamp (400 W) with constant magnetic stirring to ensure a higher level of homogeneity of photocatalyst presence in the suspension. 5 mL of sample is drawn with a syringe. The concentration of MO is determined using a UV-VIS-NIR spectrophotometer.

Catalytic CO oxidation:

30 mg of catalyst is put in a stainless steel reaction tube. The experiment was carried out under a flow of reactant gas mixture (1 % CO , 20 % O_2 , balanced with N_2) at a rate of 30 mL/min. The composition of the gas was monitored on-line by gas chromatography.

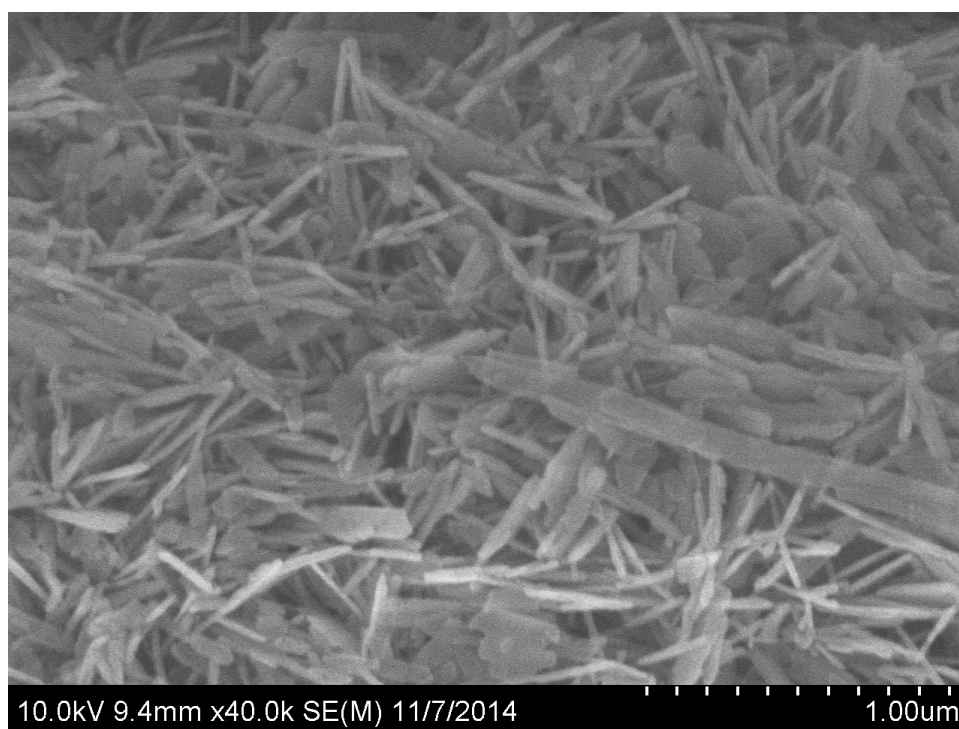


Figure S1. TEM image of Pt-Zn₅(CO₃)₂(OH)₆.

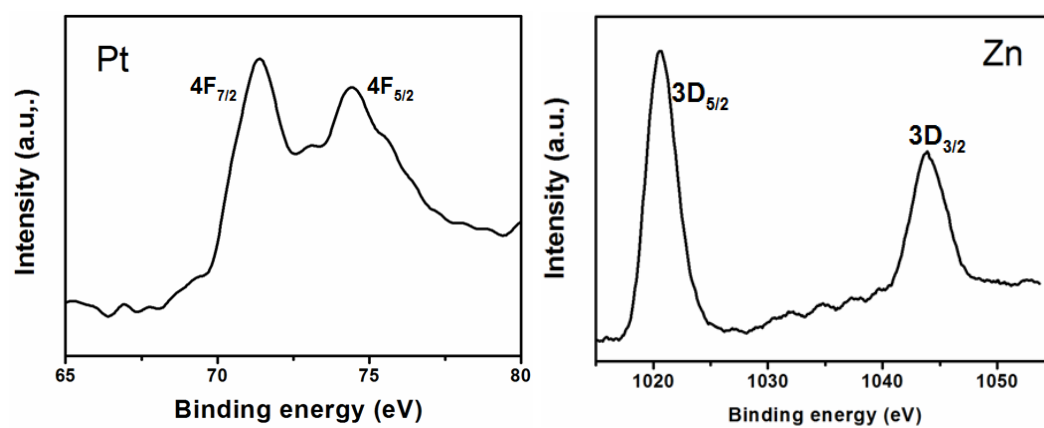


Figure S2. XPS data of Pt and Zn in Pt-ZnO nanoribbon.

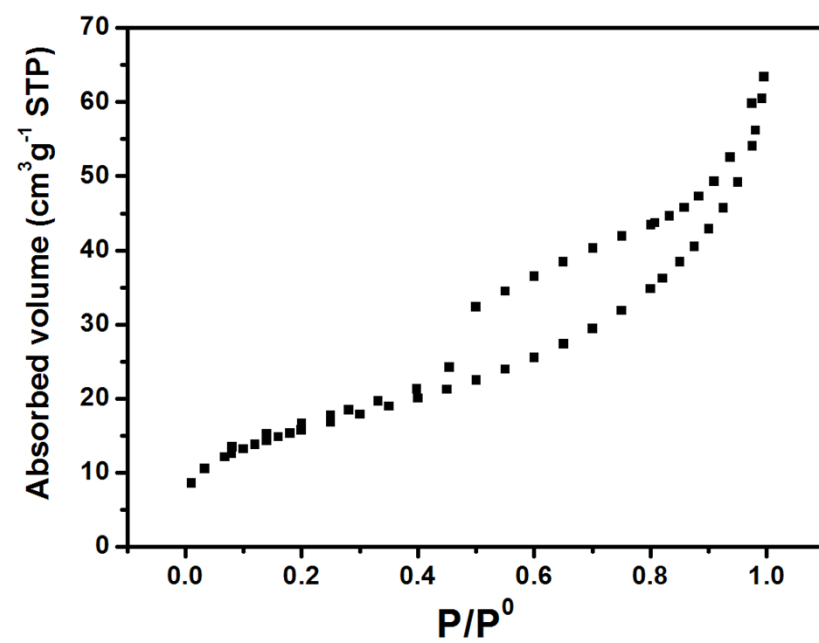


Figure S3. BET curve of Pt-ZnO nanoribbons.

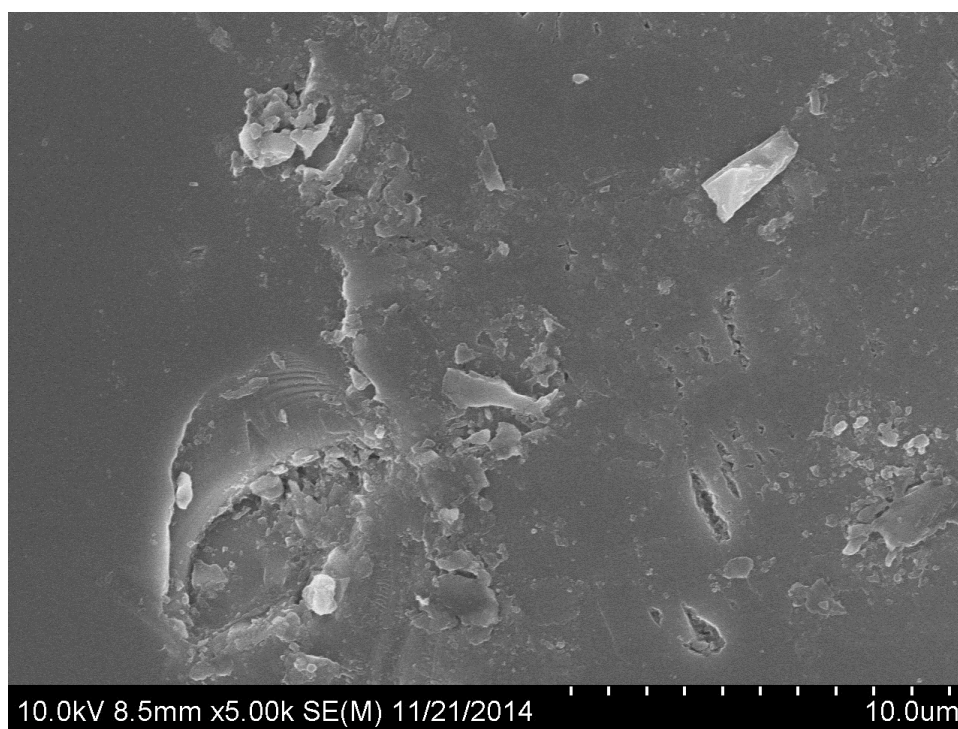


Figure S4. SEM image of Pt-Zn₅(CO₃)₂(OH)₆ obtained without addition of L-lysine in the reaction solution..

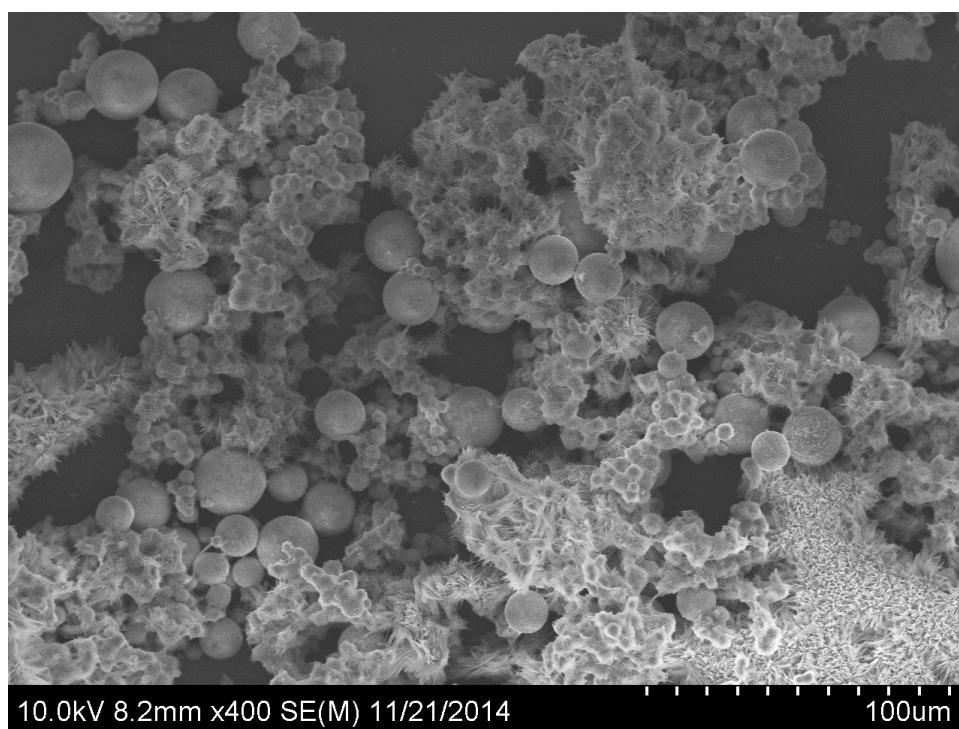


Figure S5. SEM image of Pt-Zn₅(CO₃)₂(OH)₆ obtained by addition of 2 mmol urea in the reaction solution..

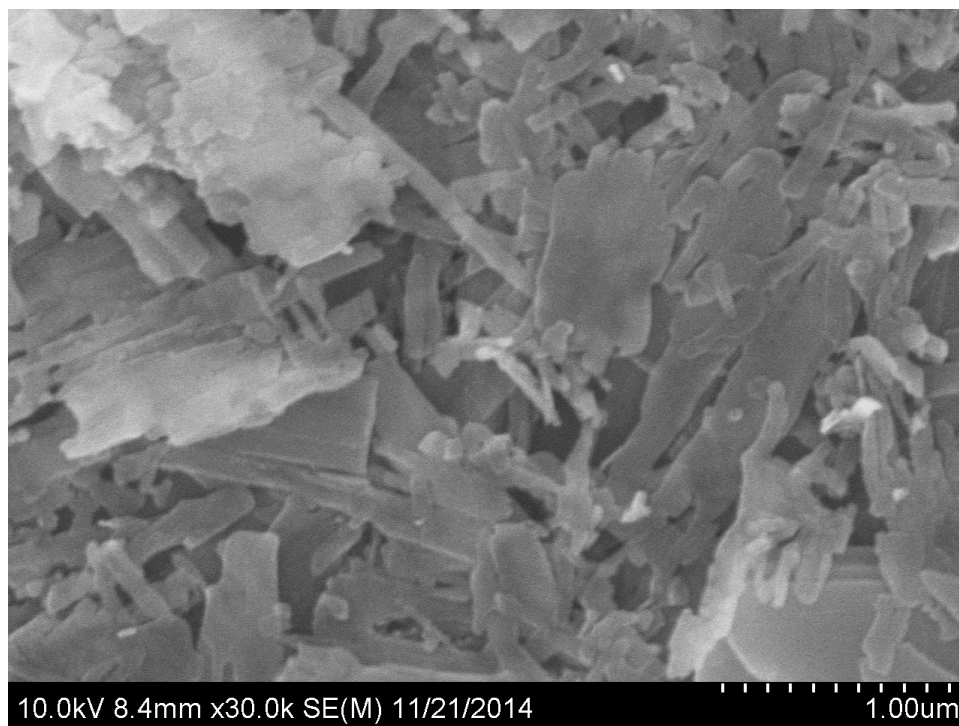


Figure S6. SEM image of Pt-Zn₅(CO₃)₂(OH)₆ obtained by addition of 10 mmol urea in the reaction solution.

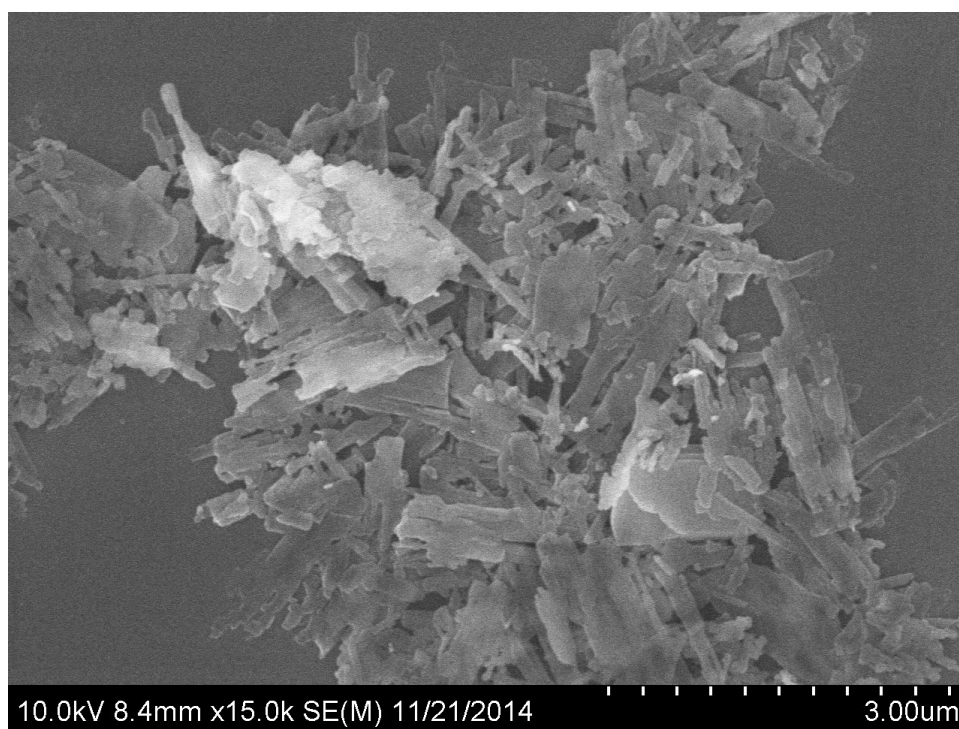


Figure S7. SEM image of Pt-Zn₅(CO₃)₂(OH)₆ prepared by heat-treatment at 180 °C for 12 hours.

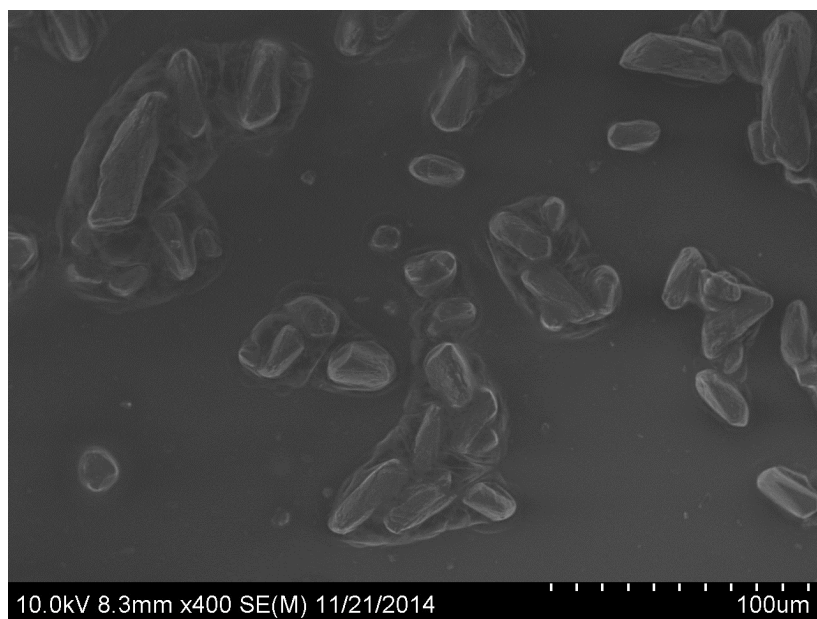


Figure S8. SEM image of Pt-Zn₅(CO₃)₂(OH)₆ prepared by heat-treatment at 120 °C for 12 hours.

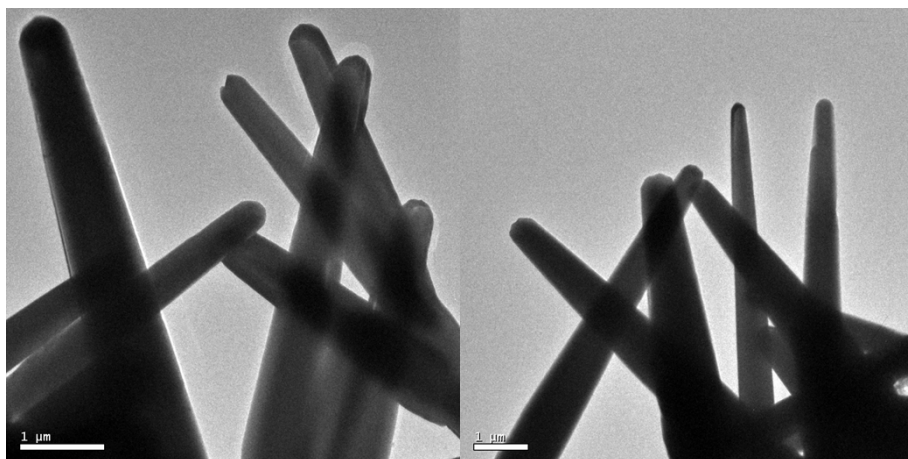


Figure S9. TEM images of ZnO nanorods.

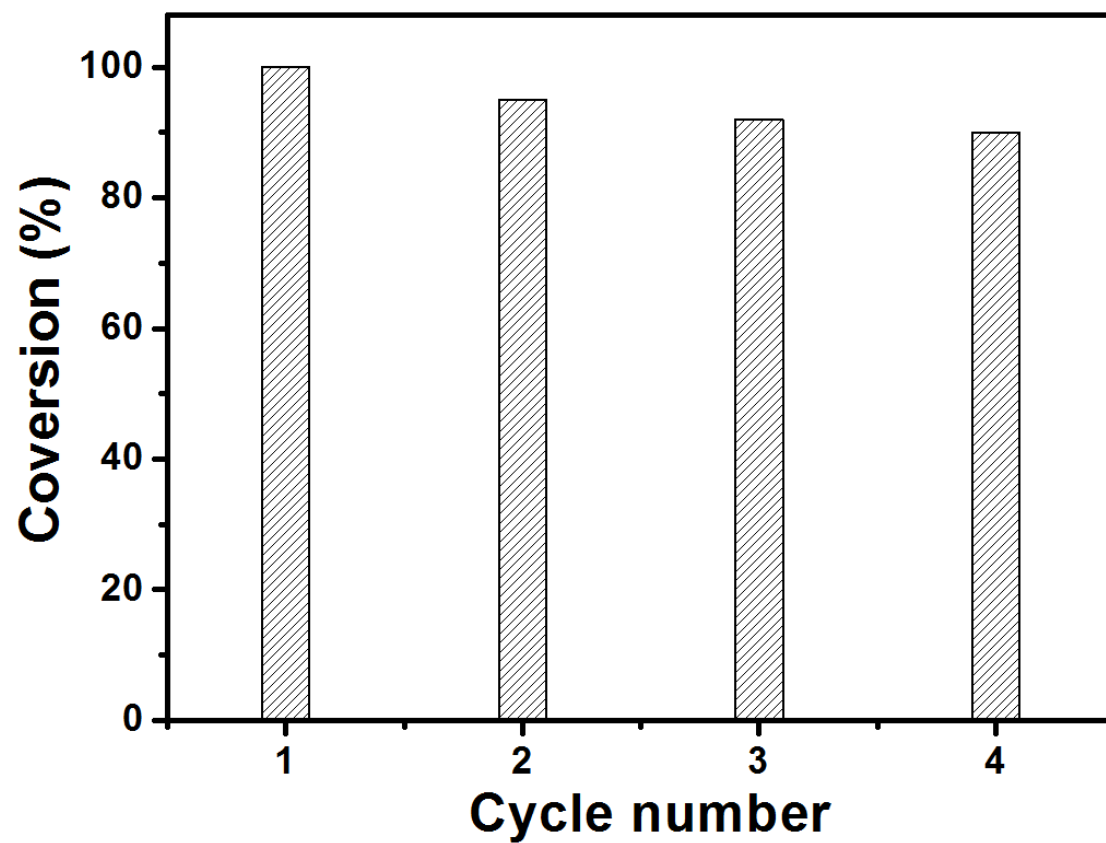


Figure S10. the cycling test of Pt-ZnO nanoribbon on the catalytic reaction of Photocatalytic degradation of MO.