Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting information

Synergistic effect of CoPi-hole cocatalyst and Cu(II)-electron cocatalyst for enhanced photocatalytic activity and photoinduced stability of Ag_3PO_4

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EXPERIMENTAL SECTION

1 CoPi/AgCl

1.1 Preparation of AgCl

AgCl particles were synthesized by a facile precipitation reaction. In a typical synthesis, a 72 mL of $AgNO_3$ solution (0.1 mol L^{-1}) was added with drop by drop into a 72 mL of NaCl solution (0.1 mol L^{-1}) under vigorous magnetic stirring. After being stirred for 60 min, the resultant powder was filtrated, rinsed, and dried. This sample is denoted as AgCl.

1.2 Preparation of CoPi/AgCl

CoPi/AgCl photocatalyst was prepared by photochemical deposition. AgCl powder was immersed in 0.05 mol L^{-1} $Co(NO_3)_2$ and 0.1 mol L^{-1} potassium phosphate electrolyte (pH=7), and illuminated 350 W Xenon lamp with a UV-cutoff filter (λ > 400 nm) as a visible-light source illuminated (40 mW cm^{-2}) samples for 10 min. The amount of Co-Pi solution was controlled to be 0.3 wt% and the resulting product will be referred to as CoPi/AgCl (0.3wt%).

1.3 Preparation of CoPi/AgCl (0.3wt%-H)

To investigate the effect of Co-Pi cocatalyst on the photocatalytic performance and structure of CoPi/AgCl, the Co-Pi cocatalyst was removed by dispersing 0.05 g of CoPi/AgCl (0.3wt%) photocatalyst into a 20 mL of hydrochloric acid solution (1 mol

L^{-1}) at room temperature for 60 min. After filtration, washing with distilled water and drying, the resulting product was referred to as CoPi/AgCl (0.3wt%-H).

2 Co(II)/Ag_3PO_4, and Pi/Ag_3PO_4

2.1 Preparation of Co(II)/Ag_3PO_4(0.3wt%)

Co(II) cocatalyst modified Ag_3PO_4 photocatalyst was prepared by *in situ* photochemical deposition. 0.5 g of Ag_3PO_4 powder was immersed in the 0.5 mL of $Co(NO_3)_2$ (0.05 mol L^{-1}), and 350 W Xenon lamp with a UV-cutoff filter ($\lambda > 400$ nm) as a visible-light source illuminated for 10 min. This sample refered to as Co(II)/Ag_3PO_4(0.3wt%).

2. 2 Preparation of Pi/Ag_3PO_4(0.3wt%)

Pi cocatalyst modified Ag_3PO_4 photocatalyst was prepared by photochemical deposition. 0.5 g of Ag_3PO_4 powder was immersed in 100 mL of phosphoric acid buffer solution, and 350 W Xenon lamp with a UV-cutoff filter ($\lambda > 400$ nm) as a visible-light source illuminated for 10 min. This sample refered to as Pi/Ag_3PO_4(0.3wt%).

2. 3 Adsorption ability

The evaluation of adsorption ability of the prepared samples for MO solution was performed. Typically, 100 mg of the sample was dispersed into 20 mL of MO solution

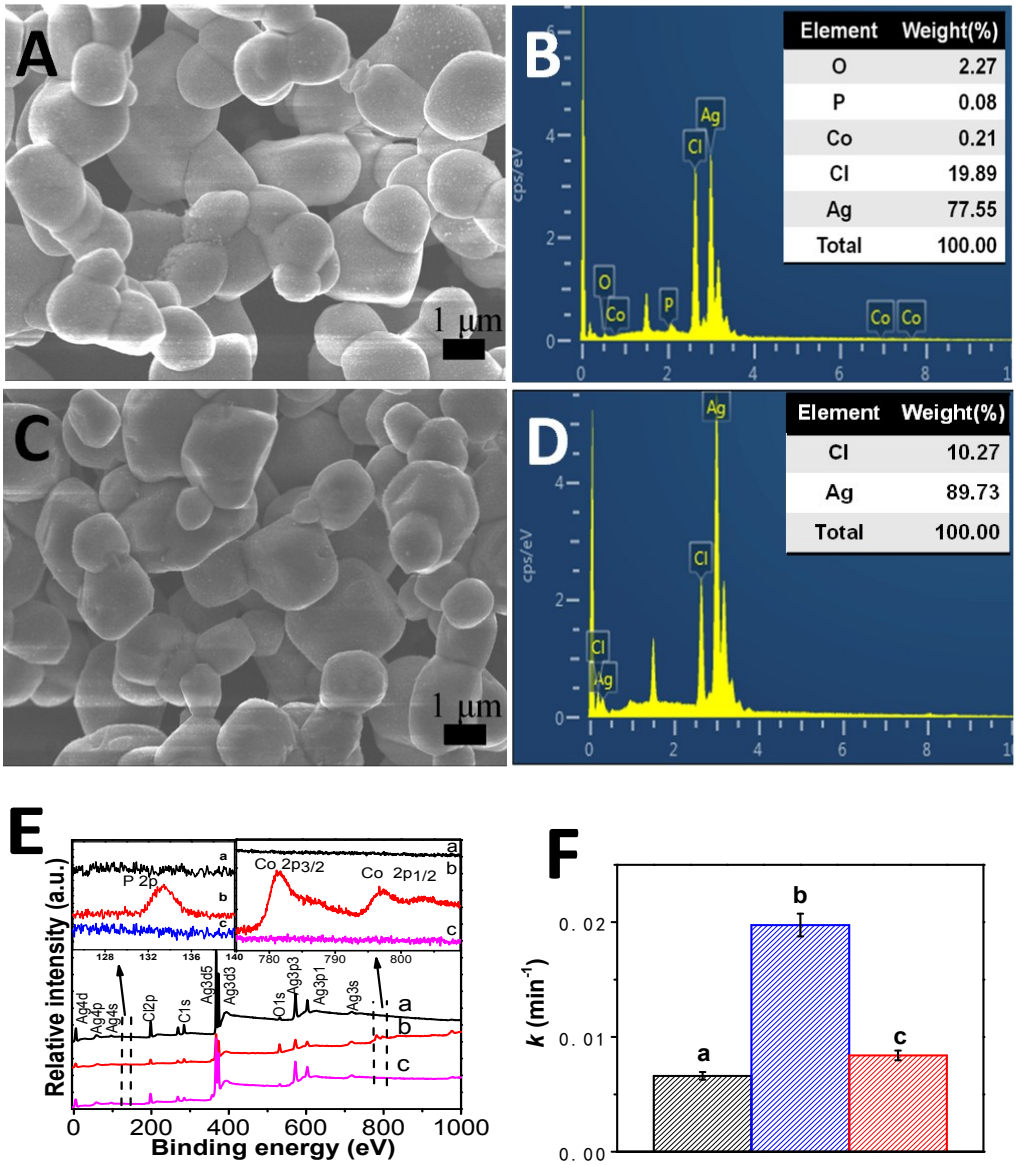
(20 mg L^{-1}) in a disk with a diameter of ca. 10 cm. At certain time intervals (30 min), the concentration of MO solution was measured. The adsorption ability may be expressed as c/c_0, where c_0 and c are the initial concentrations and the concentrations, respectively.

Figure captions

Fig. S1 (A) FESEM image, and (B) EDX of CoPi/AgCl(0.3wt%); (C) FESEM image, and (D) EDX of CoPi/AgCl(0.3wt%-H); (E) XPS spectra of (a) AgCl, (b) CoPi/AgCl (0.3wt%) and (c) CoPi/AgCl (0.3wt%-H); (F) Photocatalytic degradation of MO for (a) AgCl, (b) CoPi/AgCl (0.3wt%) and (c) CoPi/AgCl (0.3wt%-H).

Fig. S2 XPS spectra of (A) survey; (B) Co, (C) P, and (D) O element of different samples: (a) Ag_3PO_4, (b) Co(II)/Ag_3PO_4(0.3wt%), (c) Pi/Ag_3PO_4(0.3wt%), and (d) CoPi/Ag_3PO_4(0.3wt%).

Fig. S3 The adsorption ability of different samples for MO: (a) Ag_3PO_4, (b) Co(II)/Ag_3PO_4(0.3wt%), (c) Pi/Ag_3PO_4(0.3wt%), and (d) CoPi/Ag_3PO_4(0.3wt%).



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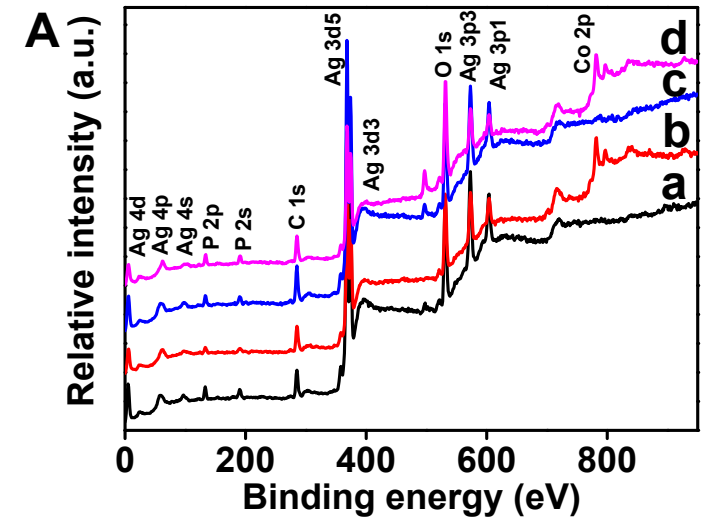
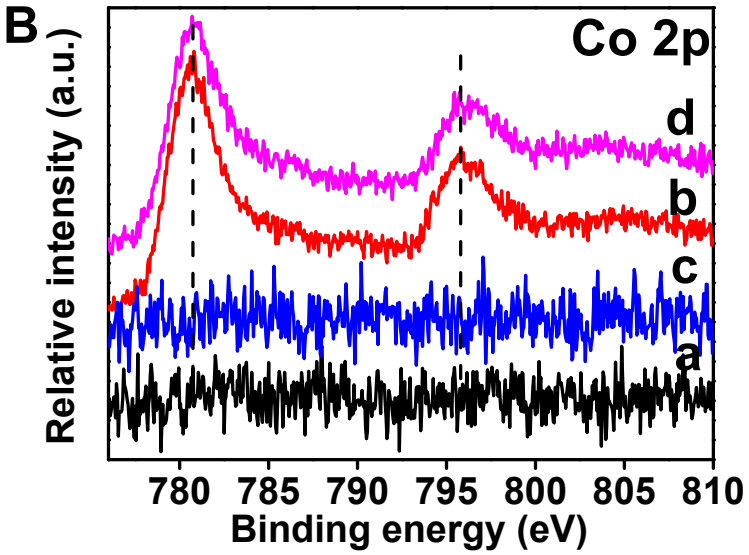
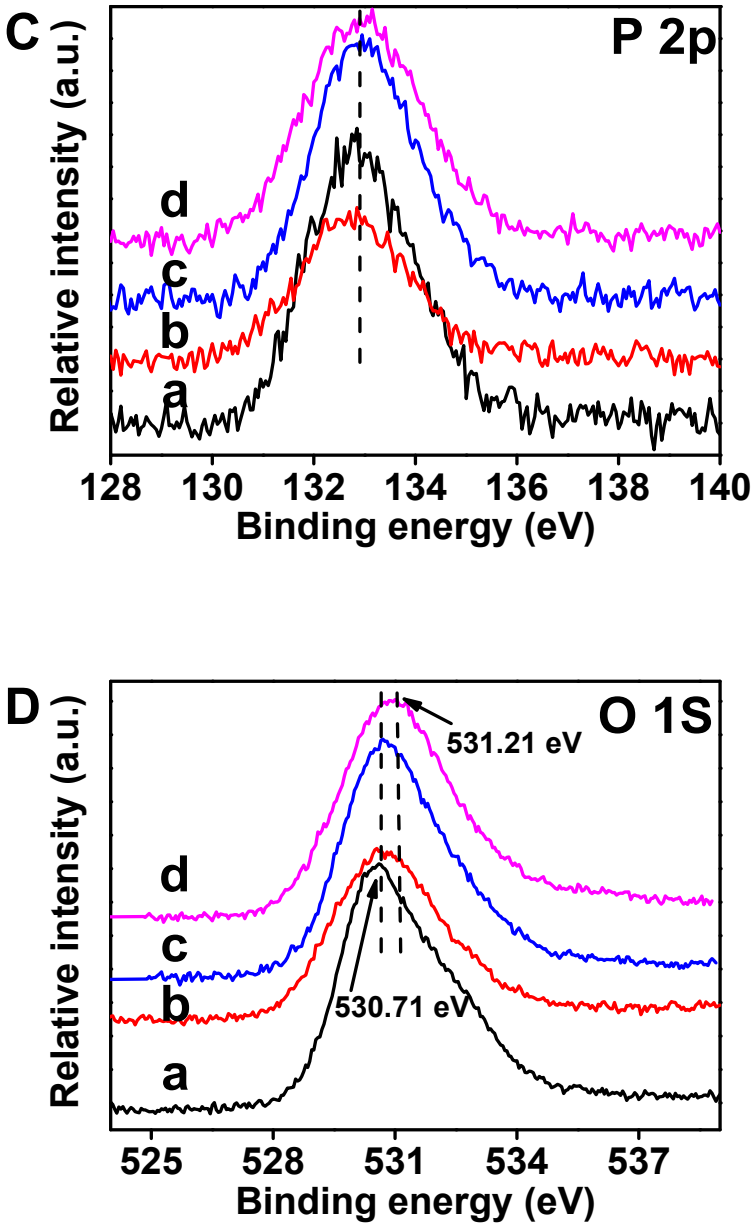

A
Relative intensity (a.u.)
Ag 4d
Ag 4p
Ag 4s
P 2p
P 2s
C 1s
Ag 3d5
Ag 3d3
O 1s
Ag 3p3
Ag 3p1
Co 2p
d
c
b
a
0
200
400
600
800
Binding energy (eV)


B
Relative intensity (a.u.)
Co 2p
d
b
c
a
780
785
790
795
800
805
810
Binding energy (eV)



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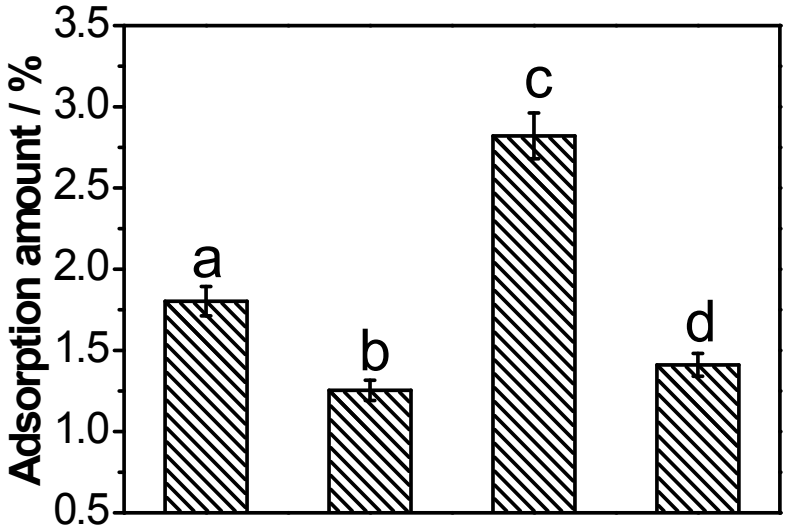

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