catalysts

Supplementary Materials: The Preparation of a Highly Efficient $Ag_3PO_4/Ag/Bi_2O_2CO_3$ Photo-Catalyst and the Study of Its Photo-Catalytic Organic Synthesis Reaction Driven by Visible Light

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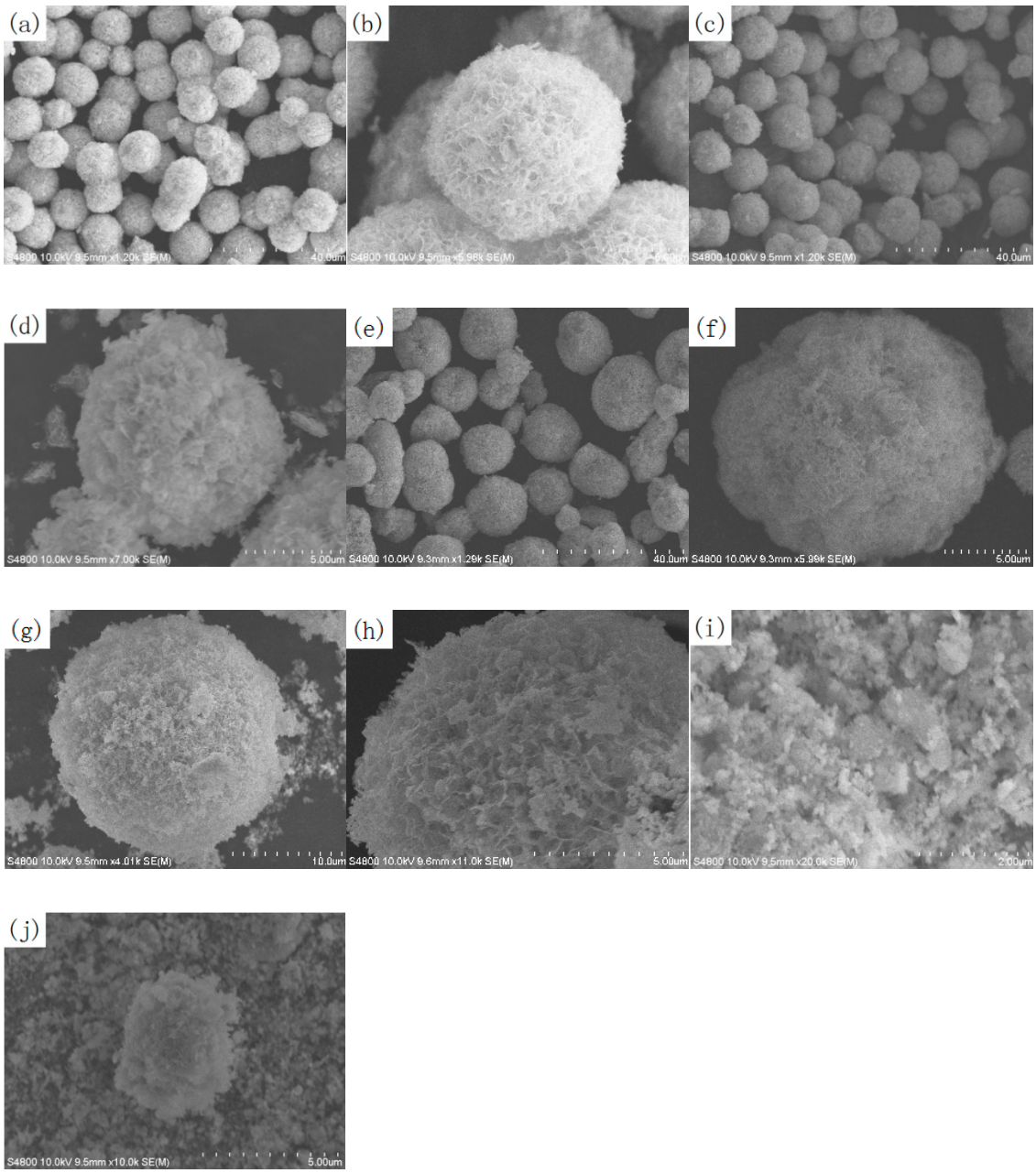
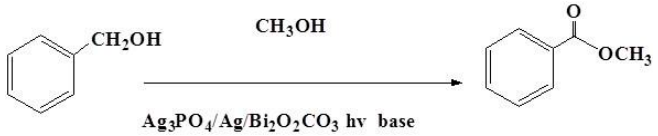


Figure S1. SEM images of the photo-catalysts (**a**,**b**) $Bi_2O_2CO_3$ (**c**,**d**) 10 wt% $Ag/Bi_2O_2CO_3$ (**e**,**f**) 64 wt% $Ag_3PO_4/Bi_2O_2CO_3$ (**g**,**h**) 71 wt% $Ag_3PO_4/Ag/Bi_2O_2CO_3$ (**i**,**j**) reused 71 wt% $Ag_3PO_4/Ag/Bi_2O_2CO_3$.

Table S1. BET surface areas of the photo-catalysts supported on $Bi_2O_2CO_3$ and $Bi_2O_2CO_3$.

Sample	BET Surface Area ($m^2 \cdot g^{-1}$)
$Bi_2O_2CO_3$	51.05
$Ag/Bi_2O_2CO_3$	46.11
$Ag_3PO_4/Bi_2O_2CO_3$	33.13
57%$Ag_3PO_4/Ag/Bi_2O_2CO_3$	18.14
64%$Ag_3PO_4/Ag/Bi_2O_2CO_3$	15.91
68%$Ag_3PO_4/Ag/Bi_2O_2CO_3$	13.21
71%$Ag_3PO_4/Ag/Bi_2O_2CO_3$	11.27
73%$Ag_3PO_4/Ag/Bi_2O_2CO_3$	7.90

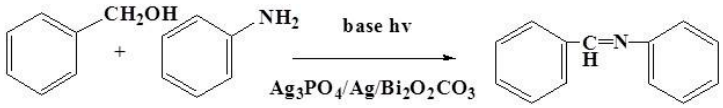
Table S2. Synthesis of esters from benzyl alcohol and methanol using 71 wt% $Ag_3PO_4/Ag/Bi_2O_2CO_3$.



Entry	Base	Alcohol	In the Visible Light		In the Dark	
			Conv. (%)	Sel. (%)	Conv. (%)	Sel. (%)
1	0.6mmol Cs_2CO_3	Methanol	93.5	83.1	11.1	51.3
2	K_2CO_3	Methanol	36.6	71.7	3.7	88.5
3	Na_2CO_3	Methanol	10.8	83.2	2.6	81.2
4	NaOH	Methanol	47.4	83.5	10.2	78.9
5	Triethylamine (NEt_3)	Methanol	20.1	88.2	4.5	80.1
6	0.4mmol Cs_2CO_3	Methanol	68.8	77.5	4.7	43.6
7	0.8mmol Cs_2CO_3	Methanol	86.8	82.0	13.6	67.2
8	1.0mmol Cs_2CO_3	Methanol	81.5	78.7	16.2	46.3

Reaction conditions: benzyl alcohol (1.0 mmol), base, $Ag_3PO_4/Ag/Bi_2O_2CO_3$ catalyst (30 mg) were added to methanol (8 mL). The reaction flask was stirred magnetically and was irradiated with a 500 W Philips halogen lamp (wavelength range of 400–800 nm, and a light intensity of 2.5×10^{-2} $W\cdot cm^{-2}$) as the visible light source under an air atmosphere at 35 ± 3 °C. After running for 24 h, the reaction conversion and selectivity were determined by GC (gas chromatography).

Table S3. Synthesis of imines from benzyl alcohol and aniline using 71wt% $Ag_3PO_4/Ag/Bi_2O_2CO_3$.



Entry	Base	Solvent	In the Visible Light		In the Dark	
			Conv. (%)	Sel. (%)	Conv. (%)	Sel. (%)
1	0.8mmol Cs_2CO_3	Benzotrifluoride	80.5	93.1	9.6	89.2
2	K_2CO_3	Benzotrifluoride	55.7	99.4	5.2	99
3	KOH	Benzotrifluoride	44.2	94.0	8.6	89.2
4	NaOH	Benzotrifluoride	73.9	96.2	9.3	99
5	LiOH	Benzotrifluoride	74.9	98.6	7.2	99
6	Cs_2CO_3	Cyclohexane	27.6	93.1	7.9	92.4
7	Cs_2CO_3	Dimethyl sulfoxide (DMSO)	29.9	>99	13.2	>99
8	Cs_2CO_3	N,N-Dimethylformamide (DMF)	32.5	88.9	2.8	78.6
9	Cs_2CO_3	Mesitylene	31.5	>99	4.7	>99
10	Cs_2CO_3	Toluene	28.6	>99	11.1	>99
11	Cs_2CO_3	Isopropanol	11.1	66.7	3.6	67.2
12	0.4mmol Cs_2CO_3	Benzotrifluoride	20.2	67.4	1.4	76.3
13	0.6mmol Cs_2CO_3	Benzotrifluoride	34.9	77.7	2.0	78.9
14	1.0mmol Cs_2CO_3	Benzotrifluoride	77.6	88.4	2.6	81.3

Reaction conditions: alcohol (1.0 mmol), aniline (0.5 mmol), base and $Ag_3PO_4/Ag/Bi_2O_2CO_3$ catalyst (30 mg) were added to solvent (6 mL). The reaction flask was stirred magnetically and was irradiated with a 500 W Philips halogen lamp (wavelength range of 400–800 nm, and a light intensity of 2.5×10^{-2} $W\cdot cm^{-2}$) as the visible light source under an air atmosphere at 35 ± 3 °C. After running for 24 h, the reaction conversion and selectivity were determined by GC.

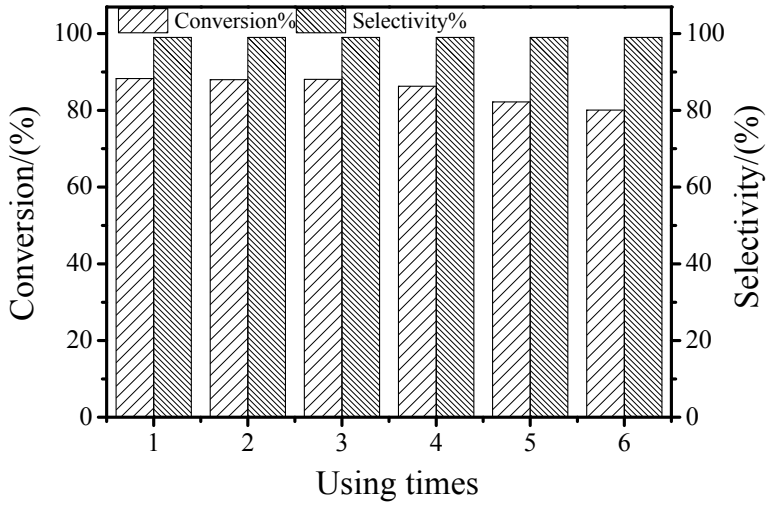


Figure S2. Photo-catalytic activity of the 71 wt% $Ag_3PO_4/Ag/Bi_2O_2CO_3$ catalyst after being used for 6 times.

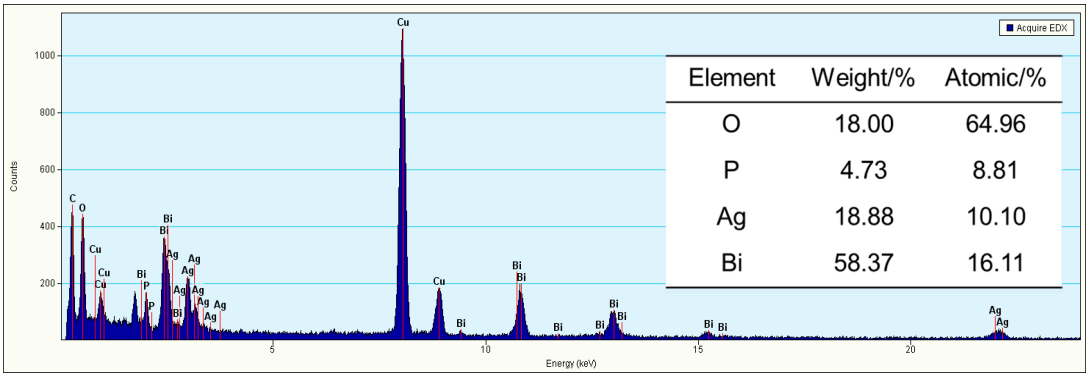


Figure S3. EDX image of 71 wt% Ag_3PO_4/Ag/$Bi_2O_2CO_3$ after reusing.