

## Supporting information

### **Cu-Ag/Hydrotalcite Catalysts for Dehydrogenative Cross-Coupling of Primary and Secondary Benzylic Alcohols**

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## **S1 Effect of calcination temperature**

As shown in Table S1, both the conversion of benzyl alcohol and yield of  $\beta$ -phenylpropiophenone were affected by the calcination and reduction temperature. At 300 °C the yield was 76% after 0.5 h and 98% after 1 h, but at 600 °C the yield after 0.5 h was only 29%. This decrease in yield may be ascribed to the increase in the size of Cu nanoparticles at the higher temperature.

## **S2 Effect of reaction conditions**

### **S2.1 Reaction temperature**

As shown in Fig. S1, increasing the reaction temperature caused both the conversion of benzyl alcohol and the yield of  $\beta$ -phenylpropiophenone to increase. A 2% yield at 120 °C was increased to 24 and 76% at temperatures of 140 and 150 °C, respectively.

### **S2.2 Reaction time**

Similar to the situation for temperature and as shown in Fig. S2, increasing the reaction time increased the yield of  $\beta$ -phenylpropiophenone, which reached nearly 99% after 1 h.

### **S2.3 Effect of solvents**

The properties of solvents used affect the reaction rate of secondary and primary alcohols [8,11]. Toluene [8], *p*-xylene [11], and *o*-xylene [11] are common solvents for the cross-coupling of secondary and primary alcohols. The effect of the three solvents was investigated in the presence

of Cu-Ag/HT with reactivity increasing in line with the order listed above, as shown in Table S2.

#### **S2.4 Catalyst amount**

As shown in Fig. S3, increasing the amount of catalyst increased both the conversion of benzyl alcohol and the yield of  $\beta$ -phenylpropiophenone up to a point. With 0.04 g of catalyst the conversion and the yield were 73 and 45%, respectively. However, when the amount of catalyst was 0.1 g or more both values increased to the maximum observed value of nearly 99%.

**Table S1** Effect of calcination and reduction temperature on catalytic activity <sup>a</sup>

Entry	Calcination and reduction temperature	Reaction time	Conversion of benzyl alcohol (%)	Yield to $\beta$ -phenylpropiophenone (%)
1	300 °C	0.5 h	88	76
		1 h	99	98
2	600 °C	0.5 h	55	29
		1 h	84	80

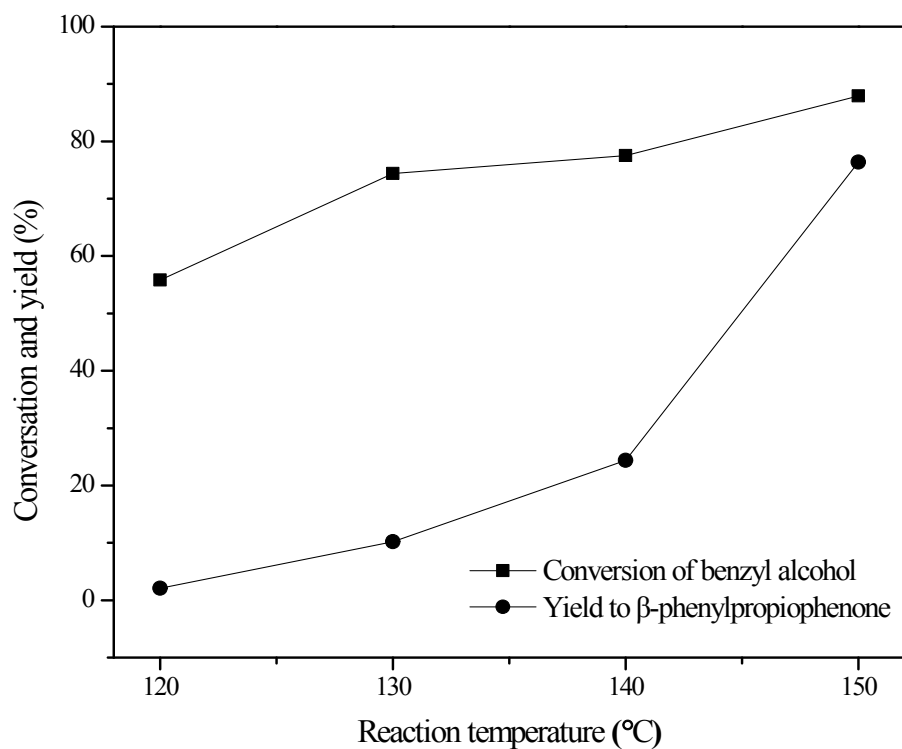
<sup>a</sup> Reaction conditions: benzyl alcohol (1.0 mmol), 1-phenylethanol (1.0 mmol), catalyst (0.1 g), *o*-xylene (3 mL), 150 °C, 1 bar N<sub>2</sub>

**Table S2** The effect of reaction solvents on reactivity <sup>a</sup>

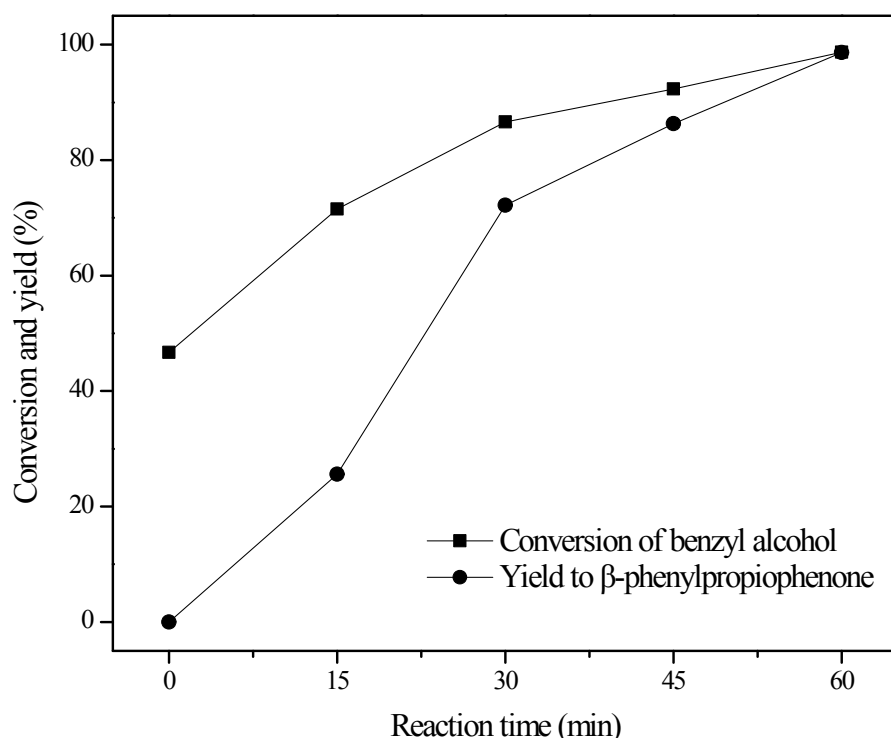
Entry	Solvents	T/°C <sup>b</sup>	t/h	Conversion of benzyl alcohol (%)	Yield to $\beta$ -phenylpropiophenone (%)
1	toluene	110	5	51	0
2	<i>p</i> -xylene	110	5	64	3
3	<i>o</i> -xylene	110	5	72	16
4	toluene	125	1	65	0
5	<i>p</i> -xylene	125	1	69	2
6	<i>o</i> -xylene	125	1	71	10
7	<i>p</i> -xylene	140	2	57	30
8	<i>o</i> -xylene	140	2	87	47
9	<i>p</i> -xylene	150	1	70	58
10	<i>o</i> -xylene	150	1	96	95

<sup>a</sup> Reaction conditions: benzyl alcohol (1.0 mmol), 1-phenylethanol (1.0 mmol), solvent (3 mL), Cu-Ag/HT (0.1 g), 1 bar N<sub>2</sub>.

<sup>b</sup> Temperature of oil bath.

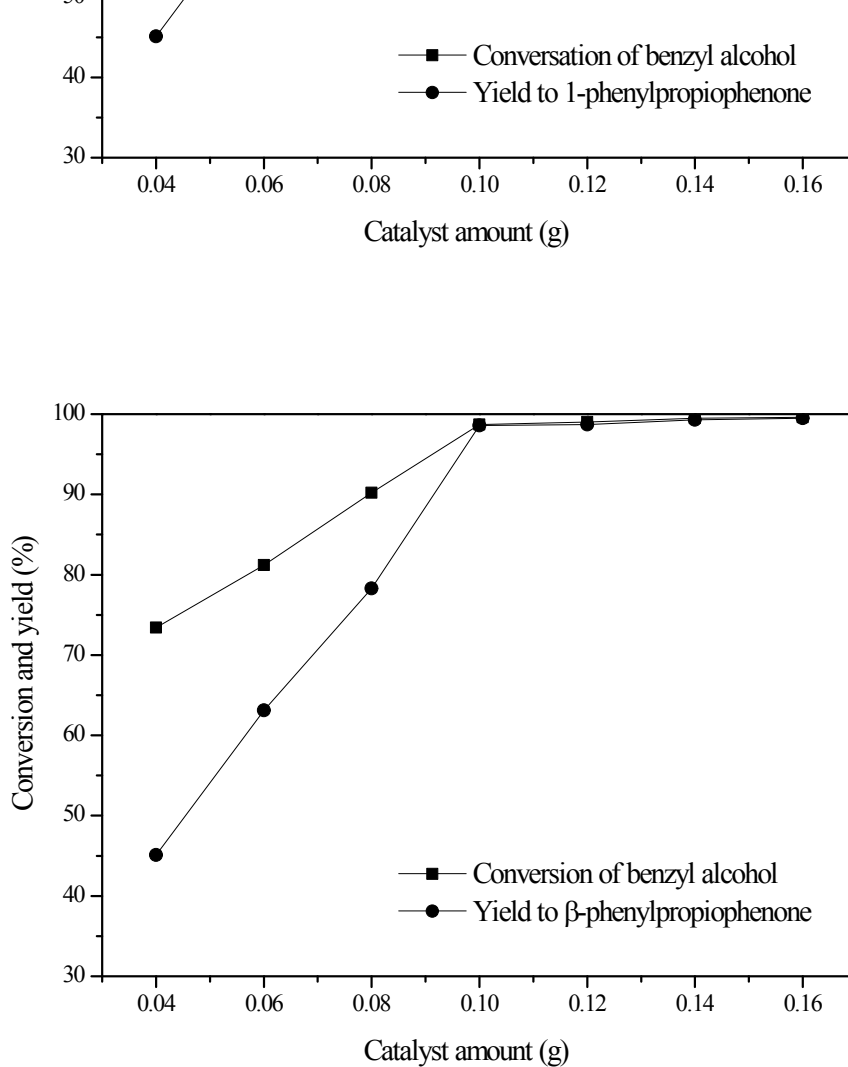


**Fig. 1** Effect of reaction temperature on catalytic activity of Cu-Ag/HT in the dehydrogenation cross-coupling reaction. Reaction conditions: benzyl alcohol (1.0 mmol), 1-phenylethanol (1.0 mmol), Cu-Ag/HT (0.1 g), *o*-xylene (3 mL), 1 bar N<sub>2</sub>, reaction time (0.5 h).



**Fig. 2** Effect of reaction time on yield of  $\beta$ -phenylpropiophenone.

Reaction conditions: benzyl alcohol (1.0 mmol), 1-phenylethanol, (1.0 mmol), Cu-Ag/HT (0.1 g), 150 °C, *o*-xylene (3 mL), 1bar N<sub>2</sub>.



**Fig. 3** Effect of catalyst amount on catalytic activity of Cu-Ag/HT in the dehydrogenation cross-coupling reaction. Reaction conditions: benzyl alcohol (1.0 mmol), 1-phenylethanol (1.0 mmol), *o*-xylene (3 mL), 150 °C, 1 bar N<sub>2</sub>, reaction time of 1 h.