Supporting Information

Pyrolysis of Metal−Organic Framework (CuBTC) decorated Filter Paper as a low-cost and highly active Catalyst for the reduction of 4-Nitrophenol

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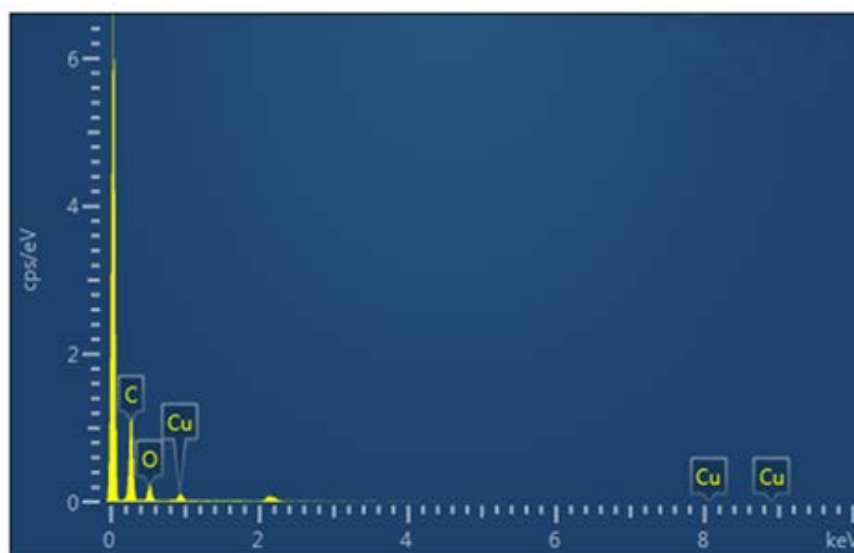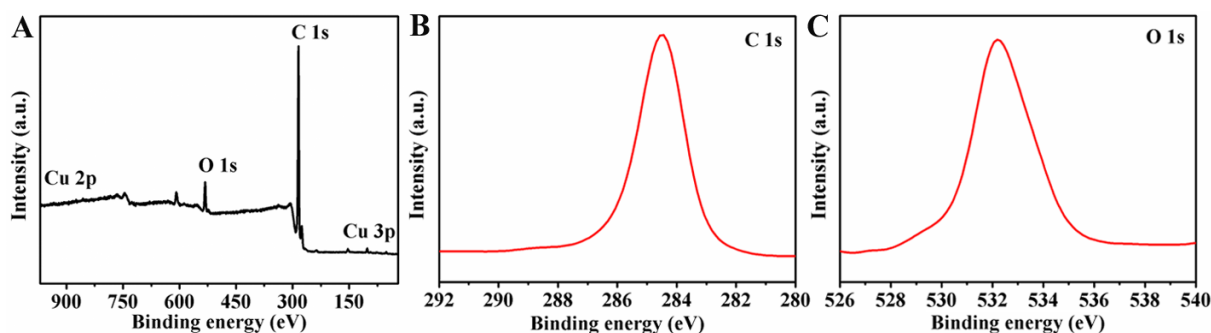
Figure S1. EDX data of the $Cu_xO@C$-400.

Figure S2. (A) XPS survey spectrum of $Cu_xO@C$-400. High-resolution scans for the C 1s (B) and O 1s (E) electrons of the $Cu_xO@C$-400.
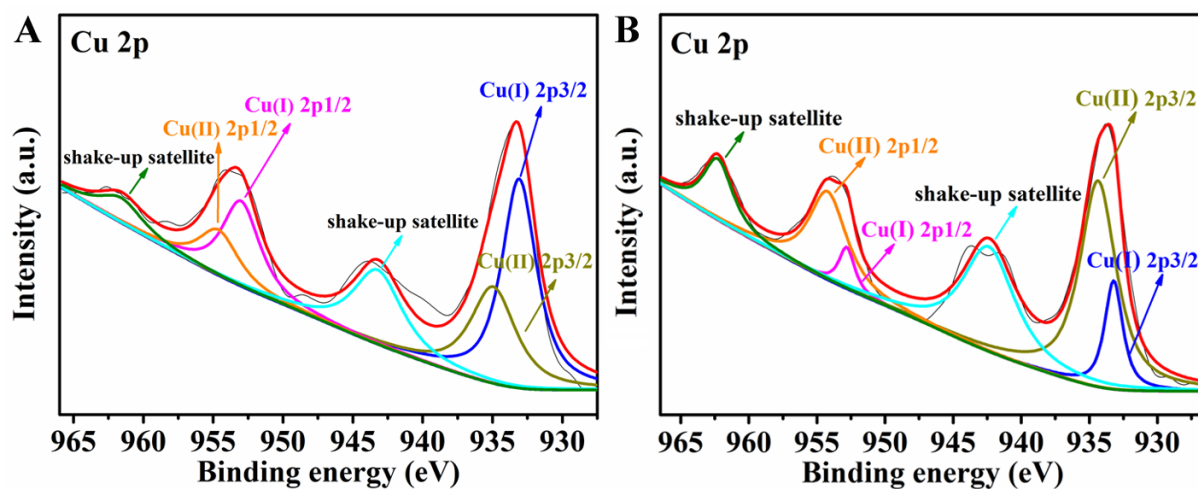
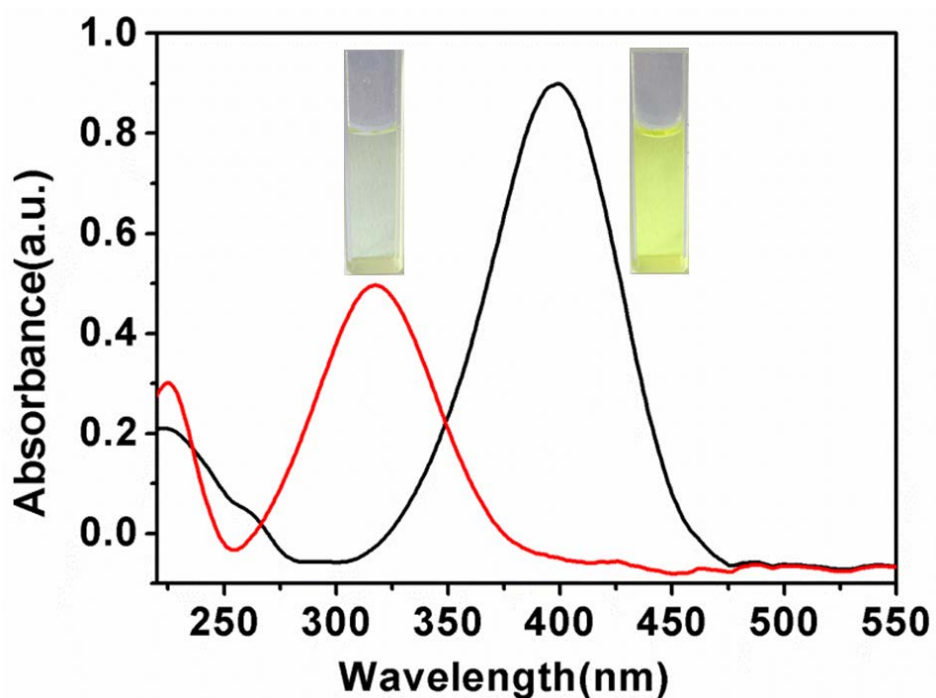**Figure S3.** High-resolution scans for the Cu 2p electron of $Cu_xO@C-300$ (A) and $Cu_xO@C-500$ (B).

Figure S4. UV−vis spectroscopy of 4-NP solution before (red line) and after (black line) addition of $NaBH_4$. Inset: color change of 4-nitrophenol solution before (left) and after (right) the addition of $NaBH_4$.
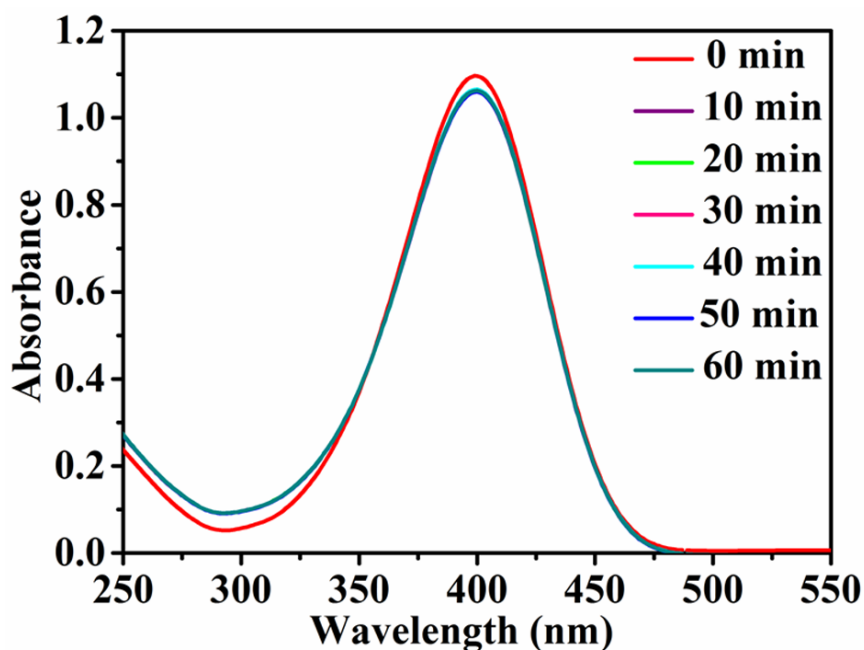
Figure S5. Time-dependent UV−vis spectra of the reaction solution in the absence of $Cu_xO@C$-400.

Figure S6. Time-dependent UV−visible spectrum for the reduction of 4-nitrophenol to 4-aminophenol in water after adding 2 mg of $Cu_xO@C$-300 (A), $Cu_xO@C$-500 (B) The concentration of 4-nitrophenolate was 5.3 μM, and that of sodium borohydride was 0.33 mM.

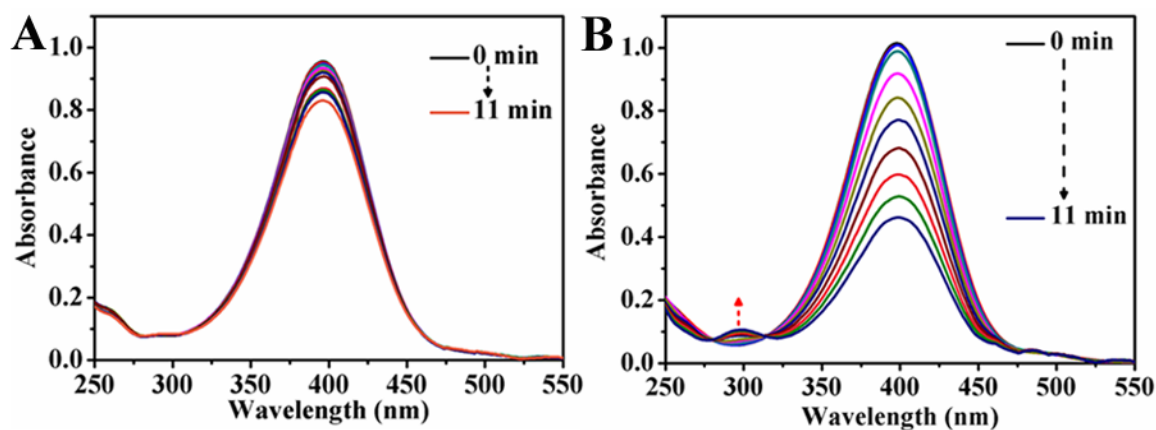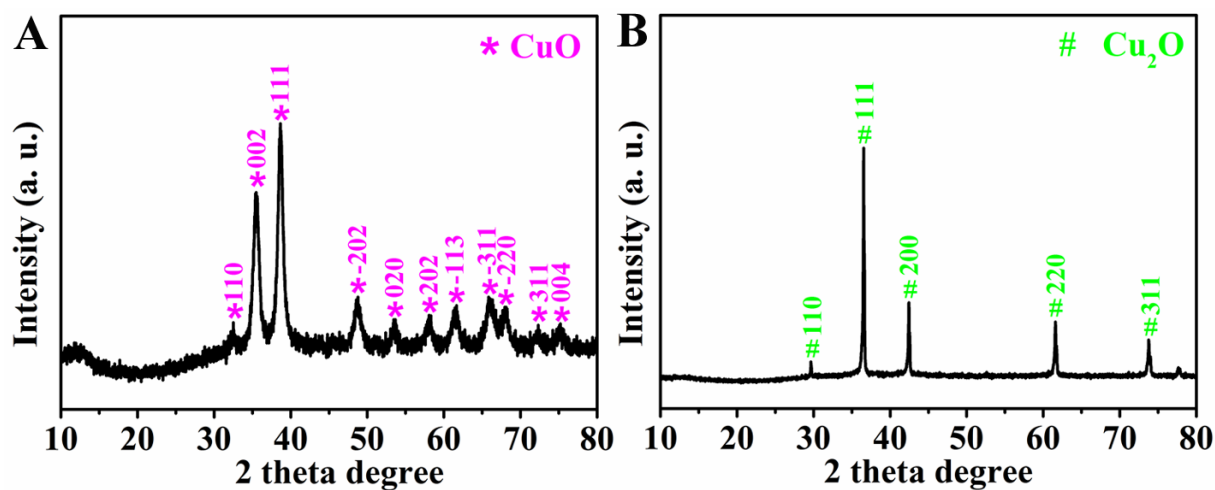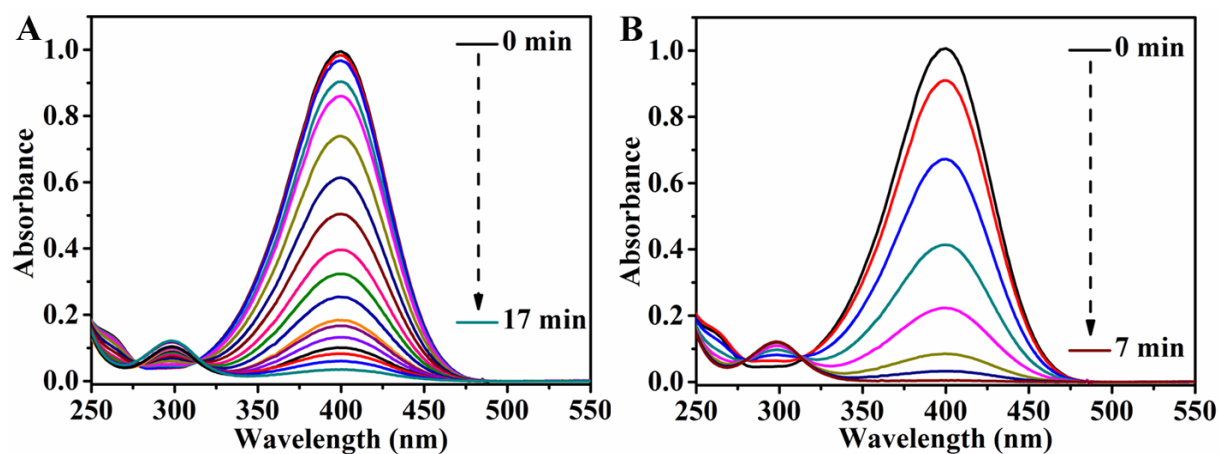**Figure S7**. **(A)** XRD pattern of the CuO. **(B)** XRD pattern of the Cu_2O.

Figure S8. Time-dependent UV−visible spectrum for the reduction of 4-nitrophenol to 4-aminophenol in water after adding 2 mg of CuO (A) and 2 mg of Cu_2O (B). The concentration of 4-nitrophenolate was 5.3 µM, and that of sodium borohydride was 0.33 mM.

Table S1. Comparison of the catalytic activity among the state-of-art notable metal based catalysts and the catalysts synthesized in this work

catalyst	4-NP : NaBH$_4$ (mol / mol)	k$_{app}$ (s^{-1})	ref.
Au/SiO$_2$	1:100	$0.3 * 10^{-3}$	47
Au@MSNs	1:400	$1.6 * 10^{-3}$	9
Ag/SiO$_2$	1:400	$2.7 * 10^{-3}$	48
CNC@PDA-AgNPs	1:317	$4.3 * 10^{-3}$	49
Bio-Pd	1:100	$3.7 * 10^{-4}$	50
CuBTC-400	1:62.5	$0.52 * 10^{-3}$	This work
FPs-400	1:62.5	$4.4 * 10^{-6}$	This work
Cu$_x$O@C-300	1:62.5	$0.21 * 10^{-3}$	This work
Cu$_x$O@C-400	1:62.5	$4.8 * 10^{-3}$	This work
Cu$_x$O@C-500	1:62.5	$1.6 * 10^{-3}$	This work

The apparent rate constant (κ_{app}) can be calculated using following equation : $\ln(C_t/C_0) = \ln(A_t/A_0) = -\kappa_{app}t$, where C_t is the concentration of 4-NP at time t, κ_{app} is the apparent rate constant, The apparent rate constant was determined from the linear plot of $\ln(A_t/A_0)$ versus time.