Supporting Information

One-step green synthesis of composition-tunable Pt-Cu alloy nanowire networks with high catalytic activity for 4-nitrophenol reduction

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Detailed calculation of the reaction rate constant and activity factor:

In terms of the reaction kinetics, as the quantity of BH_4^- was much higher than than that of 4-NP within this system, it was considered as a constant. The catalytic reduction reaction can be considered as a pseudo first-order kinetics, i.e. equation (1):

$$\ln(A_t/A_0) = -kt \qquad (1)$$

where A_t and A_0 are the associated absorbance of 4-NP at time t and the initial stage (λ=400 nm), respectively (*J. Mater. Chem.,* ***2012****, 22, 18327-18334*). As expected, a good linear correlation of ln(At/A0) versus the reaction time was obtained, and the rate constant (K) can be estimated based on the regression of the slope from the logarithm. Therefore, the K for PtCu NWNs was calculated to be 1.339 $\times 10^{-2}$ s^{-1}, while those of the $PtCu_2$ NWNs, Pt_2Cu NWNs, Pt_4Cu NWNs, pure Pt NWNs and Pt/C were calculated as 7.02 $\times 10^{-3}$ s^{-1}, 3.42×10^{-3} s^{-1}, 1.51×10^{-3} s^{-1}, 1.16 $\times 10^{-3}$ s^{-1} and 1.03 $\times 10^{-3}$ s^{-1}, respectively.

To compare our results with the literature reported, we calculated the activity parameter k, which was the ratio of the rate constant to the total mass of the catalyst, i.e. equation (2):

$$k = K/m. \qquad (2)$$

where m is the total mass of the catalyst (200 μg). The activity factor(k) of PtCu NWNs was 66.95 s^{-1} g^{-1}, while those of the $PtCu_2$ NWNs, Pt_2Cu NWNs, Pt_4Cu NWNs, pure Pt NWNs and Pt/C were calculated as 35.1 s^{-1} g^{-1}, 17.1 s^{-1} g^{-1}, 7.55 s^{-1} g^{-1}, 5.8 s^{-1} g^{-1} and 5.15 s^{-1} g^{-1}, respectively. Therefore, the catalytic activity ranking was PtCu NWNs > $PtCu_2$ NWNs > Pt_2Cu NWNs > Pt_4Cu NWNs > Pt NWNs > commercial Pt/C.

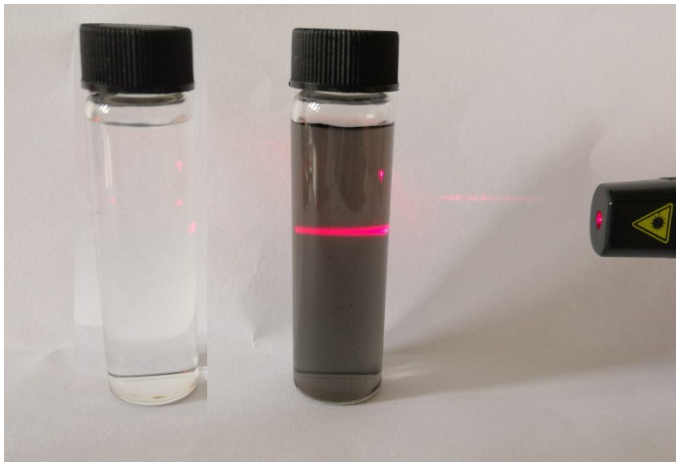

Fig. S1 Tyndall phenomenon of the PtCu NWNs.

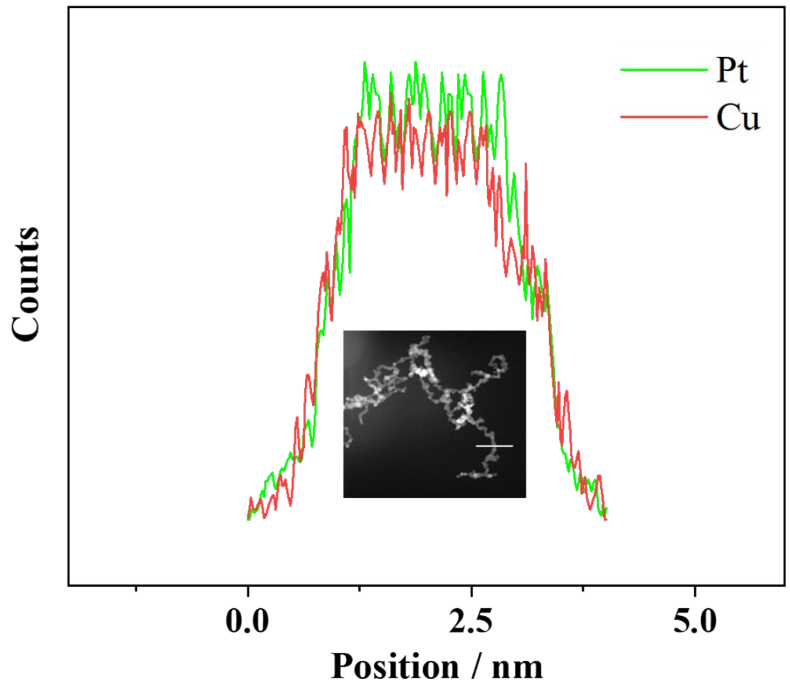

Fig. S2 EDS line scanning profiles of the as-prepared PtCu NWNs.

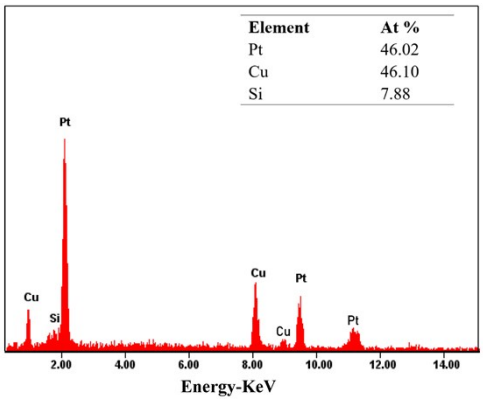

Fig. S3 EDS pattern of the as-prepared PtCu NWNs

Table S1. Molar ratio of Pt to Cu for PtCu NWNs measured by ICP-AES.

Sample	Pt	Cu
mg/L	6.81	2.12
Molar ratio (%)	51	49

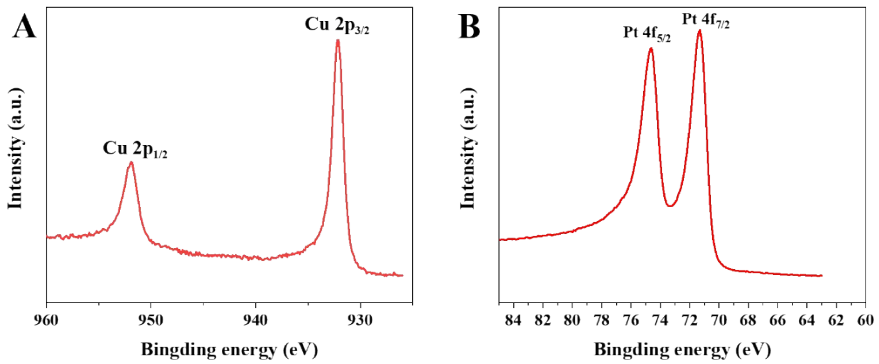

Fig. S4 The binding energies (BEs) of the PtCu NWNs: (A) the Pt4f peaks, (B) the Cu2p peaks.

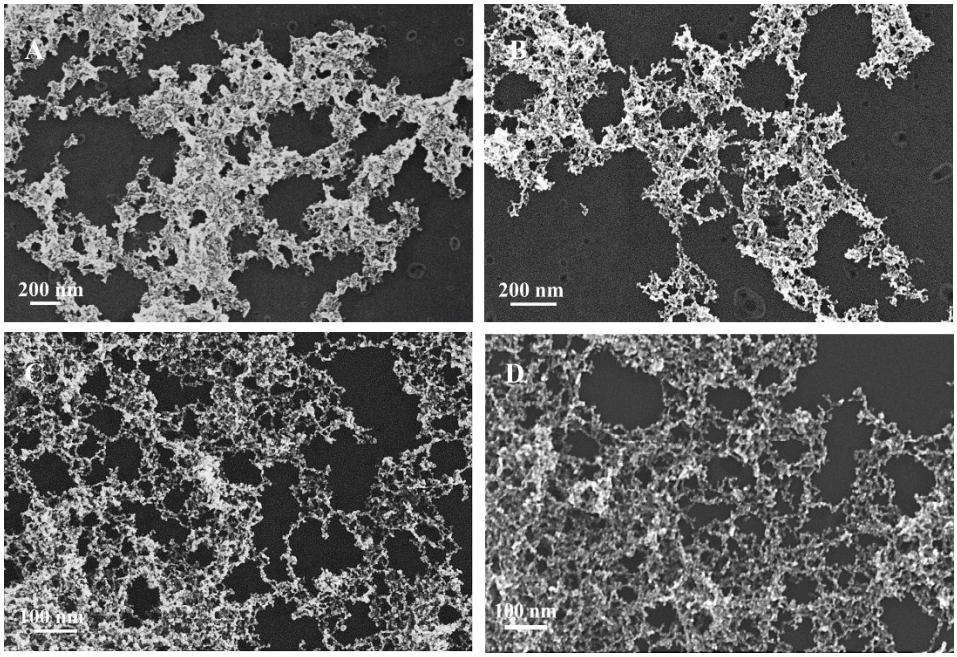

Fig. S5 SEM images of time-dependent intermediate products of the PtCu NWNs.

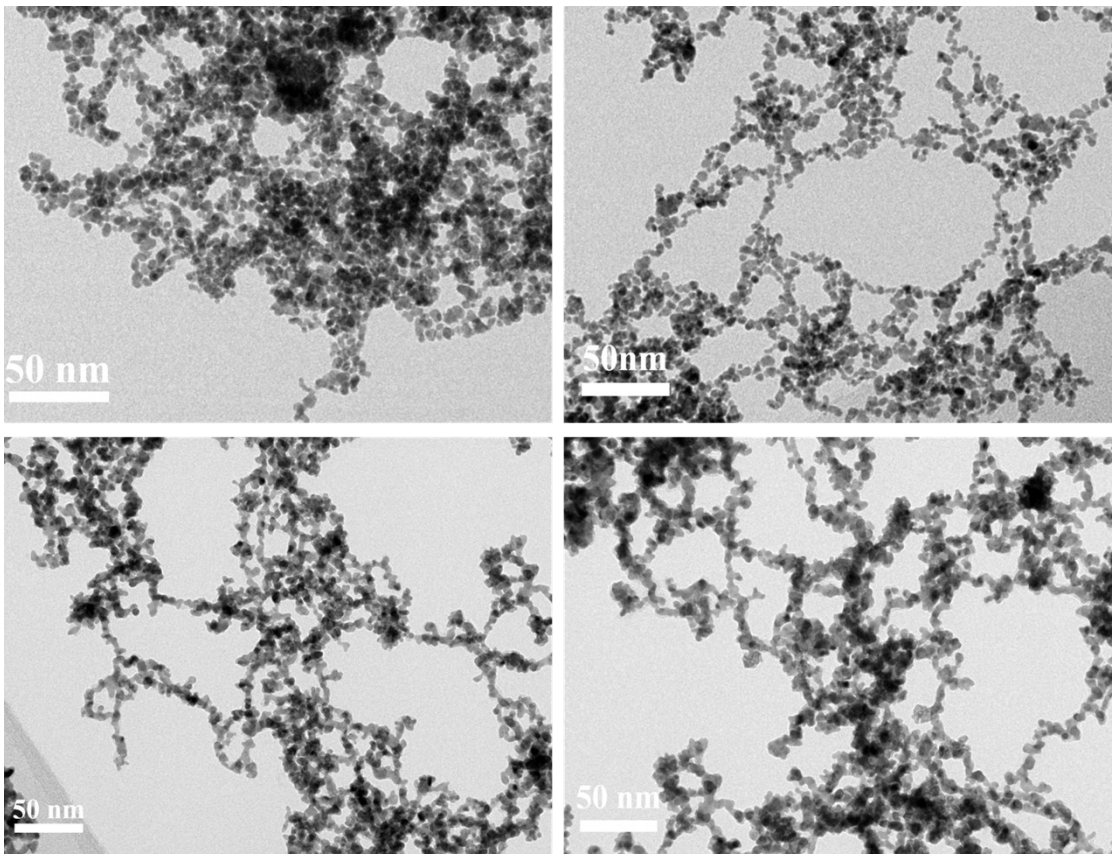

Fig. S6 TEM images of time-dependent intermediate products of the PtCu NWNs

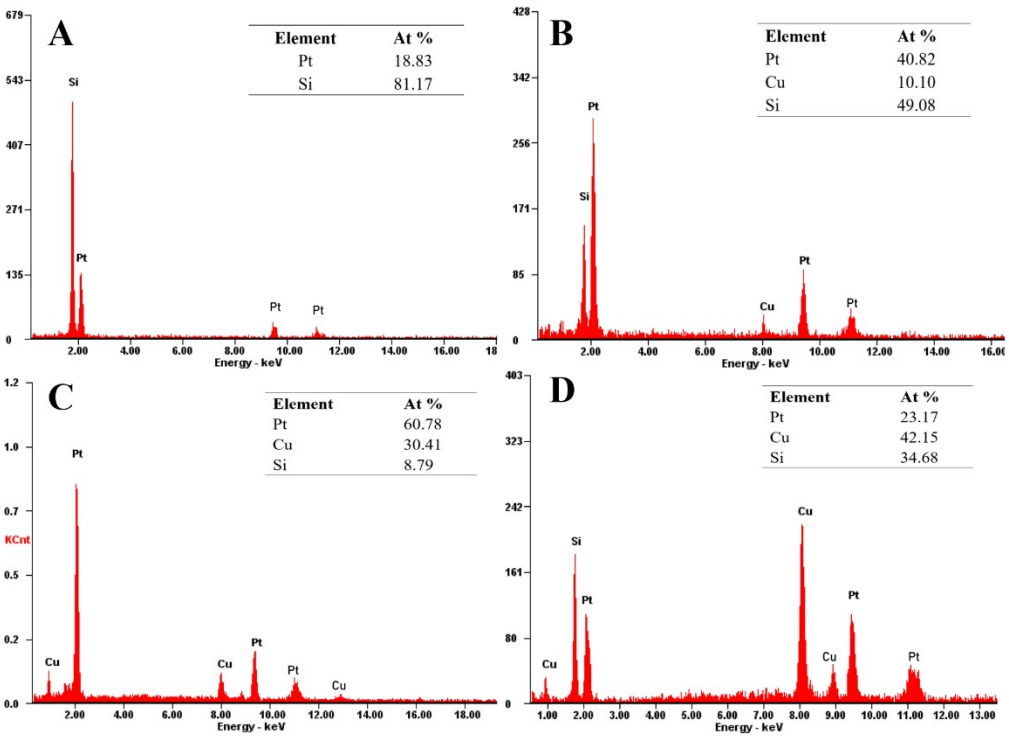

Fig. S7 EDS patterns of the product prepared under different molar ratio of Pt and Cu precursors: (A) pure Pt, (B) 4:1, (C) 2:1, (D) 1:2.

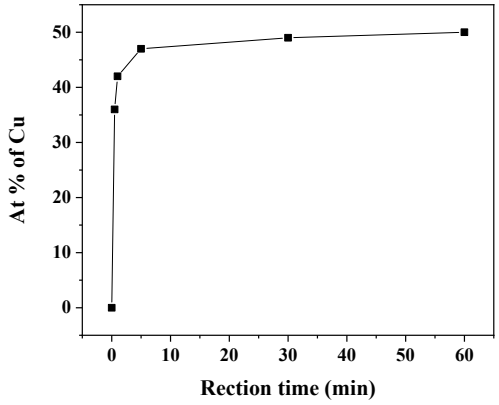

Fig. S8. The composition ratio changes of Cu to Pt in intermediate products of the PtCu NWNs, as determined by EDS spectra.

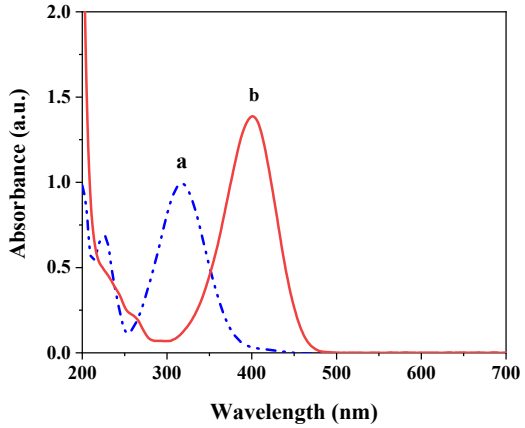

Fig. S9 UV-vis spectra of (a) 4-NP before adding $NaBH_4$, (b) 4-nitrophenolate formation in the presence of $NaBH_4$.

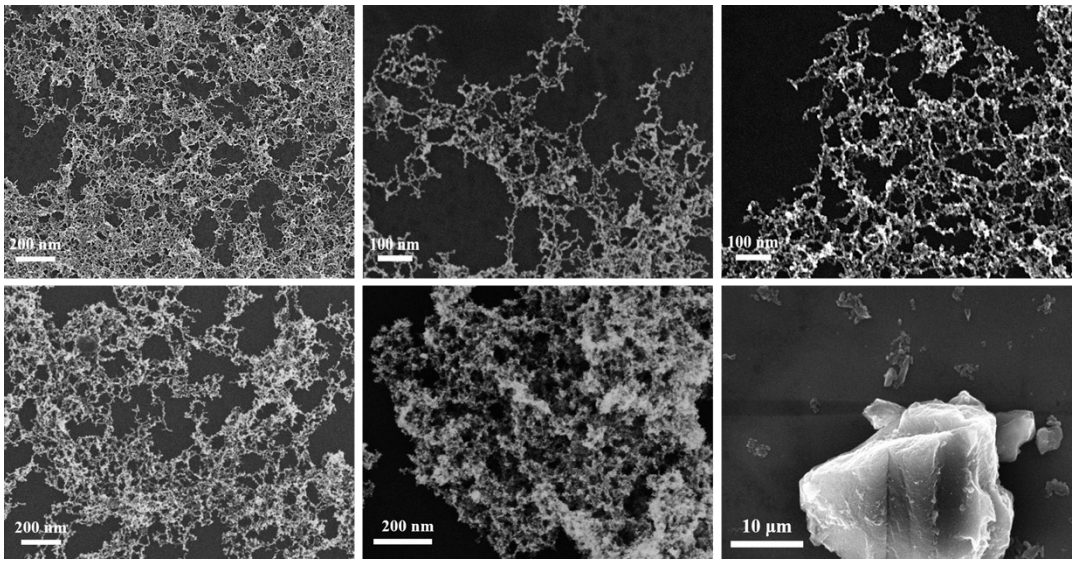

Fig. S10 SEM images of catalysts after the catalytic assays: (A) Pt NWNs; (B) Pt_4Cu NWNs; (C) Pt_2Cu NWNs; (D) PtCu NWNs; (E) $PtCu_2$ NWNs and (F) commercial Pt/C.

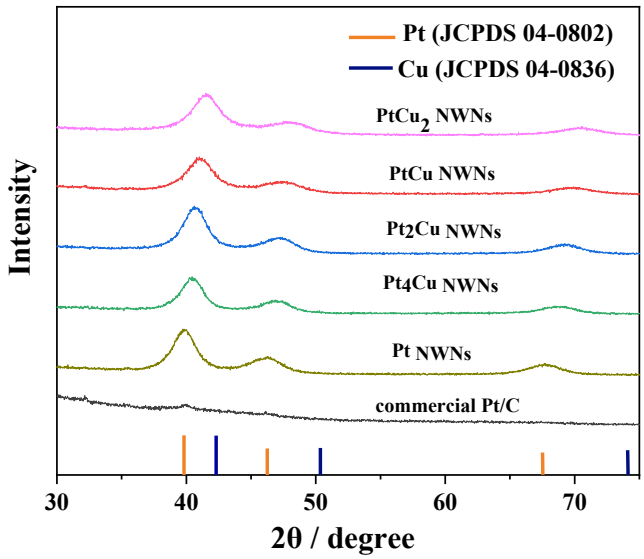

Fig. S11 XRD pattern of catalysts after the catalytic assays

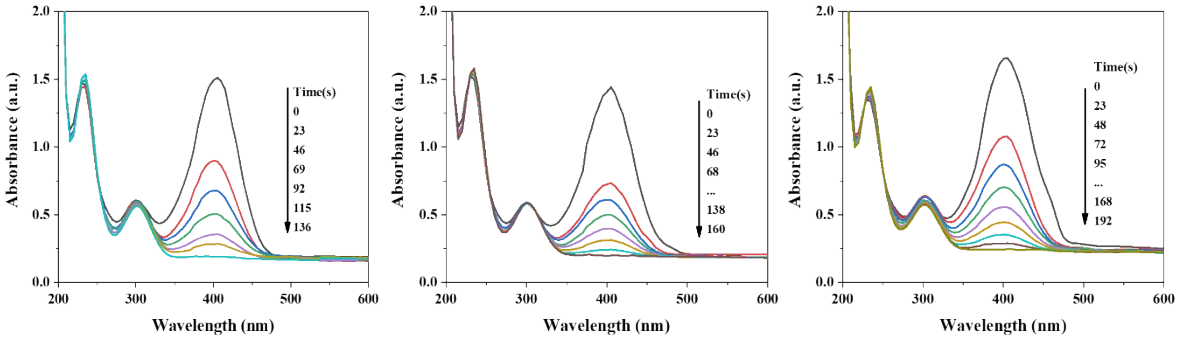

Fig. S12 Time-dependent UV-vis absorption spectra of 4-NP catalytic reduction for 3 cycles.

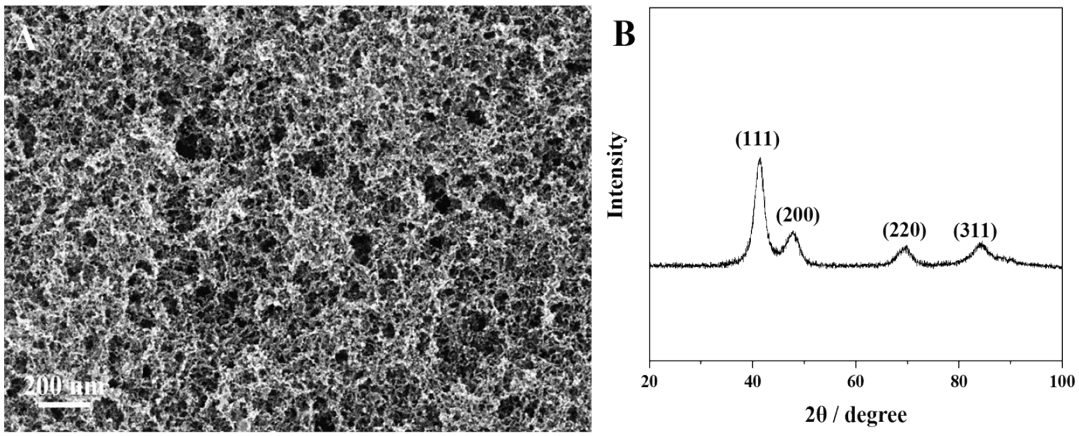

Fig. S13 SEM image (a) and XRD pattern (b) of PtCu NWNs after the catalytic assays.