Supporting Information For

An Environmentally Friendly Route to Synthesize the Cu Micro/Nanomaterials with “Sustainable Oxidation Resistance” and Promising Catalytic Performance

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Fig S1. (a) FESEM; (b) STEM; and (c) HRTEM image of as-prepared Cu.

Fig S2. EDX of the as-prepared products.
Here, potassium citrate, potassium carbonate and potassium chloride are instead of sodium citrate, sodium carbonate and sodium chloride. When we replace all sodium ions with potassium ions, the resulting product is Cu. And the product has no tendency to be oxidized even upon 30 days air exposure.

![Typical FESEM image of products prepared by no additive.](image)

![XRD patterns of the resulting product when no sodium citrate was involved.](image)

![XRD patterns of the resulting product when all sodium salts were replace by potassium salts.](image)

![TG curve for the resulting Cu particles.](image)
Fig S7. XRD patterns of the obtained product when the sodium citrate was replaced by potassium sodium tartrate.

As shown in Fig 8, the conversion can be accelerated with the stirring of solution, which the oxidized Cu particles can restore their unoxidized state in 3 days.

Fig S8. XRD patterns of the annealed Cu particle and the sample upon the 3 days of stirring treatment.

Fig S9. XRD patterns of the original Cu₂O microcrystals and the product after being aged in the reaction solution for 3 days.

Fig S10. The plot of ln (C/C₀) versus time for the reduction of 4-NP that catalyzed by the Cu particles at different temperatures.

Table S1 Reaction rate constants in the presence of the Cu particles at different temperatures

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Reaction rate constants (s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>0.0385 ± 0.0003</td>
</tr>
<tr>
<td>23</td>
<td>0.0388 ± 0.0004</td>
</tr>
<tr>
<td>28</td>
<td>0.0437 ± 0.0003</td>
</tr>
<tr>
<td>33</td>
<td>0.0464 ± 0.0009</td>
</tr>
</tbody>
</table>
According to the Arrhenius equation (ln \( k = \ln A - \frac{E_a}{RT} \)), the activation energy (\( E_a \)) can be obtained from the slope for the linear fitting of ln \( k \) versus 1000/T. As shown the linear fitting in Fig. S11, slope of ln \( k \) versus 1000/T is -1.269. We can thus obtain the \( E_a \).

\[
E_a / R = 1.269 \times 1000; \\
E_a / R = 1.269 \times 1000; E_a = 10.55 \times 10^3 \text{J} \cdot \text{mol}^{-1} = 10.55 \text{KJ} \cdot \text{mol}^{-1};
\]

Intercept for ln \( k \) versus 1000/T is 1.07525. Therefore, we can estimate the pre-exponential factor (\( A \)).

\[
\ln A = 1.07525; A = 2.93 \text{s}^{-1};
\]

Entropy of activation (\( \Delta S \)) can be obtained from the equation \( \ln A = \Delta S / R \).

\[
\Delta S = 1.07525 \times 8.314 = 8.94 \text{ J/mol} \cdot \text{K}
\]

In this synthesis, we chose AgNO₃ and AuCl₃·HCl·4H₂O as the precursor to obtain Ag and Au, respectively. The purity and crystallinity of as-prepared products were examined using powder XRD measurement. Similar to Cu particles, all the prepared noble metals are aggregation of nano-particles.

Only in the presence of NaBH₄, Methyl orange would be degraded to 33% after 60 hours. Nevertheless, this degradation could not proceed even after another 90 hours reaction time. This result indicates the Methyl orange cannot be degraded completely without catalyst.
Fig S14. Plots of maximum absorption peak for Methyl orange versus the reaction time.

Fig S15. Plots of maximum absorption peak for Rhodamine B versus the reaction time.