Supporting Information for the manuscript

A facile and green approach to synthesize Pt@CeO$_2$ nanocomposite with tunable core-shell and yolk-shell structure and its application as a visible light photocatalyst

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Method for calculation procedures for energy position of conduction band edge ($E_C$) and valence band edge ($E_V$) of semiconductors

The calculation can be described as the following steps.

1. Calculate electronegativity of the elements $^{[S1]}$

\[ \chi = \frac{I + A}{2} \]

where $\chi$ is electronegativity; I is ionization energy and A is electron affinity.

2. Calculate electronegativity of the compound $^{[S2,S3]}$

\[ \chi_{oxide} = \left[ (\chi_M)^m (\chi_O)^n \right]^{1/(m+n)} \]

3. Calculate the $E_g$ (band gap) from DRS (UV-visible diffuse reflectance spectra) result $^{[S4]}$

\[ E_g = \frac{1240}{\lambda} \]

4. Determine $E_C$ and $E_V$ $^{[S5]}$

   vs. AVS (the absolute vacuum scale)

\[ E_C = -\chi + 0.5E_g \]
\[ E_V = -\chi - 0.5E_g \]

   vs. SHE (standard hydrogen electrode)

\[ E_C = -\chi + 0.5E_g - 4.5 \]
\[ E_V = -\chi - 0.5E_g - 4.5 \]


Fig. S1 The result of EDS for the core-shell Pt@CeO$_2$ nanoparticles (note: the signals of Cu and Zn resulted from the sample holder).

Fig. S2 HRTEM and SAED images of the yolk-shell Pt@CeO$_2$ nanocomposite.
**Fig. S3** TEM and EDS results of the as-synthesized yolk-shell Pt@CeO$_2$ nanocomposite (note: the singal of Cu resulted from the sample holder).

**Fig. S4** Photograph (A) and TEM image (B) of the original Pt colloid nanoparticles.