Supporting Information for the Manuscript

Aggregation- and Leaching-Resistant, Reusable and Multifunctional 
Pd@CeO$_2$ as a Robust Nanocatalyst Achieved by a Hollow 
Core-Shell Strategy

Nan Zhang, and Yi-Jun Xu$^*$

State Key Laboratory Breeding Base of Photocatalysis, College of Chemistry and Chemical 
Engineering, Fuzhou University, Fuzhou, 350002, P.R. China

To whom correspondence should be addressed. Tel. /fax: +86 591 83779326

E-mail Address: yjxu@fzu.edu.cn

Figure S1. (A) TEM image of the as-prepared Pd nanoparticles and (B) the size distribution; the 
inset of A is the photograph of Pd colloid solution.
**Figure S2.** The zeta potentials ($\xi$) of (A) carbon spheres and (B) carbon spheres–Pd composite in deionized water.

**Figure S3.** XRD patterns of commercial CeO$_2$, supported Pd/CeO$_2$ and Pd@hCeO$_2$ core-shell nanocomposites.
Figure S4. N 1s XPS spectra of the Pd@hCeO₂ hollow core-shell nanocomposite.

Figure S5. Thermogravimetric analysis of the Pd@hCeO₂ hollow core-shell nanocomposite.
**Figure S6.** Time-dependent UV–vis spectral changes of the thermocatalytic reduction of 4-nitrophenol (4-NP) to 4-aminophenol (4-NA) catalyzed by Pd@hCeO\(_2\) core-shell nanocomposite in the presence of NaBH\(_4\) solution under ambient conditions.

**Figure S7.** TEM image of the used Pd@hCeO\(_2\) core-shell nanocomposite.
Figure S8. ICP–MS spectra of element Pd in (A) DI water and the supernatant after thermocatalytic reduction of 4-NP over (B) Pd@hCeO$_2$ core-shell and (C) supported Pd/CeO$_2$ nanocomposite; (D) the bar chart comparison of the ICP–MS spectra intensity of Pd obtained in the samples under the same experimental conditions.

Figure S9. Photographs of the supernatants (A1 and B1) before and after thermocatalytic reduction of 4-NP over (A2) the Pd@hCeO$_2$ core-shell nanocomposite and (B2) supported Pd/CeO$_2$ nanocomposite under ambient conditions.
Figure S10. The normalized intensity of Pd (3d) XPS spectra of (a) fresh and (b) used supported Pd/CeO$_2$ nanocomposite.

Figure S11. UV–vis diffuse reflectance spectra (DRS) of commercial CeO$_2$, supported Pd/CeO$_2$, Pd@hCeO$_2$ core-shell nanocomposites (top panel) and the corresponding photographs (bottom panels).
**Figure S12.** (A) UV–vis diffuse reflectance spectra (DRS) of the supported Pd/CeO$_2$ and Pd@hCeO$_2$ core-shell nanocomposites before and after the photocatalytic reaction; (B) the corresponding photographs of the fresh and used samples showing the color change.