Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Information for

A Highly Reactive and Magnetic Recyclable Catalytic System Based on AuPt Nanoalloys Supported on Ellipsoidal Fe@SiO_2

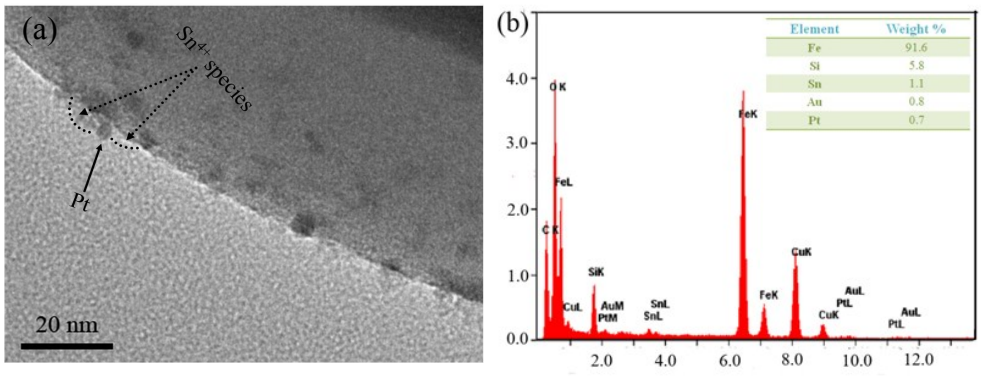

Figure S1 (a) Representative enlarged TEM image of Fe_2O_3@SiO_2/Pt to show the "islands in the sea" configuration (one side of Pt NPs linking with SiO_2 layer is covered with a smooth layer and another side of Pt NPs is exposed). (b) EDX spectroscopy of the as-prepared Fe_2O_3@SiO_2/AuPt NPs and the corresponding element composition.

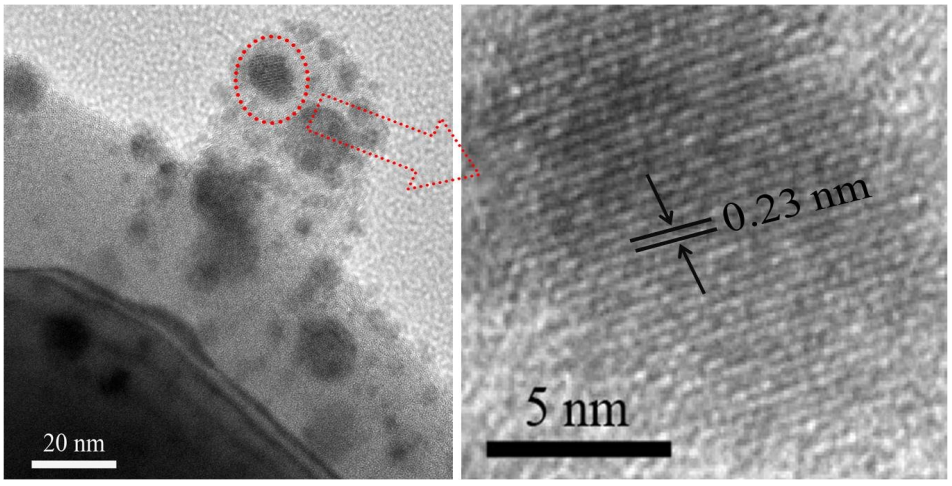

Figure S2 A representative HRTEM image of AuPt NPs on the surface of Fe@SiO_2 NCs.

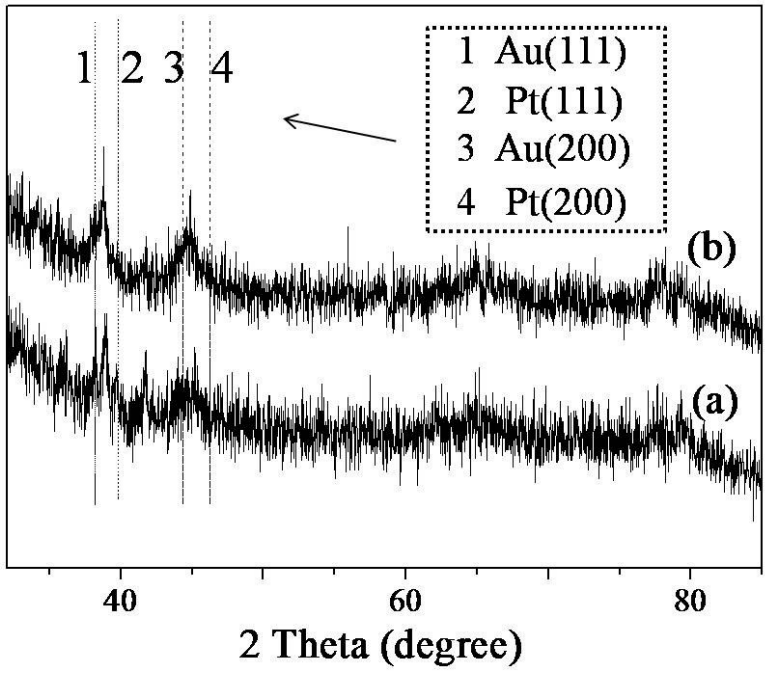

Figure S3 XRD patterns for the SiO_2/AuPt with different ratio of AuPt dosage. (a) 0.5:1, and (b) 1:1(The corresponding TEM images were shown in Figure S8a). All the samples were sequentially suffered from roasting under air and then H_2 atmosphere.

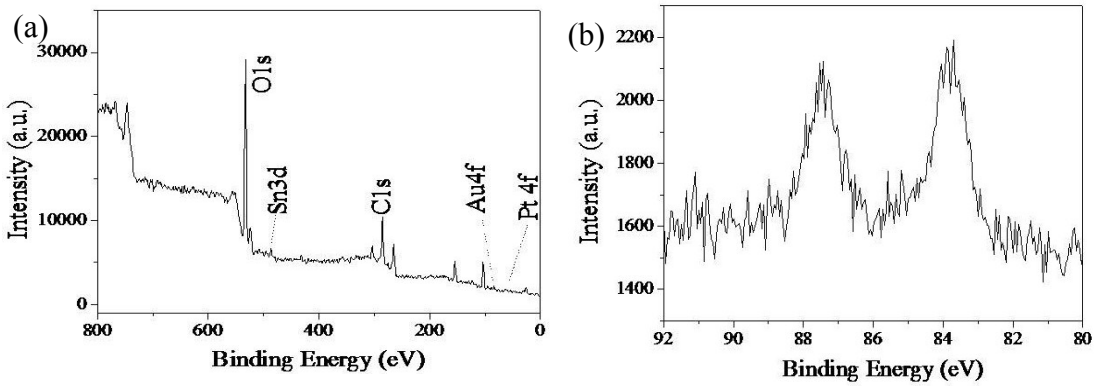

Figure S4 XPS spectra of the Fe@SiO_2/AuPt nanocomposites: (a) fully scanned spectra, and (b) Au 4f spectra.

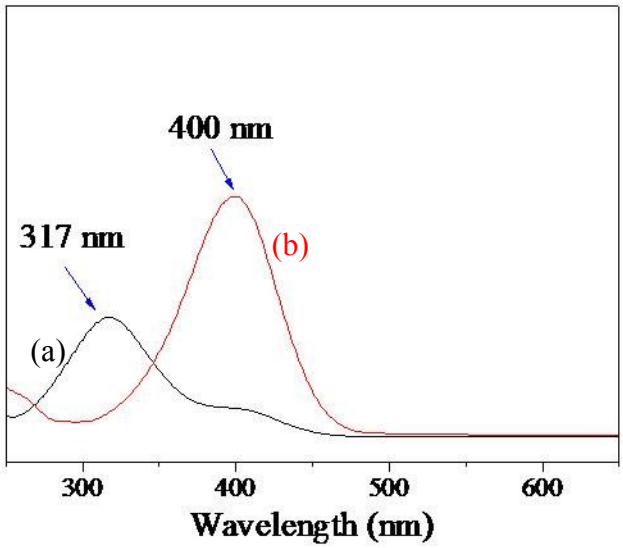

Figure S5 UV-vis absorption spectra of 4-NP (a) without and (b) with the addition of $NaBH_4$ solution.

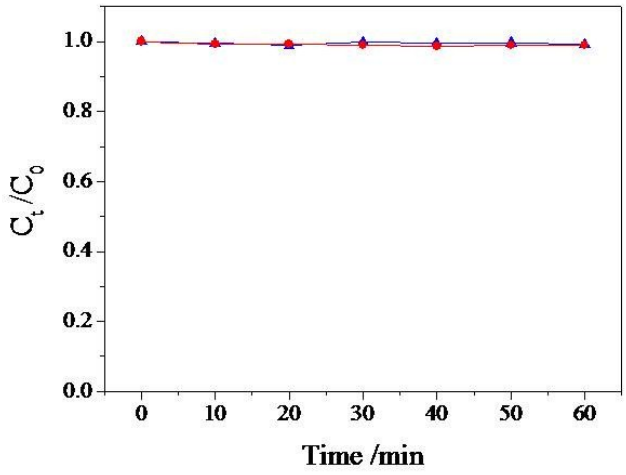

Figure S6 C_t/C_0 versus reaction time for the reduction of 4-NP with $Fe@SiO_2$ NCs (blue line), and $Fe@SiO_2$-Sn NCs (red line).

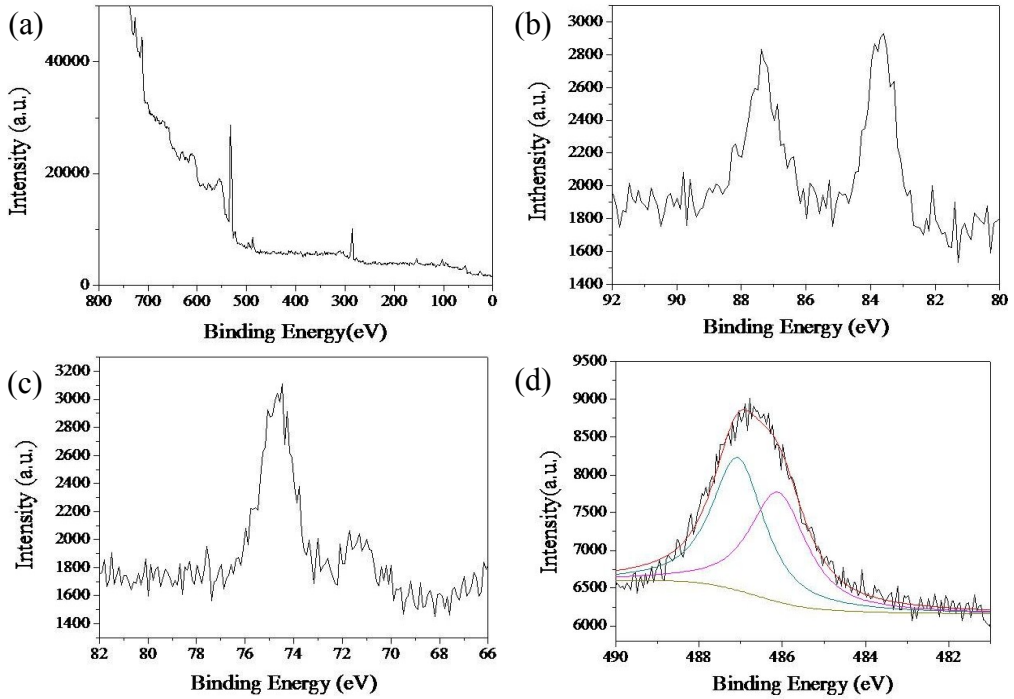

Figure S7 XPS spectra of the Fe/SiO_2/AuPt composites after reduction reaction of 4-NP. (a) Fully scanned spectra, (b) Au 4f spectra, (c) Pt 4f spectra, and (d) Sn 3d spectra.

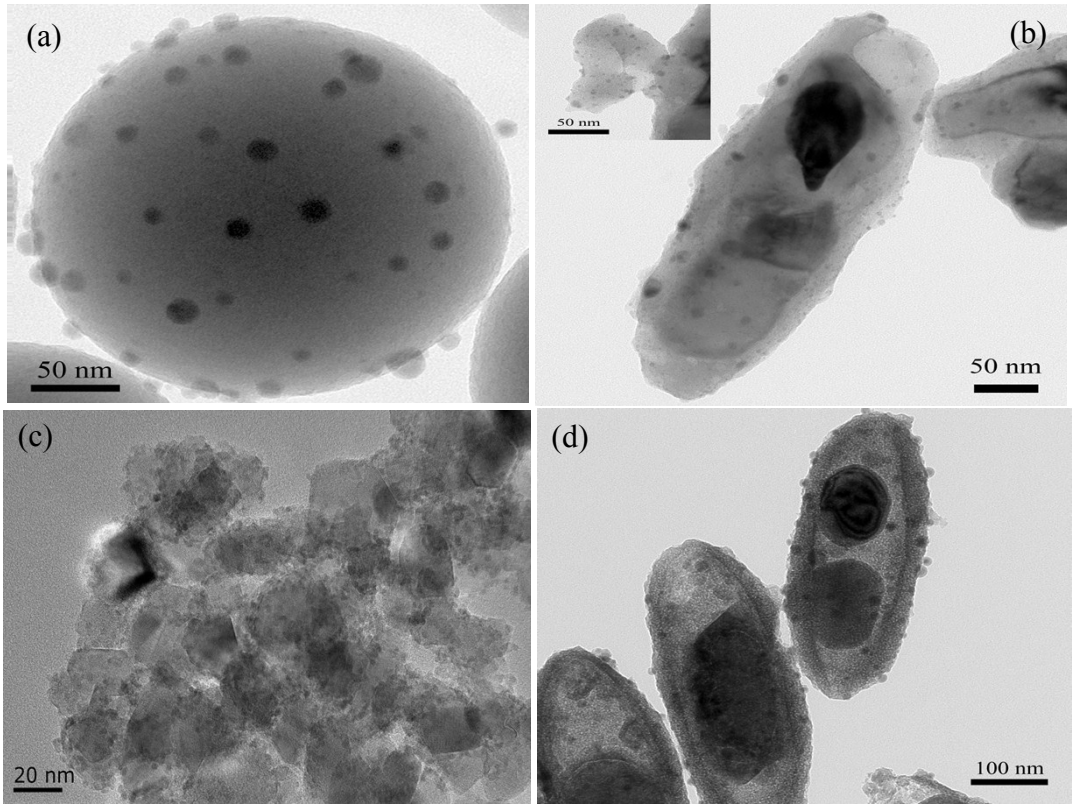

Figure S8 TEM images showing the versatile in-situ reduction methods to obtain AuPt bimetallic NPs on different oxides surface with more uniform distribution. (a) SiO_2/AuPt(1:1), (b) Fe@TiO_2/AuPt (Inset shows clearly the quite small size of AuPt NPs in the shell), (c) Degussa P25/AuPt , and (d) Fe@$Ti_{0.5}Zr_{0.5}O_2$/AuPt. For the sample of (a) and (c), the nominal total weight of Au and Pt contents is increased to 1.0 %. And for the sample of (b) and (d), the addition of Au and Pt precursor is the same as the Fe@SiO_2/AuPt. All the samples expect (c) have been suffered from thermal treatments sequentially in air and H_2 atmosphere.

(For the preparation of Fe_2O_3@TiO_2 and Fe_2O_3@ZrO_2-TiO_2: 50 mL of the colloidal solution was added into a mixture solution containing ethanol (50 mL), 1-hexadecylamine (0.25 g), and ammonia (0.5 mL) with mechanical stirring. Then 0.4 mL of tetrabutyl titanate (for Fe_2O_3@TiO_2) or a mixed solution containing 0.2 mL of tetrabutyl titanate and 0.2 mL of zirconium(IV) n-butoxide (for Fe_2O_3@ZrO_2-TiO_2) that dissolved in ethanol (25 mL) was slowly added to the colloidal mixture. After injection, the solution was kept to stir for 4 h, and then age for 12 h)

Table S1 Comparison of rate constant for the catalytic reduction of 4-NP by $NaBH_4$ using catalysts containing Au and (or) Pt nanoparticles.

Catalyst	Size of noble metal NPs (nm)	Initial concentration of 4-NP (mM)	Amount of noble NPs (nmol)	k_{app} per noble NPs content (10^{-2} $s^{-1}\mu mol^{-1}$)
Au@SiO_2[1]	40	0.1	135.9	1.40
Fe_3O_4@SiO_2-Au@m-SiO_2[2]	12	0.24	335	1.74
Au-CeO_2[3]	4	0.068	4.55	281
PtCo/NaY[4]	14	7.2	579.5	1.722
Fe_3O_4/C/Pt-Pd[5]	10-20	0.05	1.68	1202
Porous AuPt particles[6]	-	0.24	~2564	2.145
Fe@SiO_2/AuPt(This work)	10	0.37	4.18	662.0

References

1. Z. Wang, H. Fu, D. Han and F. Gu, *J Mater Chem A*, 2014, DOI: 10.1039/c4ta04524f.
2. Y. H. Deng, Y. Cai, Z. K. Sun, J. Liu, C. Liu, J. Wei, W. Li, C. Liu, Y. Wang and D. Y.

Zhao, *J Am Chem Soc*, 2010, 132, 8466-8473.
3. C. M. Fan, L. F. Zhang, S. S. Wang, D. H. Wang, L. Q. Lu and A. W. Xu, *Nanoscale*, 2012, 4, 6835-6840.
4. Z. M. El-Bahy, *Appl Catal a-Gen*, 2013, 468, 175-183.
5. P. Zhang, R. Li, Y. M. Huang and Q. W. Chen, *Acs Appl Mater Inter*, 2014, 6, 2670-2677.
6. A. J. Ma, J. Xu, X. H. Zhang, B. Zhang, D. Y. Wang and H. L. Xu, *Sci Rep-Uk*, 2014, 4.