Supplementary Information

Preparation of yolk/shell Fe_xO_y/Pd@mesoporous SiO_2 composites with high stability and their application in catalytic reduction of 4-nitrophenol

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Fig. S1 (a) Survey XPS spectra of Fe_3O_4@C (black line) and Fe_3O_4@C/Pd (red line) samples; (b) high-resolution Fe 2p XPS spectrum of Fe_3O_4@C composites; (c) high-resolution Pd 3d XPS spectrum of Fe_3O_4@C/Pd composites.

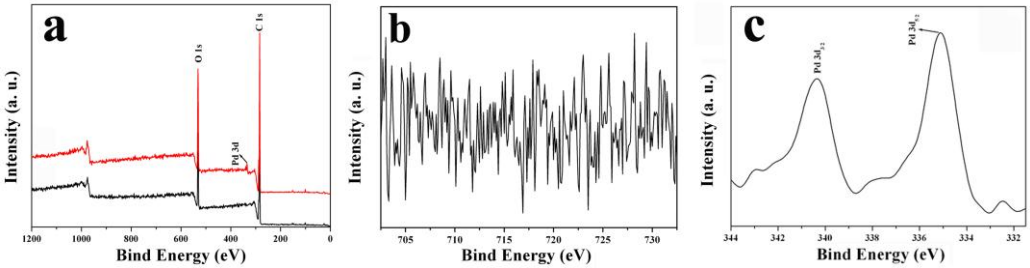

Fig. S2 TEM image of Fe_3O_4@C composites prepared with glucose dosage of 5.0 g. The thickness of carbon shell is around 25 nm.

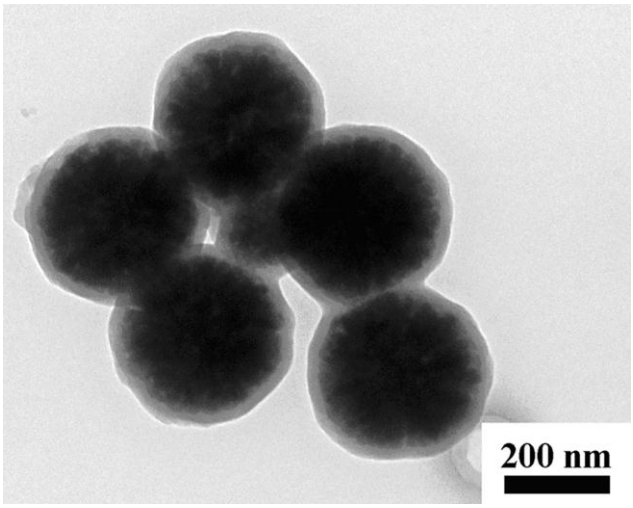

Fig. S3 Zeta-potentials of the Fe_3O_4@C composites in aqueous solution at different pH values. When pH value was adjusted above 12, plenty of hydroxyl ions were introduced into the solution, which resulted in the increase of ion concentration in solution and compression of the electric double layer; and hence, the absolute value of zeta-potential gradually reduced.

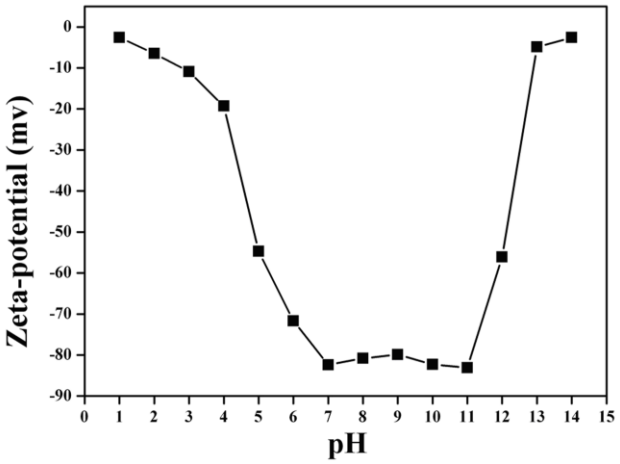

Fig. S4 The rate constant *k* estimated by the slopes of straight lines of $\ln(A_t/A_0)$ *vs.* reduction time using Fe_xO_y/Pd@mSiO_2 catalysts prepared with different Pd nanoparticles loading: (a) 0.43 wt%; (b) 1.1 wt%; (c) 1.4 wt%; (d) 1.9 wt%.

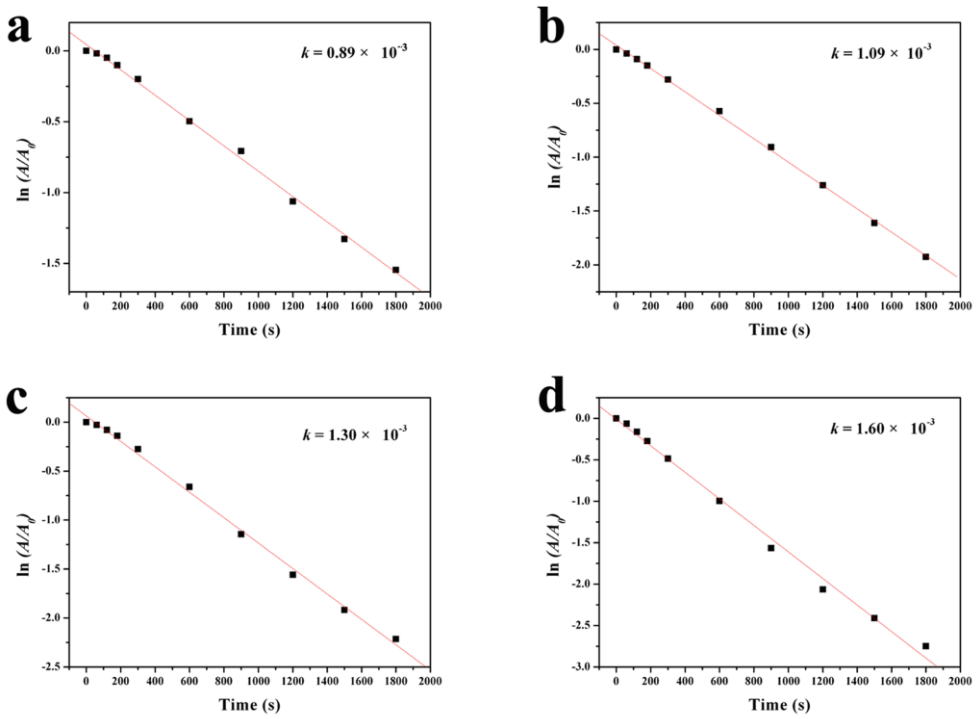

Fig. S5 (a) Conversion of 4-NP using obtained Pd@mSiO$_2$ composites as catalysts (0.1 mg) for various time; (b) The rate constant *k* estimated by the slopes of straight lines of ln*(A$_t$/A$_0$) vs.* reduction time.

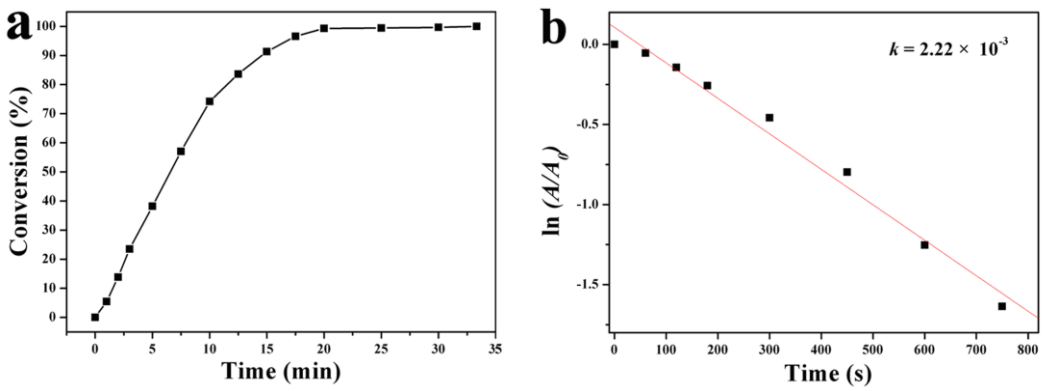

Fig. S6 (a) Conversion of 4-NP using Fe_3O_4@C/Pd composites with the same Pd nanoparticle loading as corresponding Fe_xO_y/Pd@mSiO_2 catalysts for various time; (b) The rate constant *k* estimated by the slopes of straight lines of $\ln(A_t/A_0)$ *vs.* reduction time.

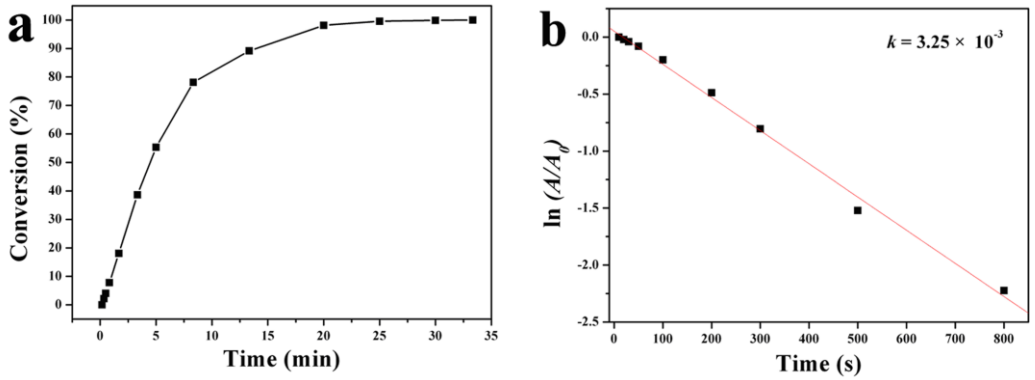

Fig. S7 UV-Vis spectra of 4-NP reduction with Fe_xO_y/Pd@mSiO_2 catalysts in different cycles. Inset showed the digital image of reaction solution after reaction for 10 times

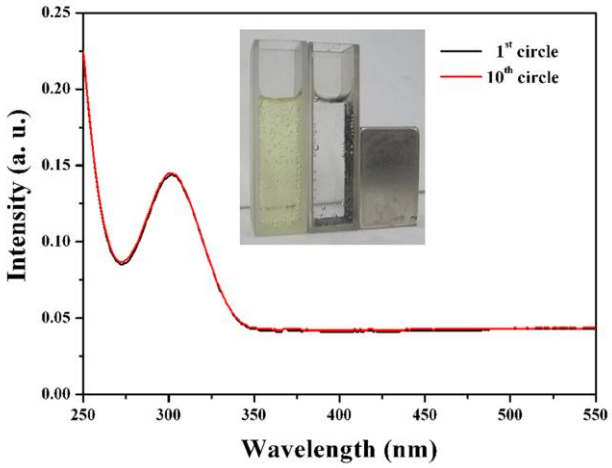

Fig. S8 (a) SEM image of Fe_xO_y/Pd@mSiO_2 composites after used in catalytic tests for 10 times. The inset showed the magnified image. The yolk/shell structure could be confirmed from the ruptured mSiO_2 shell which was indicated by arrow. (b) TEM image of obtained Pd@mSiO_2 composites which were prepared by dissolution of magnetic core in corresponding Fe_xO_y/Pd@mSiO_2 samples (*Fig. S8a*). The inset showed the magnified image. It could be seen that both the size and dispersity of Pd nanoparticles were well preserved.