Electronic Supplementary Information

Multifunctional Au-Fe_3O_4@MOF core-shell nanocomposite catalysts with controllable reactivity and magnetic recyclability

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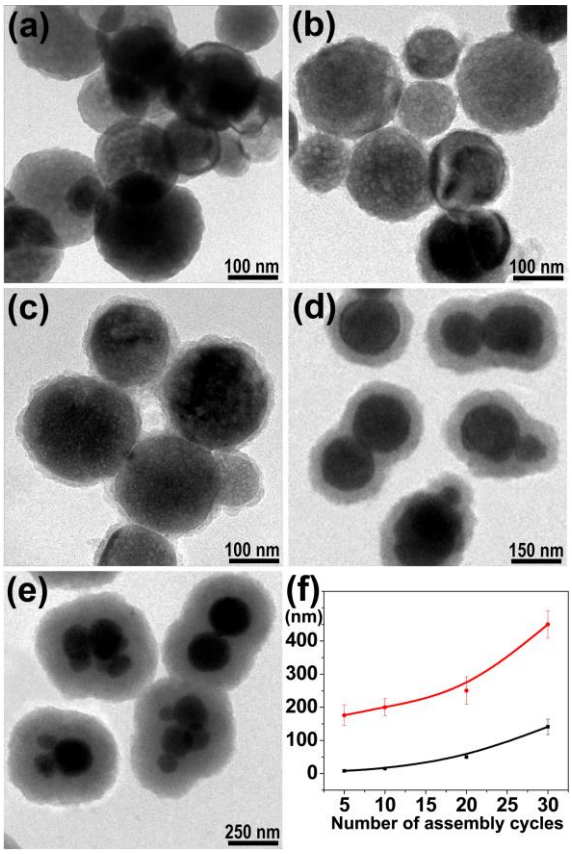

Fig. S1 TEM images of Au-Fe_3O_4 (a) and Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic NPs after 5 (b),10 (c), 20 (d), 30 (e) assembly cycles. (f) The correlations between the assembly cycles and the resulting diameter (red line) and shell thickness (black line).

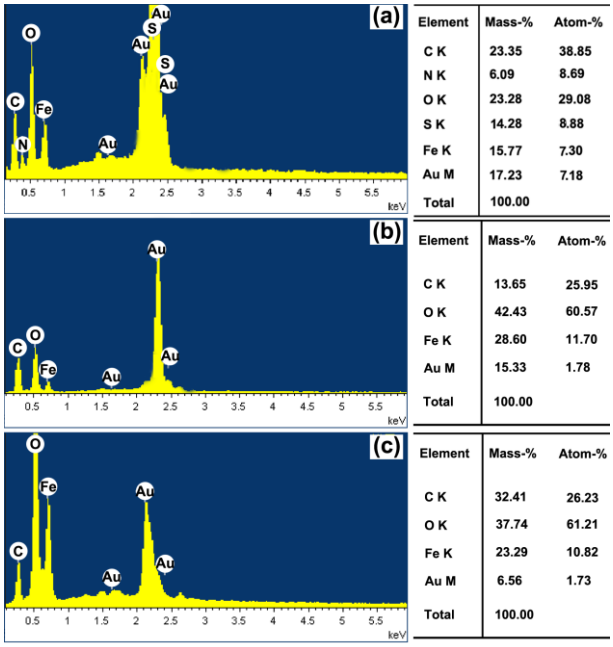

Fig. S2 EDX spectra of Au-Fe_3O_4 (a), Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic NPs after 5 (b) and 30 assembly cycles (c).

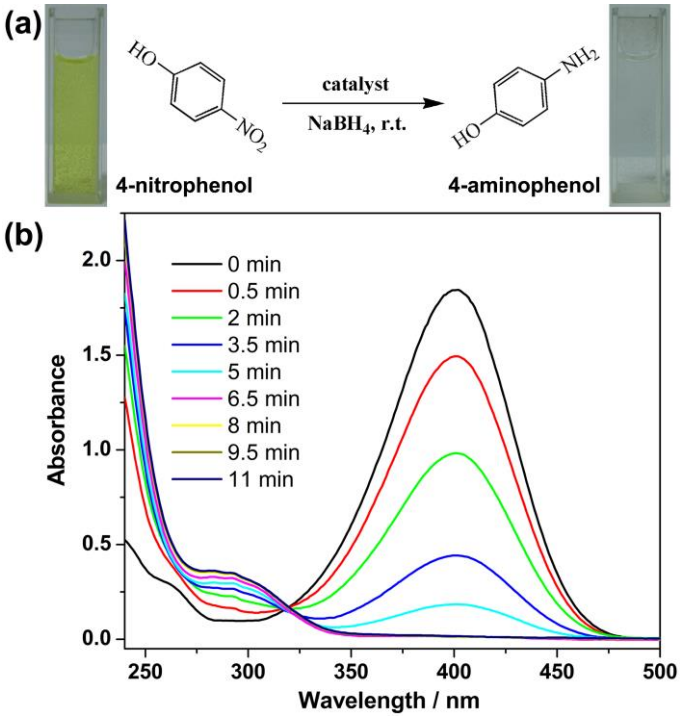

Fig. S3 (a) The reaction scheme, associated photographs of the color change for conversion of 4-NP from bright yellow to colorless, and (b) UV-vis spectra of 4-NP reduction with Au-Fe_3O_4@MIL-100(Fe) core-shell NPs after 30 assembly cycles.

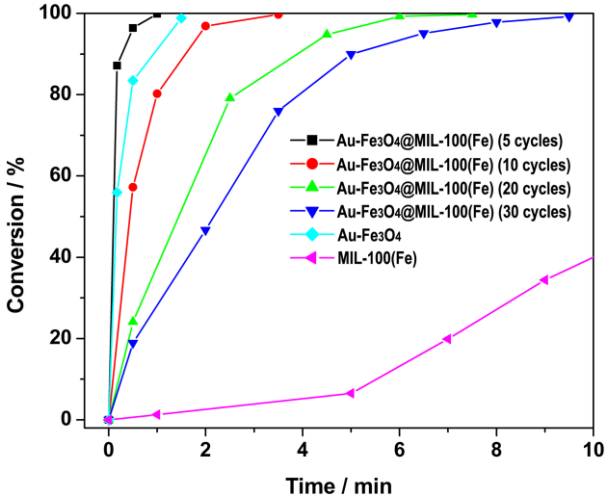

Fig. S4 Catalytic conversion of 4-NP to 4-AP over Au-Fe_3O_4, MIL-100(Fe), and Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic NPs after 5, 10, 20 and 30 assembly cycles, respectively.

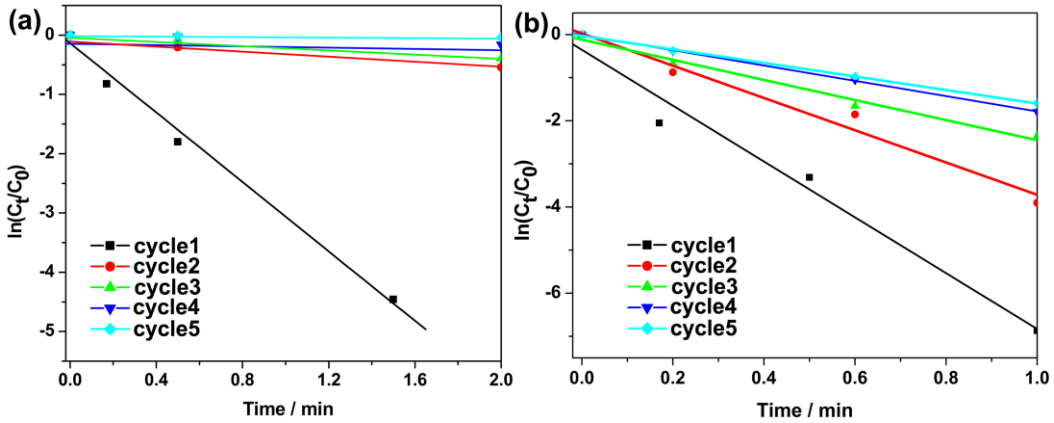

Fig. S5 Relationship of the ln(C_t/C_0) and reaction time t for 5 cycles of 4-NP reduction under the same reaction conditions over the Au-Fe_3O_4 magnetic NPs (a), and the core-shell Au-Fe_3O_4@MIL-100(Fe) magnetic NPs synthesized with five assembly cycles (b).

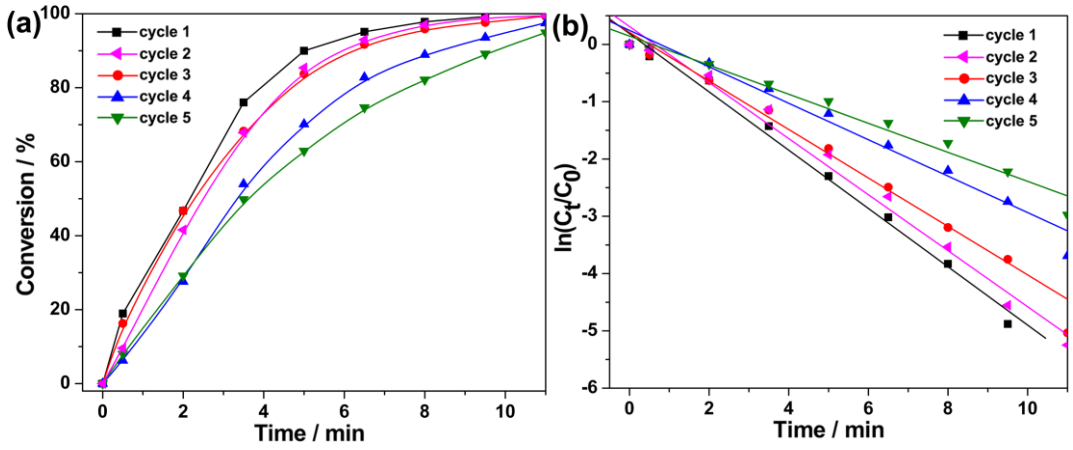

Fig. S6 Catalytic conversion (a) and relationship of the ln(C_t/C_0) and reaction time t (b) for 5 cycles of 4-NP reduction over the core-shell Au-Fe_3O_4@MIL-100(Fe) magnetic NPs. The catalysts were synthesized with 30 assembly cycles.

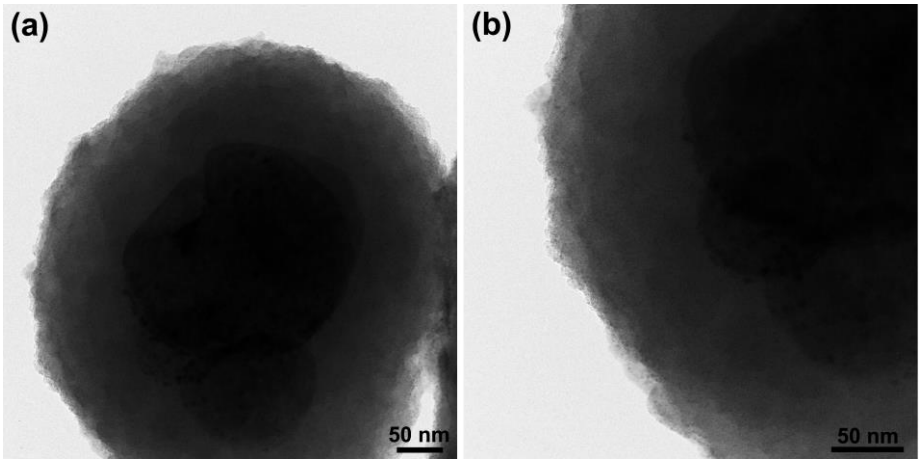

Fig. S7 TEM images (a,b) of the Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic catalysts after the catalytic reaction. The catalysts were synthesized with 30 assembly cycles.

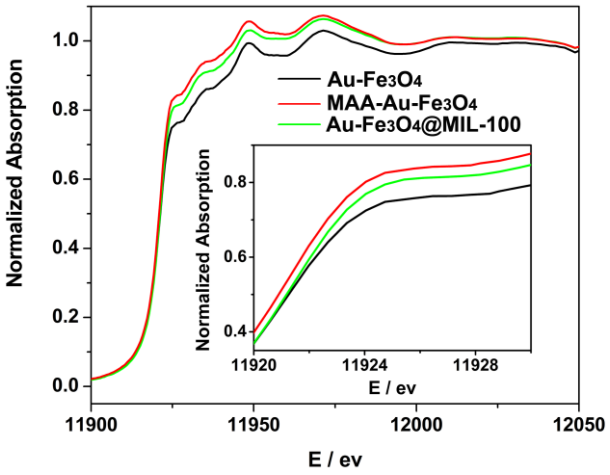

Fig. S8 Au L_3-edge XANES spectra for Au-Fe_3O_4, MMA-Au-Fe_3O_4, and Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic NPs. The insert shows the zoom-in lines.

Table S1 Recovery and reuse of Au-Fe_3O_4.

Use	Yield (%)	k (min^{-1})
first	100	2.92
second	42	0.12
third	33	0.090
fourth	15	0.054
fifth	4	0.020

Table S2 Recovery and reuse of Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic nanocatalysts. The catalysts were synthesized with 5 assembly cycles.

Use	Yield (%)	k (min^{-1})
first	100	5.53
second	98	3.74
third	91	2.33
fourth	84	1.77
fifth	80	1.57

Table S3 Recovery and reuse of Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic nanocatalysts. The catalysts were synthesized with 30 assembly cycles.

Use	Yield (%)	k (min^{-1})
first	100	0.51
second	100	0.49
third	99	0.42
fourth	98	0.32
fifth	95	0.26

Table S4 Fitting parameters of the Au L_3-edge EXAFS oscillations for Au-Fe_3O_4, MAA-Au-Fe_3O_4, and Au-Fe_3O_4@MIL-100(Fe) core-shell magnetic NPs.

sample	bond	R / Å	N	σ^2 / Å^2(10^{-3})	ΔE
Au-Fe_3O_4	Au-Au	2.88 ± 0.02	10.4 ± 0.4	11.2 ± 1.1	3.1 ± 1.0
	Au-S	2.29 ± 0.03	0.8 ± 0.2	6.5 ± 1.0	4.0 ± 0.5
MAA-Au-Fe_3O_4	Au-Au	2.87 ± 0.02	9.8 ± 0.4	13.0 ± 1.1	4.5 ± 1.2
	Au-S	2.33 ± 0.03	1.1 ± 0.2	6.1 ± 1.0	3.0 ± 0.4
Au-Fe_3O_4@MIL-100(Fe)	Au-Au	2.87 ± 0.02	10.1 ± 0.4	12.7 ± 1.1	2.9 ± 1.1
	Au-S	2.33 ± 0.03	1.0 ± 0.2	6.2 ± 1.0	3.5 ± 0.5