Supporting information for New Journal of Chemistry

Preparation of Hollow Fe_3O_4/Pd@C NCs to stabilize subminiature Pd nanoparticles for reduction of 4-nitrophenol

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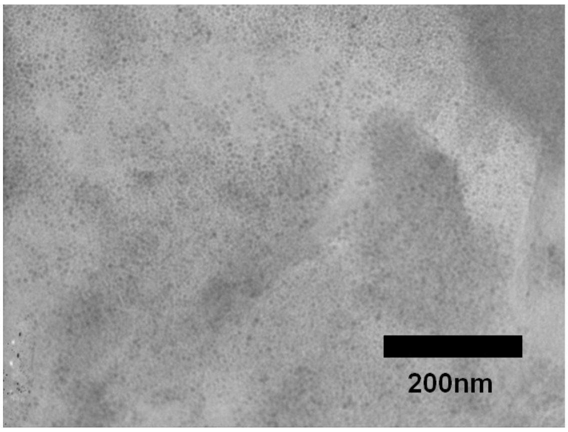

Fig. S1 TEM image of the PVP-Fe_3O_4.

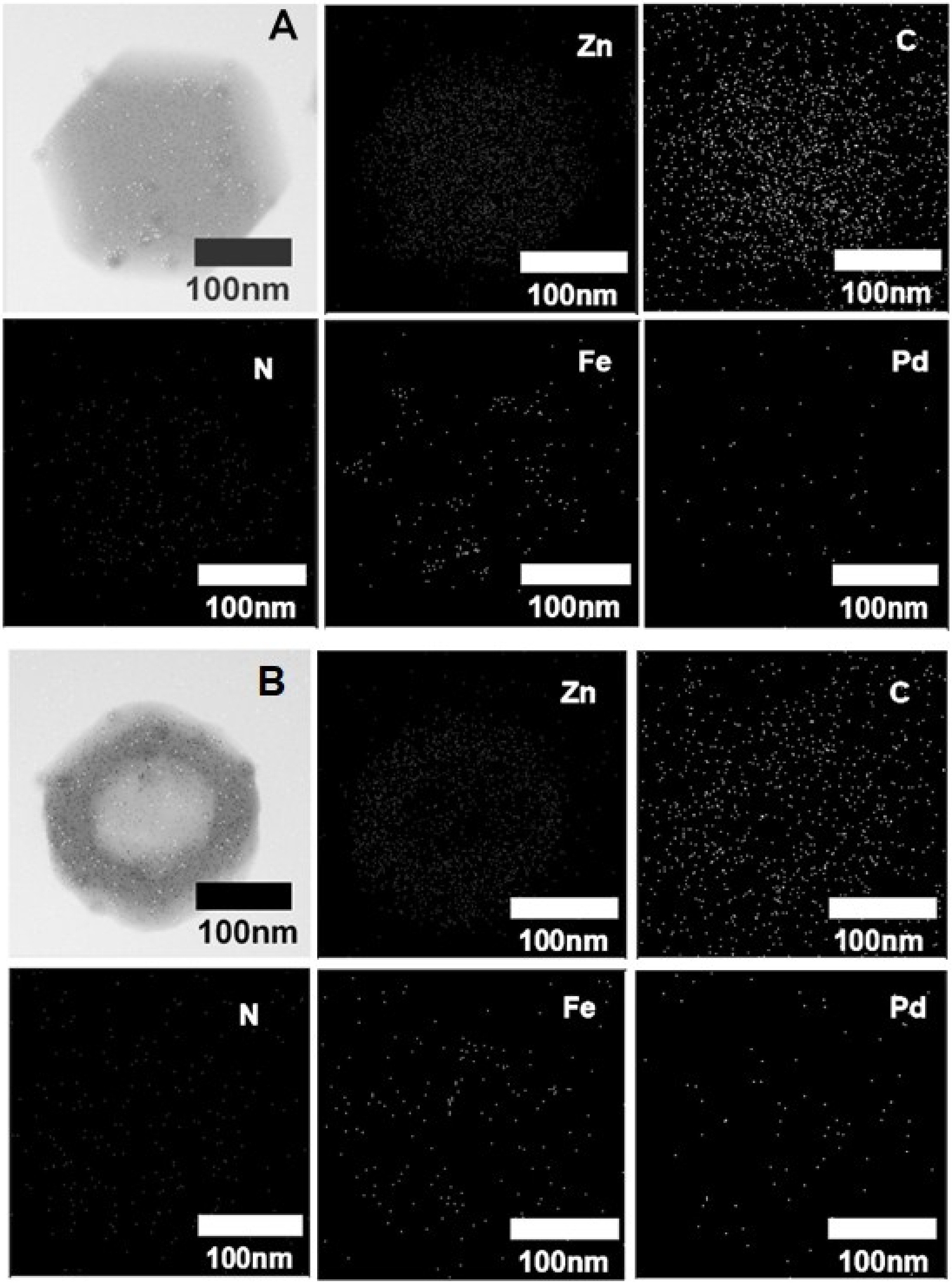

Fig. S2 Elemental mapping images of Fe (green), Pd(yellow), N (pink), C (blue) and Zn (red) of (A) Fe_3O_4/Pd^{2+}@ZIF-8, (B) Fe_3O_4/Pd^{2+}@PDA NCs.

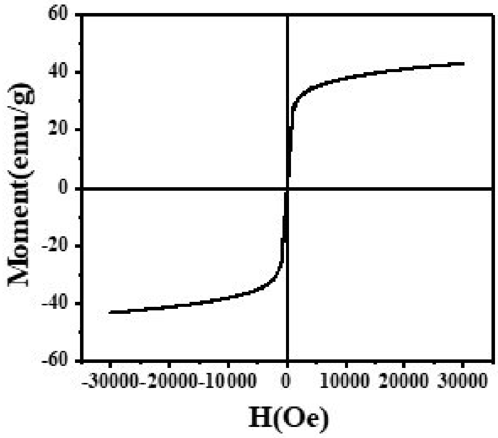

Fig. S3 M-H curve of OA-stabilized Fe_3O_4 NPs.

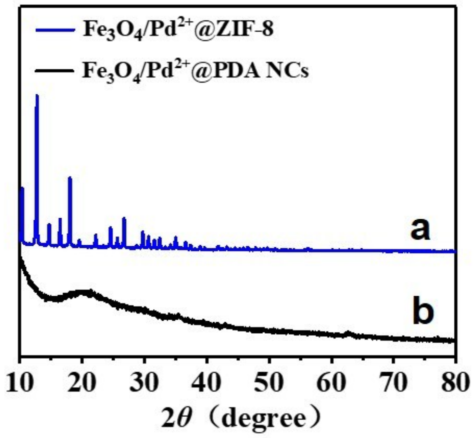

Fig. S4 XRD patterns of Fe_3O_4/Pd^{2+}@ZIF-8 (a) and Fe_3O_4/Pd^{2+}@PDA NCs (b).

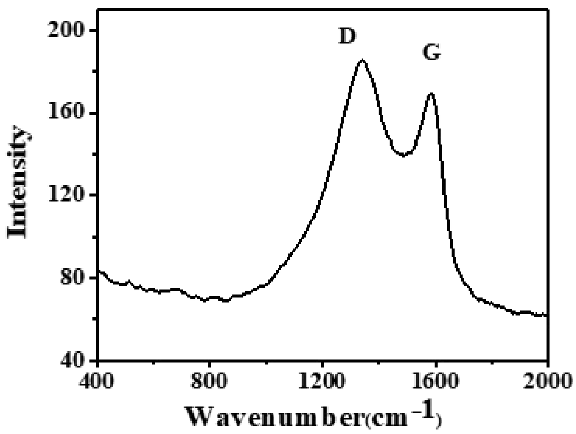

Fig. S5 Raman spectrum of Fe_3O_4/Pd@C NCs.

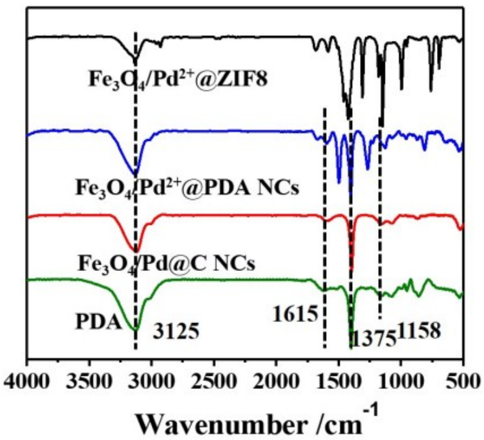

Fig. S6 FT-IR spectrums of Fe_3O_4/Pd^{2+}@ZIF-8 (black), Fe_3O_4/Pd^{2+}@PDA NCs (blue), Fe_3O_4/Pd@C NCs and pure PDA (green).

Table S1 Elemental analysis results in the XPS spectrum of Fe_3O_4/Pd@C NCs catalysts.

Elements	**At. /%**
C	**88.80**
N	**7.01**
Fe	**3.89**
Pd	**0.30**

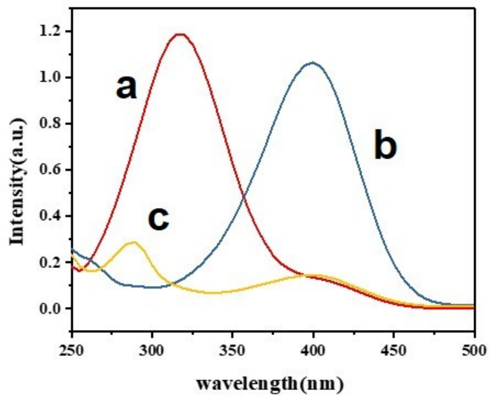

Fig. S7 UV–vis absorption spectra of 4-NP (a); 4-NP + $NaBH_4$ (b) and 4-AP (c).

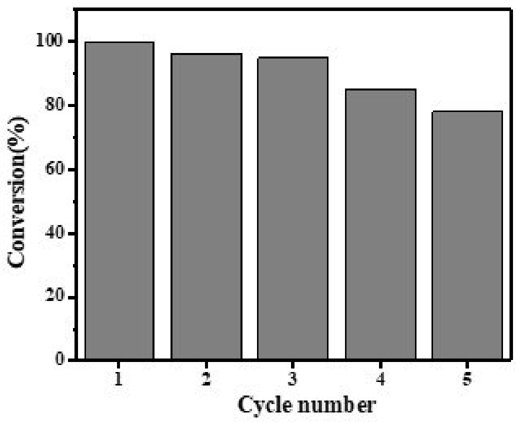

Fig. S8 Conversion of 4-NP in 5 successive cycles of reduction with 5.0 mg of Fe_3O_4/Pd@C NCs catalysts.

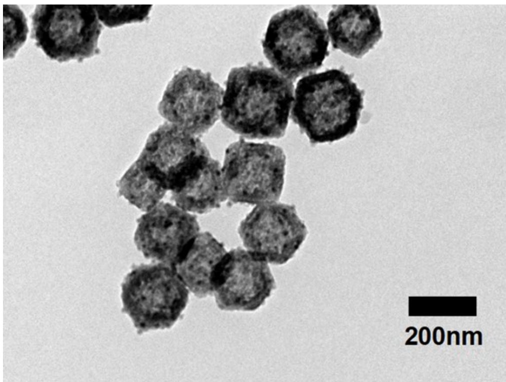

Fig. S9 TEM image of Fe_3O_4/Pd@C NCs after 5 cycles.

Table S2 Comparison of rate constant values for the 4-NP reduction to 4-AP using various catalysts

catalyst	k (s^{-1})	Ref.
Fe_3O_4/Pd@C NCs	3.26×10^{-3}	This work
p(AMPS)–Co composite	2.00×10^{-3}	46
rGO/Pd–Fe_3O_4/PPy	3.20×10^{-3}	47
Ni NPs	2.67×10^{-3}	48
Pd–graphene nanohybrid	2.67×10^{-3}	49
Au–Pd bimetallic NPs/graphene	1.45×10^{-2}	50
Dumbbell-like Au-Fe_3O_4	1.45×10^{-2}	51