

Fig.S1. ^1H NMR Spectrum of zwitterionic liquid monomer PVIS.

^1H -NMR (400 MHz, D_2O , signals referenced to δ 4.8 ppm): 2.33-2.30 (m, 2H, $-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{SO}_3^-$), 2.93-2.90 (m, 2H, $-\text{CH}_2-\text{CH}_2-\text{SO}_3^-$), 4.40-4.37(m, 2H, $-\text{CH}_2-\text{SO}_3^-$), 5.41-5.39 (d, 1H, $=\text{CHH}$), 5.80-5.76 (d, 1H, $=\text{CHH}$), 7.14-7.08 (m, 1H, $-\text{CH}=\text{CH}_2$), 7.60, 7.76, 9.06 (s, 3H, imidazole)

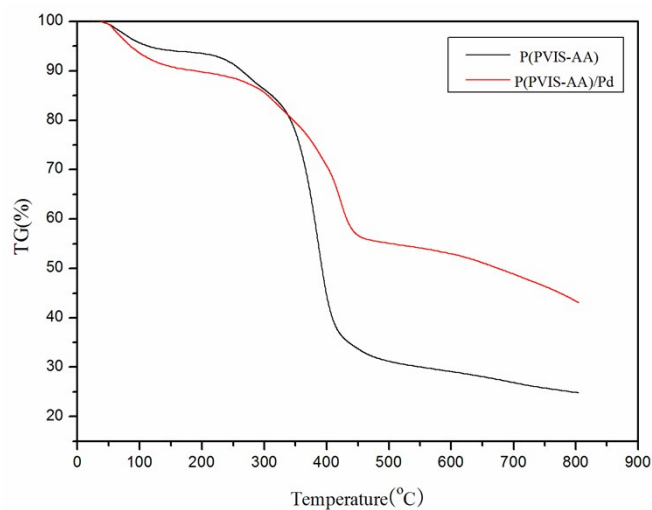


Fig.S2. TG curves of hydrogel, hybrid gel/Pd

The TG curves of hydrogel of P(PVIS-AA) and P(PVIS-AA)/Pd are presented in Fig. S2. The TG curve of P(PVIS-AA) hydrogel exhibited three steps, 27–180°C, 180–305°C and 305–802 °C, with weight loss of 6.31%, 8.09% and 60.97%, respectively. The P(PVIS-AA)/Pd

hydrogel had a two-step thermogram, 29–200 °C and 200–803 °C, with weight losses of 10.44% and 46.62%, respectively. Compared with P(PVIS-AA) hydrogel, TGA results suggested that the Pd-entrapped hydrogel exhibits higher thermal stability than the original hydrogel.

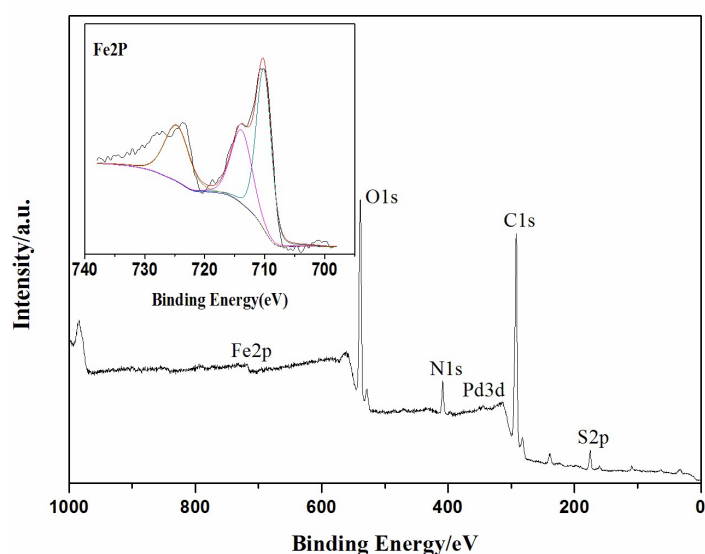
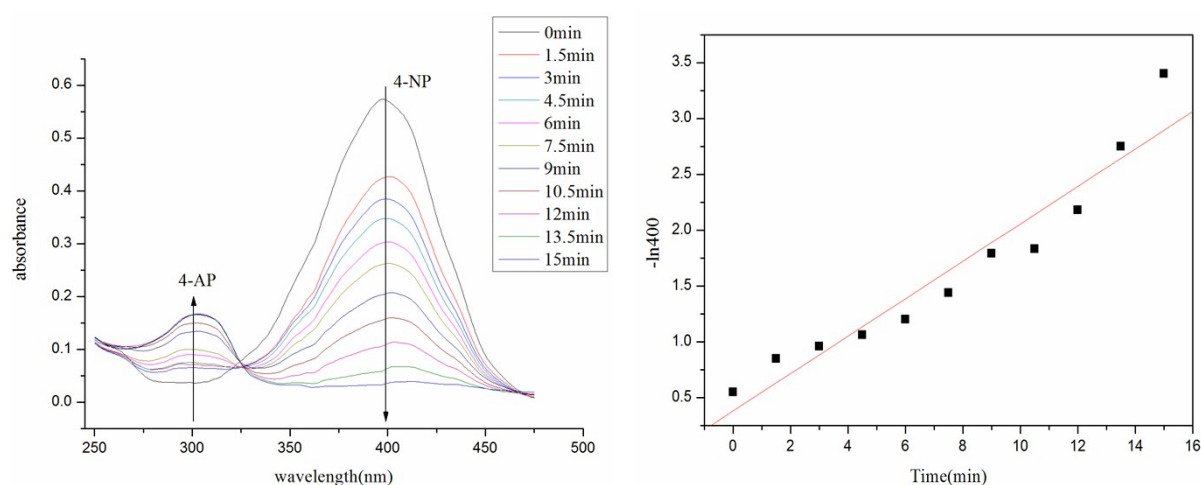


Fig.S3. XPS survey spectra of the P(PVIS- AA)/Pd@Fe³⁺

XPS spectrum results were investigated to examine the formation of P(PVIS-AA)/Pd@Fe³⁺ hydrogel. S, C, Pd, N, O, and Fe peaks are clear in the XPS spectrum(Fig. 3). The peak of Fe 2p could be split into three peaks located at the BEs of about 710.2, 713.6 and 724.8eV, which attributed the presence of Fe(II)¹, Fe(III)¹ and Fe(0)² species, respectively. The results showed Fe(III) was reduced partly following the catalytic reduction of 4-nitrophenol by NaBH₄, in addition to Pd nanoparticles, the catalyst of the reaction therefore include Fe nanoparticles at the same time.



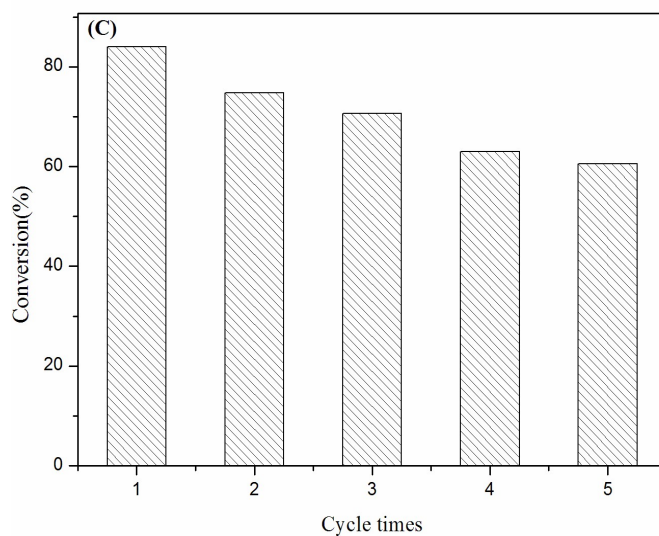


Fig. S4 **a** UV–Vis spectra of 4-nitrophenol during reduction with P(PVIS-AA)/Pd as a catalyst. **b** The straight line of time dependence of nitrophenol absorbance at $\lambda = 400$ nm built in logarithmic coordinates. **c** Reusability of the P(PVIS-AA)/Pd matrix catalyst

References

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- 2 L. Lozzi, M. Passacantando, P. Picozzi, S. Santucci, H. den Daas, *Surf. Sci.*, 1995, **331-333**, 703-709.