Electronic Supplementary Information (ESI) for

Graphene sheets manipulated thermal-stability of ultrasmall Pt nanoparticles supported on porous Fe_2O_3 nanocrystals against sintering

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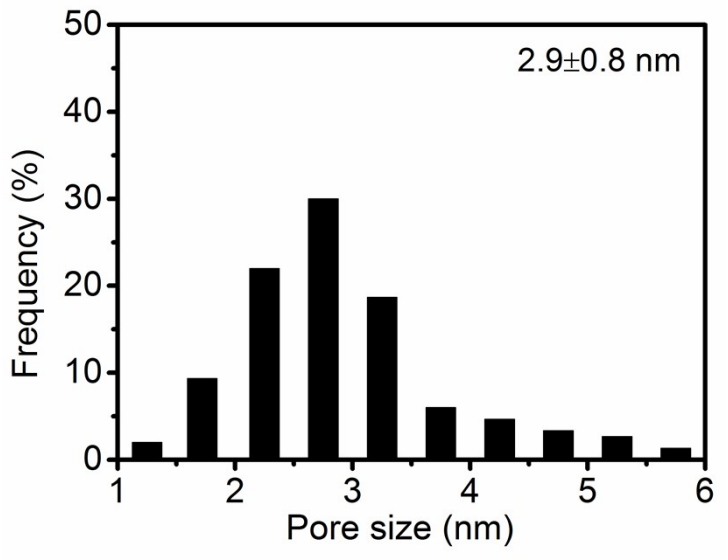

Figure S1. Size distribution of pores in Fe_2O_3 nanocrystals.

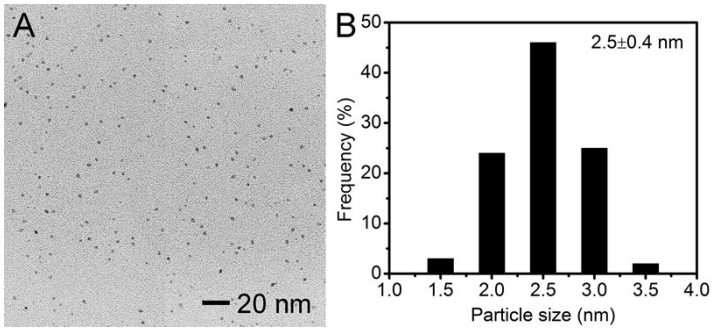

Figure S2. (A) TEM image of ulatrsmall Pt NPs and (B) the corresponding size distribution calculated by counting a minimum of representative 100 particles in TEM images.

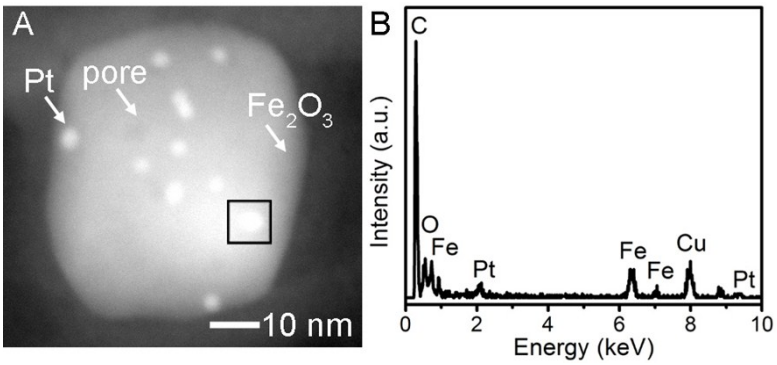

Figure S3. (A) HAADF-STEM image of Pt/Fe_2O_3 NPs and (B) the EDX spectrum obtained from the black square in A. The Cu signal came from the copper TEM grid.

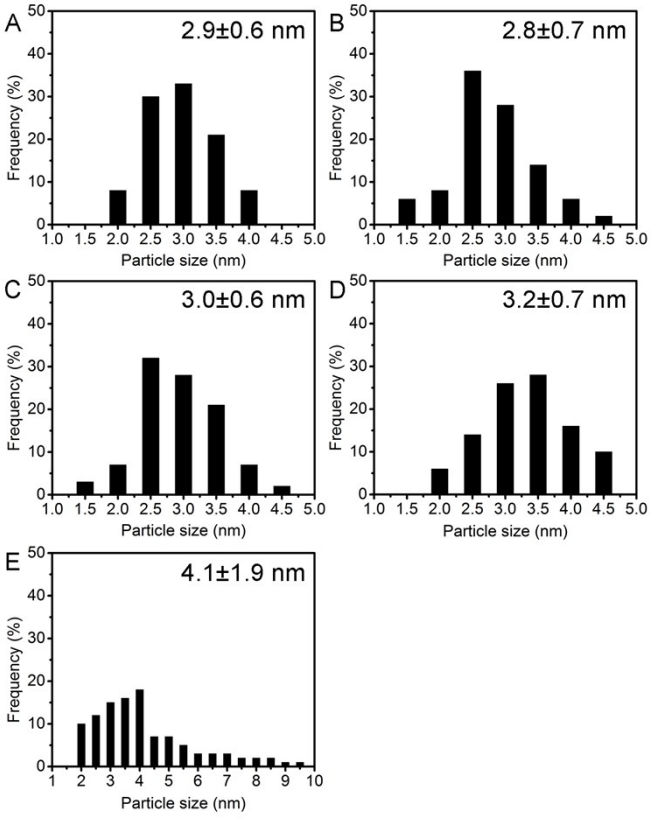

Figure S4. Diagrams of size distributions of Pt in $Pt/Fe_2O_3/GO$ catalyst system heated at (A) 350, (B) 500, (C) 650, (D) 750 and (E) 850 ^oC for 2 h in N_2 atmosphere.

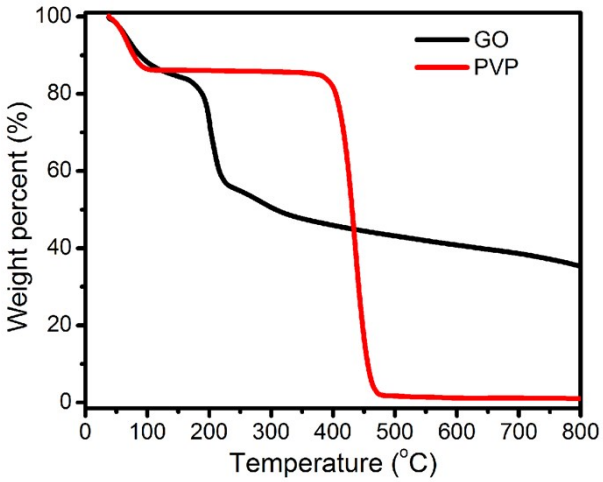

Figure S5. TGA curves of graphene oxides (GO) and PVP under N_2 flow at a heating rate of 10 ^{o}C/min.

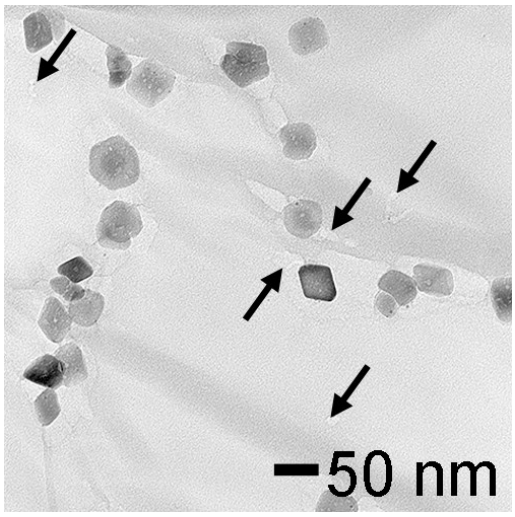

Figure S6. TEM image of $Pt/Fe_2O_3/GO$ sheets after being heat treated at 350 ^oC in N_2 for 2 h. The black arrows highlight the pores in GO sheets possibly due to losing oxygen-containing groups.

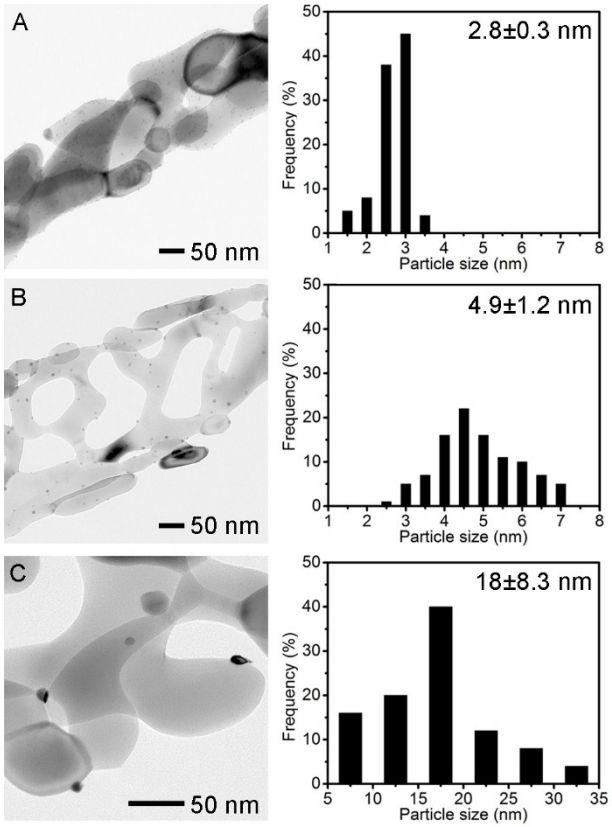

Figure S7. TEM images and the corresponding size distribution diagram of Pt supported on polycrystalline α-Fe_2O_3 nanofibers (A) before and after being heat treated at 750 ^oC for 2 h in (B) N_2 and (C) air, respectively. The Pt sintered dramatically on polycrystalline α-Fe_2O_3, revealing the single crystalline α-Fe_2O_3 played vital role of preserving excellent thermal stability of Pt at high temperatures.

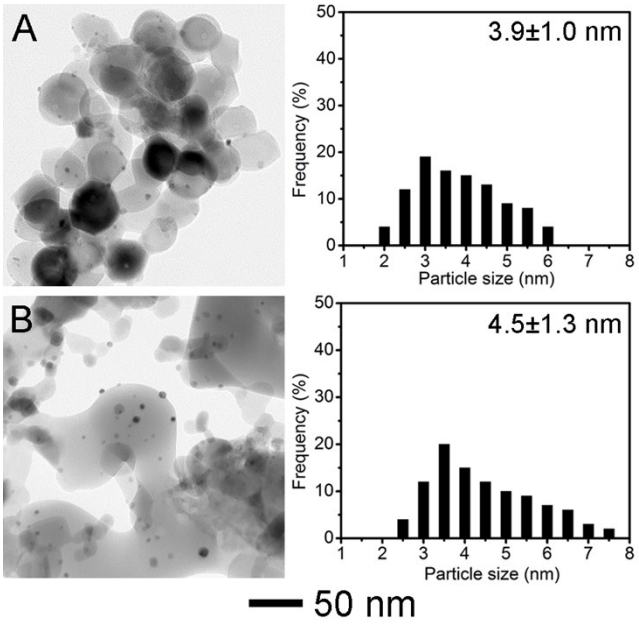

Figure S8. (Left) TEM image and (Right) corresponding size distribution of the Pt/Fe_2O_3/GO catalyst after treating in N_2 for 2 h at 750 ^oC, in which the amount of GO sheets were decreased to (A) 50% and (B) 20% in co-precipitate process.

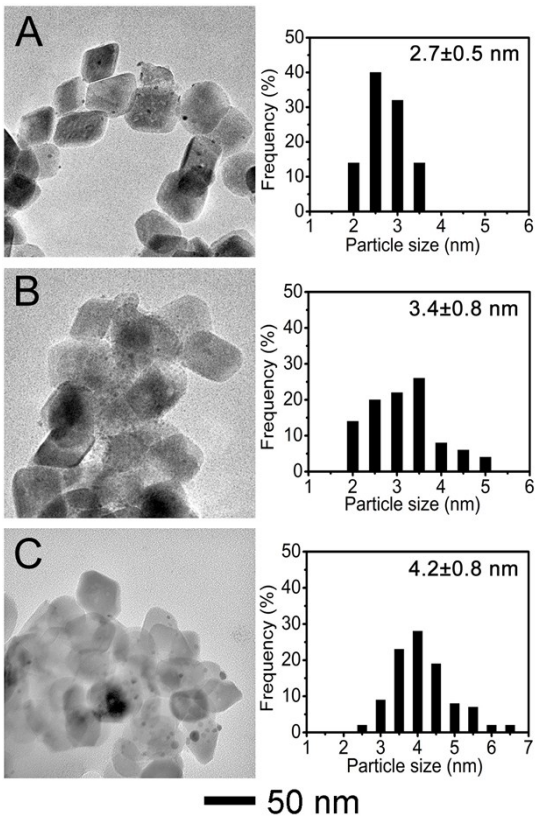

Figure S9. (Left) TEM image and (Right) corresponding size distribution of the Pt/Fe_2O_3 catalyst after treating in N_2 for 2 h at at (A) 350, (B) 500 and (C) 650 ^oC in N_2 for 2 h.

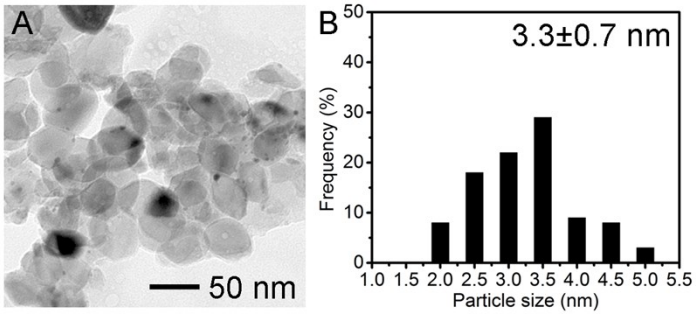

Figure S10. (A) TEM image and (B) corresponding size distributions of Pt in Pt/Fe_2O_3/GO sheets heated at 750 ^oC for 2 h in air.

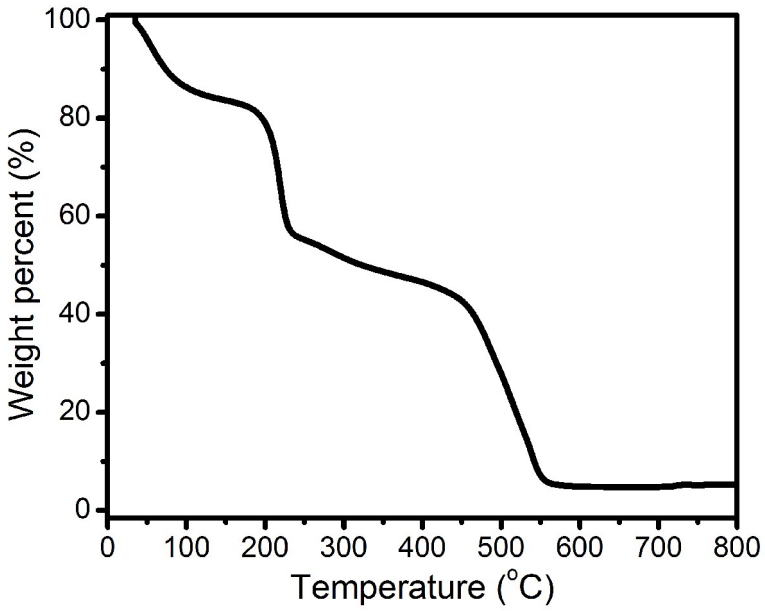

Figure S11. TGA curves of graphene oxides (GO) under air flow at a heating rate of 10 °C/min.

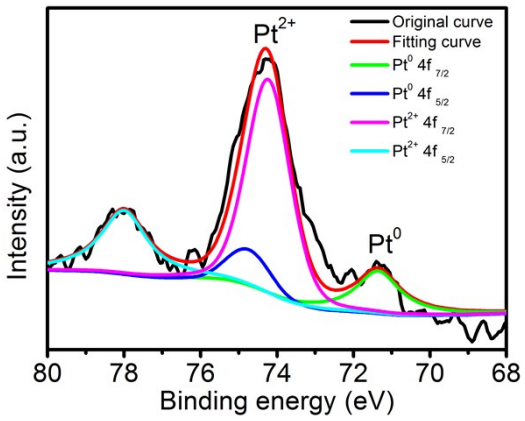

Figure S12. Pt *4f* high-resolution XPS spectrum of Pt/Fe_2O_3/GO sheets calcined at 750 ^oC in air. Two newly emerged peaks appear in addition to pristine Pt^o peaks. These new peaks are assigned to Pt^{2+} states, demonstrating that the metallic Pt^o were oxidized partially to PtO species.

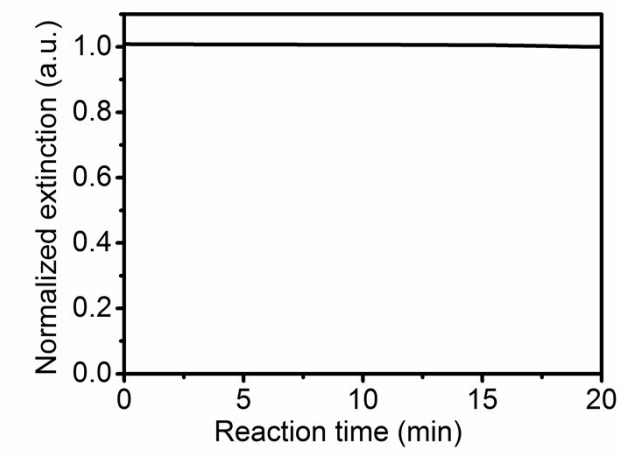

Figure S13. The normalized extinction at 400 nm for the 4-nitrophenol reduction after adding Fe_2O_3/GO sheets without Pt NPs.