

Supporting Information

One-step melamine-assisted synthesis of graphene-supported AuPt@Au nanocrystals for enhanced catalytic reduction of *p*- nitrophenol

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Experimental section

1. Chemicals

Graphite powder (99.95%, 8000 mesh), chloroauric acid (HAuCl_4), chloroplatinic acid (H_2PtCl_6), melamine, hydrazine hydrate (16.5 M), *p*-nitrophenol, sodium borohydride (NaBH_4) and commercial Pt/C (10 wt%) were purchased from Shanghai Sigma Chemical Reagent Company. Other chemicals were of analytical grade and used without further purification. Twice-distilled water was used throughout the whole experiments.

2. Preparation of AuPt@Au NCs/rGO

For typical synthesis of AuPt@Au NCs/rGO, 0.0631 g melamine was firstly dissolved into 8.5 mL of the graphene oxide (GO) suspension (0.5 mg L^{-1}) under stirring. Then, 800 μL of HAuCl_4 (24.3 mM) and 520 μL of H_2PtCl_6 (38.6 mM) were subsequently injected into the suspension. After homogeneous mixing, 200 μL of hydrazine hydrate solution (16.5 M) was drop-wisely put into the mixture. The mixed solution became black quickly and continually reacted for 10 min under constant stirring at 60 °C. Finally, the products were cleaned thoroughly and dried at room temperature. For comparison, individual HAuCl_4 or H_2PtCl_6 was used as the precursor, while the other experimental conditions were kept unchanged. The resulting products were denoted as Au/rGO and Pt/rGO, respectively.

3. Physical characterization

The morphology and crystalline structure of the samples were characterized by transmission electron microscopy (TEM) and high-resolution TEM (HR-TEM) measurements at a JEM-2100F transmission electron microscope coupled with selective area electron diffraction (SAED). High angle annular dark-field scanning TEM (HAADF-STEM) image and elemental mapping images were recorded on a scanning TEM (STEM). X-ray diffraction (XRD) analysis was performed with a Philips PW3040/60 diffractometer. X-ray photoelectron spectroscopy (XPS) experiments were conducted at a K-Alpha XPS spectrometer (Thermo-Fisher, E. Grinstead, UK). Raman experiments were performed on a Renishaw Raman system model 1000 spectrometer with a CCD detector. Thermogravimetric analysis (TGA) was conducted in air on a NETZSCH STA 449C thermogravimetric analyzer. The samples were heated from room temperature to 900 °C at the heat rate of 10 °C min⁻¹.

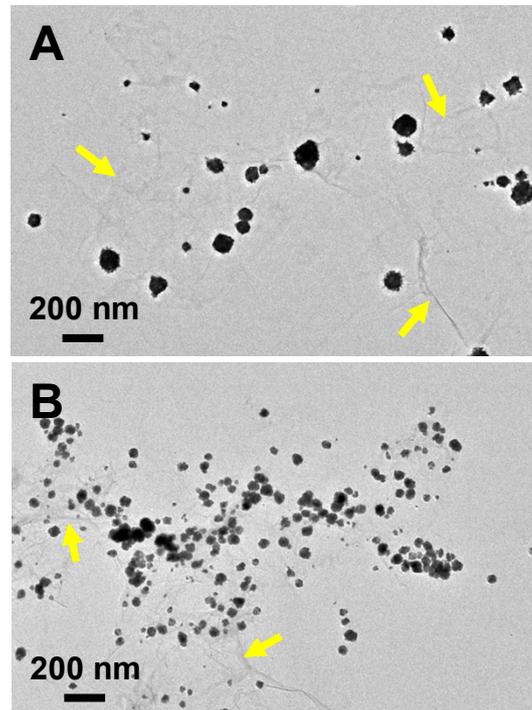


Fig. S1. TEM images of Au/rGO (A) and Pt/rGO (B). Arrows indicate the wrinkles of rGO.

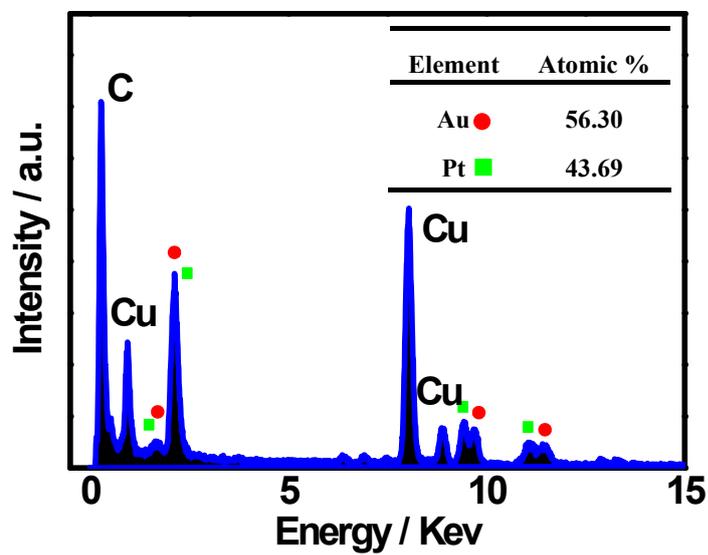


Fig. S2. EDS pattern of AuPt@Au NCs/rGO.

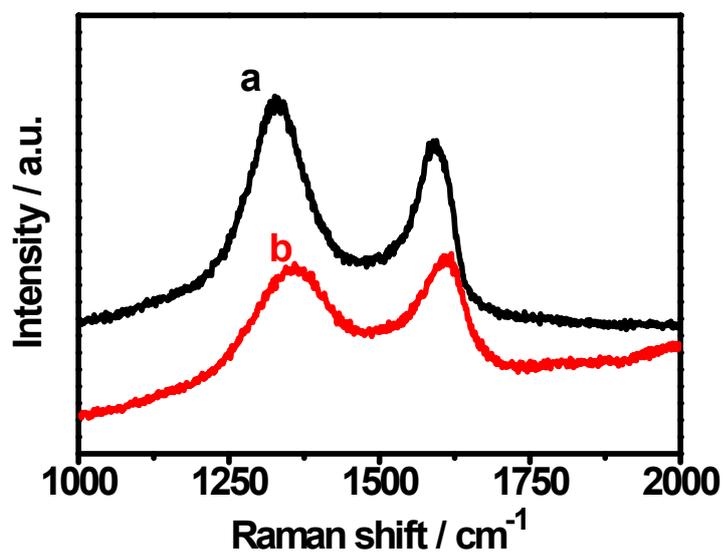


Fig. S3. Raman spectra of AuPt@Au NCs/rGO (curve a) and GO (curve b).

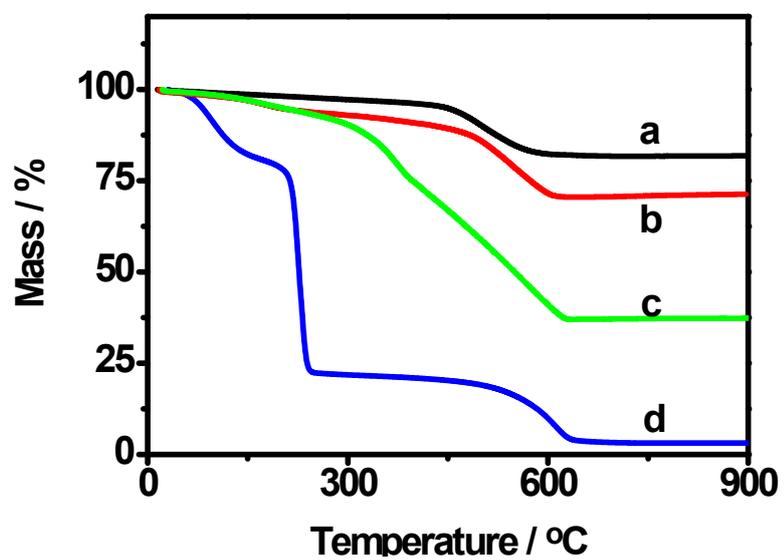


Fig. S4. TGA curves of AuPt@Au NCs/rGO (curve a), Au/rGO (curve b), Pt/rGO (curve c) and GO (curve d).

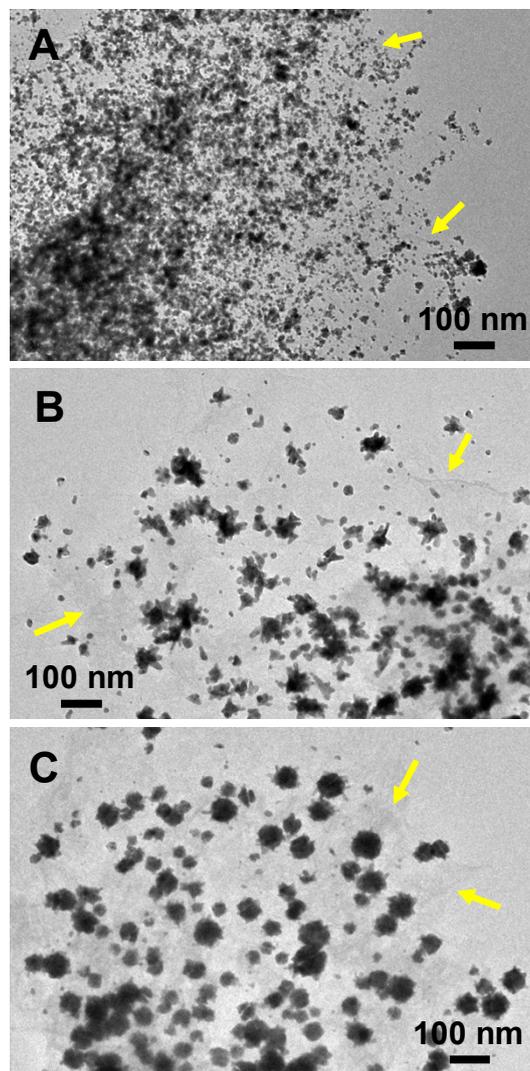


Fig. S5. TEM images of AuPt/rGO obtained without (A), and with 10 mM (B) and 25 mM (C) melamine. Arrows indicate the wrinkles of rGO.

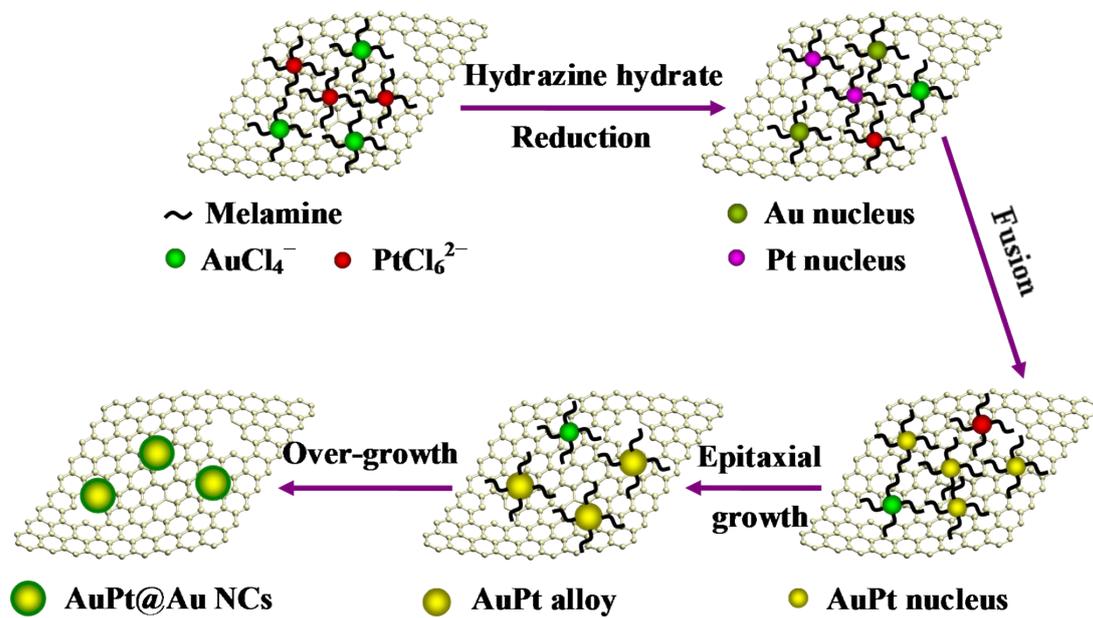


Fig. S6. Schematic illustration of the formation mechanism of AuPt@Au NCs/rGO.

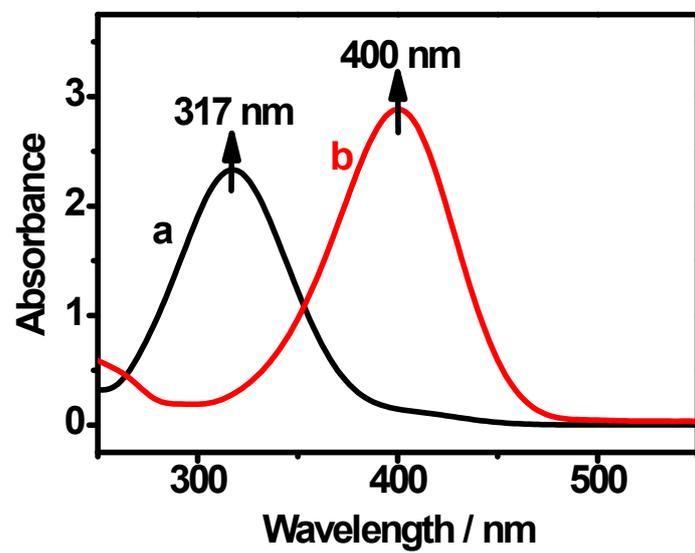


Fig. S7. UV-vis spectra of *p*-nitrophenol solution before (curve a) and after (curve b) the addition of NaBH₄.