Supporting information for:

Formation of AgPt alloy nanoislands via chemical etching with tunable optical and catalytic properties

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Gold nanorods synthesis. Gold nanorods (NRs) were prepared via a seed-mediated growth. First, CTAB-capped Au seeds were synthesized by chemical reduction of $HAuCl_4$ with $NaBH_4$: 7.5 ml CTAB (0.1M) aqueous solution was mixed with 100 μl $HAuCl_4$ (24 mM) and diluted with water to 9.4 ml. Then, 0.6 ml ice-cold $NaBH_4$ (0.01M) was added while stirring magnetically. After 3 min, the stirring was stopped and the seed solution was kept undisturbed at room temperature for 30 min prior to any further experimentation. The seeds can be used within 2-5 h after preparation. After that, the growth solution of the Au NRs was prepared, which consisted of 100 ml CTAB (0.1 M), 2.04 ml $HAuCl_4$ (0.024 M), 2 ml H_2SO_4 (0.5 M), 1 ml $AgNO_3$ (10 mM), and 800 μL AA (0.1 M). 240 μl seed solution was added to the above growth solution to initiate the growth of the Au NRs. After 12 h, the Au NRs were purified by centrifugation (12000 rpm for 10 min). The precipitates were collected and redispersed in deionized water. The volume is 100 ml.

Pre-coating a thin Pt layer on the Au nanorod. 2 mM $PtCl_4^{2-}$ aqueous solution was prepared as follow: 0.0688 g of K_2PtCl_4 was dissolved in 2 mL of 0.2 M aqueous HCl solution and then diluted into 100 mL with deionized water. 1 mL above Au NR solution was mixed with 23.5 μL of 2 mM $PtCl_4^{2-}$ solution. Then, 5 μL AA (0.1M) was added. The mixture was shaken vigorously and placed in a 30°C water bath. Within 3 hours, the color of the solution changed from pink-red to gray, suggesting the formation of the Pt shell. The calculated Pt/Au molar ratio is 0.1. We name the products as Au@Pt 0.1 nanorods.

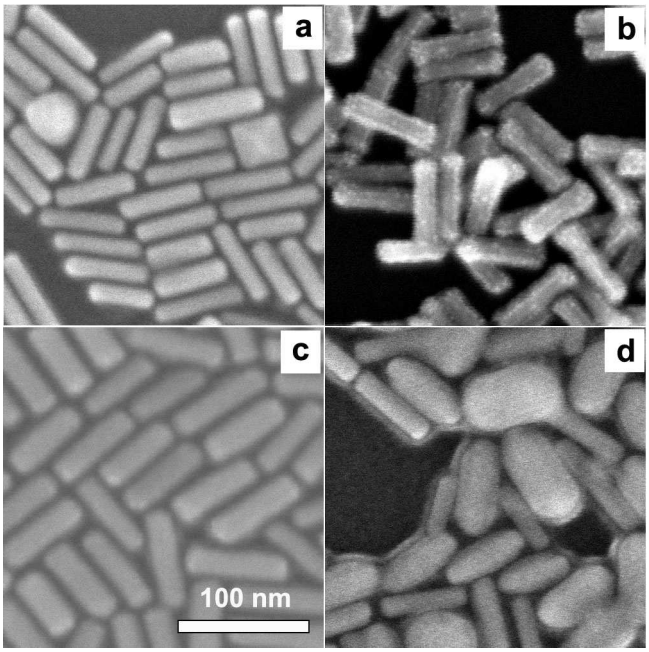

Figure S1. SEM images of the Au (a), Au@Pt0.1 (b), Au@Pt0.1@Ag0.85 (c), and Au@Ag0.85 (d) nanorods.

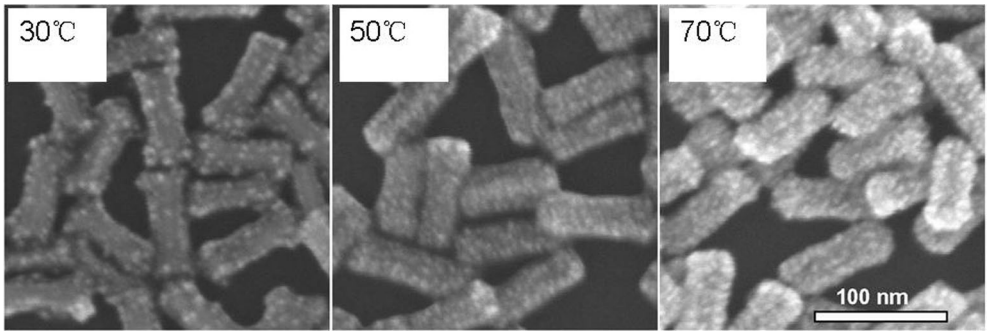

Figure S2. SEM images of Au@Pt@AgPt NRs etched by $PtCl_4^{2-}$ with a $PtCl_4^{2-}$ /Ag^0 ratio of 1/1 under different temperatures.

Table S1. The Ag/Au, Pt/Au and Ag/Pt ratio measured by EDX in Au@AgPt NRs after etching by $PtCl_4^{2-}$ with a $PtCl_4^{2-}$ /Ag^0 ratio of 1/1 under different temperature.

T(℃)	Ag/Au	Pt/Au	Ag/Pt
30	0.56	0.23	2.44
50	0.34	0.48	0.70
70	0.45	1.05	0.43

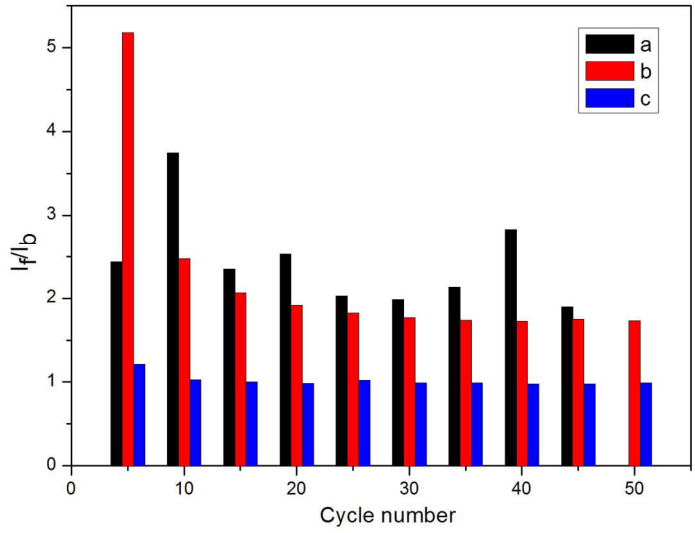

Figure S3. The I_f/I_b ratio versus cycle number for Au@Pt0.1@AgPt NRs-modified electrodes with $PtCl_4^{2-}/Ag^0_1$ ratio of (a) 0.5, (b) 1.0, and (c) 2.0, respectively.

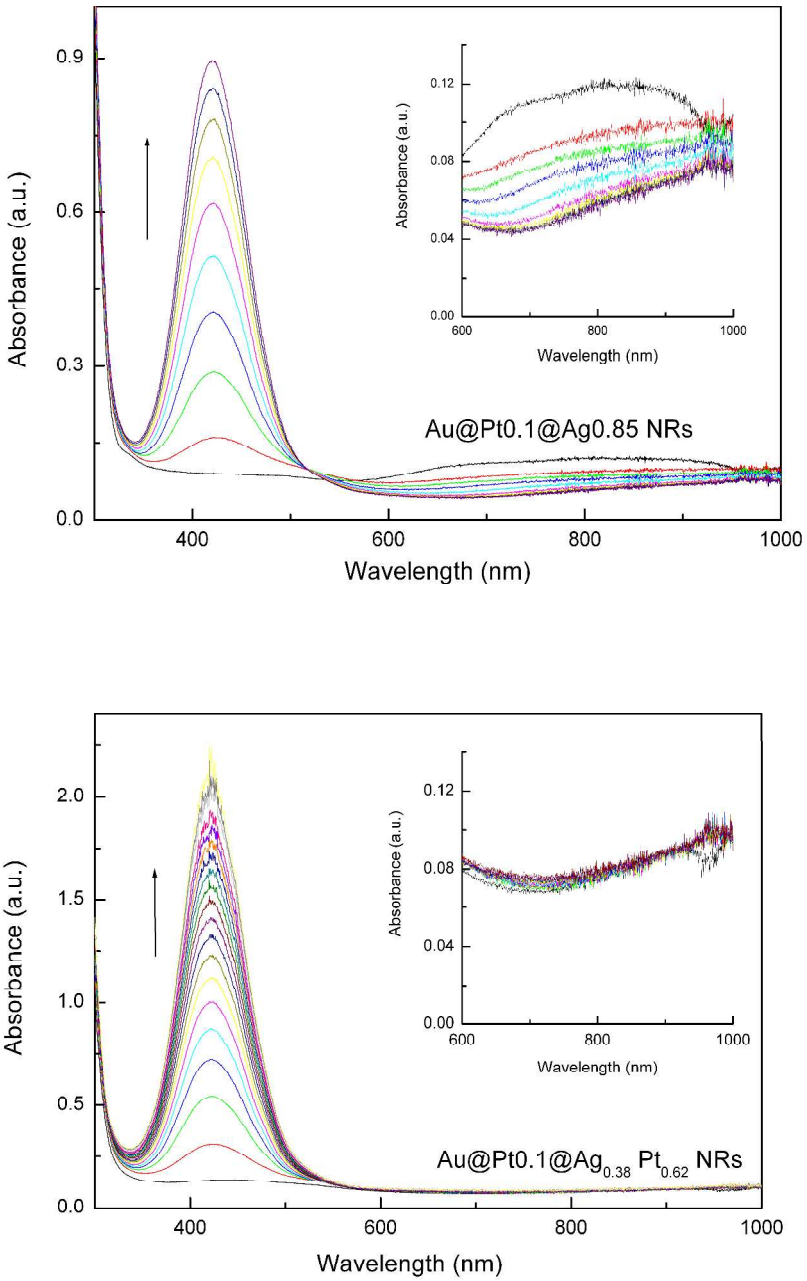

Figure 4S. The evolution of absorbance spectra of OPD oxidation upon addition of Au@Pt0.1@Ag0.85 NRs (upper figure) and Au@Pt0.1@Ag0.38Pt0.62 NRs (lower figure) over time. Reaction conditions: reaction temperature: 40℃, [H_2O_2]: 0.3 M, [OPD]: 0.3mM, [NRs]: approximately 1.5×10^{10} rods/ml.