Electronic Supplementary Material (ESI)

Site-Specific Growth of Pt shell on Au nanoplates: tailoring their surface plasmonic behavior

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1. Experimental details

1. 1. Synthesis of Au nanoprisms

0.5 mL of 20 mM aqueous $HAuCl_4 \cdot 3H_2O$ solution was added to 36.5 mL of deionized water (Millipore). And then 1 mL of a 10 mM aqueous solution of sodium citrate and 1 mL of 0.1 M aqueous $NaBH_4$ (ice-cold) solution were added with vigorous stirring.

A mixture of 108 mL of 0.05 M aqueous CTAB (from Fluka) solution and 54 μL of 0.1 M aqueous NaI solution was divided into three containers labeled with 1, 2, and 3. Container 1 and 2 hold 9 mL of the mixture and container 3 holds the rest solution of 90 mL. Then, a mixture of 125 μL of 20 mM aqueous $HAuCl_4 \cdot 3H_2O$ solution, 50 μL of 0.1 M NaOH, and 50 μL of 0.1 M ascorbic acid were added to each container 1 and 2. A mixture of 1.25 mL of 20 mM $HAuCl_4 \cdot 3H_2O$, 0.5 mL of 0.1 M NaOH, and 0.5 mL of 0.1 M ascorbic acid were added to container 3.

1 mL of the seed solution was added to the container 1 with mild shaking. Then, 1 mL of container 1 solution was added container 2. After 5 s shaking, the whole solution of container 2 was added to container 2. After 30 min, the color of container 3 shows magenta-purple.

1. 2. Synthesis of Au nanodisks

1.5 mL of a mixture of 10 mL of 0.05 M CTAB and 250 μL of 20 mM of $HAuCl_4 \cdot 3H_2O$ was added to 10 mL of Au nanoprism solution. After 1 h, the reaction completes.

2. DDA calculation

The optical properties of Au@Pt nanoplates have been calculated using the Discrete Dipole Approximation (DDA).[1-2] DDA represents the nanoparticles volume as a square array of point dipoles. Each dipole obtains an oscillating polarization from the local field at that lattice site, which is composed of the incident plane wave and the fields radiated from the other dipoles in the array. The dipole polarizability incorporates the optical constants of the metal and is assigned based upon a lattice dispersion relation.[3] Here we have utilized experimentally determined values for the refractive index of Au[4] and Pt.[5] The set of coupled dipole equations compose a large, dense matrix equation that is solved iteratively for the induced polarizations, which are then used to calculate the nanoparticle extinction.

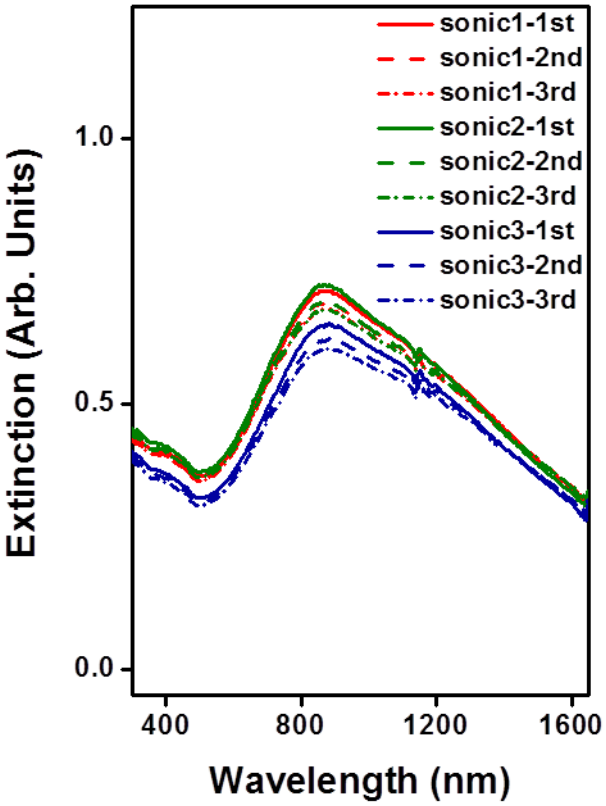

Fig. S1. UV-vis-NIR spectrum of rim-preferential grown Au@Pt nanodisks. Au@Pt nanodisks are dispersed in toluene as solvent. This spectrum is purpose of testing the reliability and stability of Au@Pt nanoplates. We conducted the measurement of UV-vis-NIR spectroscopy nine times on the same sample. For figuring out whether the serious aggregation occurs or not, the spectrum is obtained after sonication, which is written each case as sonic1, sonic2, and sonic3. All the series of measurements conducted three times. The wavelength of peak is remained at almost same position, approx. 883 nm.

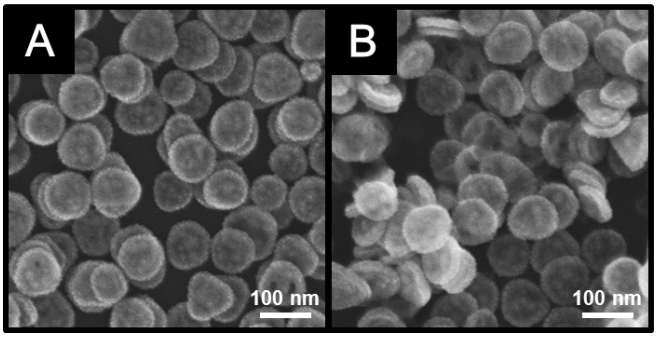

Fig. S2. FESEM images of rim-preferential Au@Pt nanodisks corresponding to the sample shown in Fig. S1. Both of samples are obtained by drying the droplet of nanoplates dispersed (A) in the DI wate r and (B) in the toluene. The colloidal nanoparticles do not show any mergence even in the organic so lvent.

Reference

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