Supporting Information

Dielectric Domain Distribution on Au Nanoparticles Revealed by Localized Surface Plasmon Resonance

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Supporting Information

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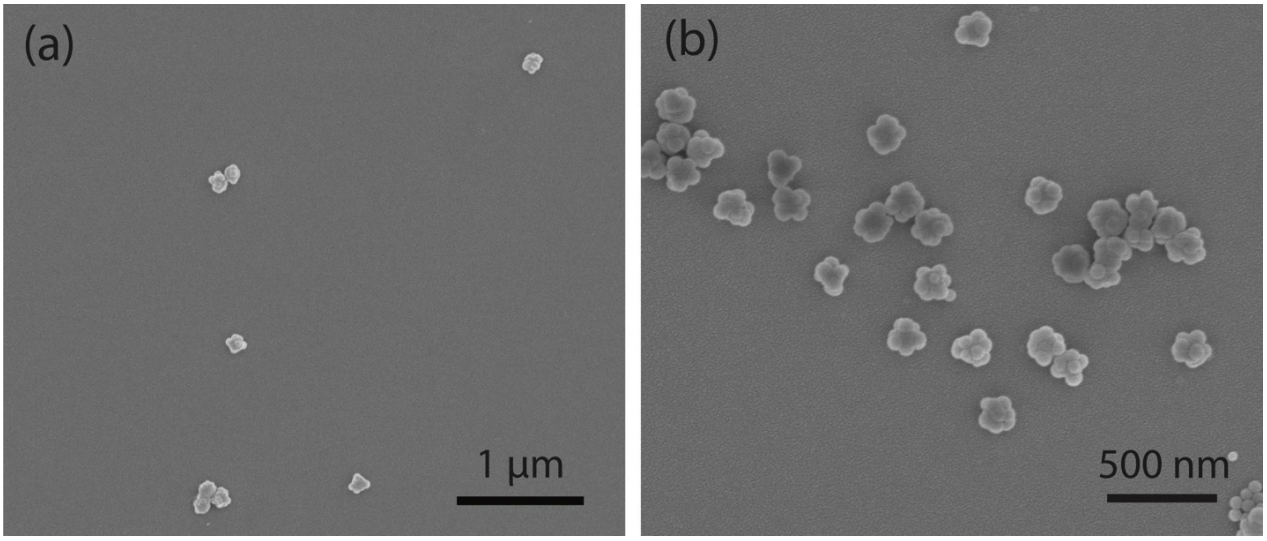

Figure S1: SEM images of 117 nm Au-silica heterostructure centrifuged after a) 1 hour of reaction, b) 1.5 hour of reaction

Experimental section

Chemicals

Tert-butanol were purchased from Sigma Aldrich. Sodium citrate dehydrate was purchased from Fisher Scientific. All chemicals were used as received.

Synthesis of citrate capped Au nanoparticle

We adopted a seed mediated method to synthesize the 120 nm citrate capped Au nanoparticle, detailed procedure can be found from Tian et.al's work.[1] The 40 nm citrate capped Au nanoparticles synthesized based on Frens' method were used as seeds.[2]

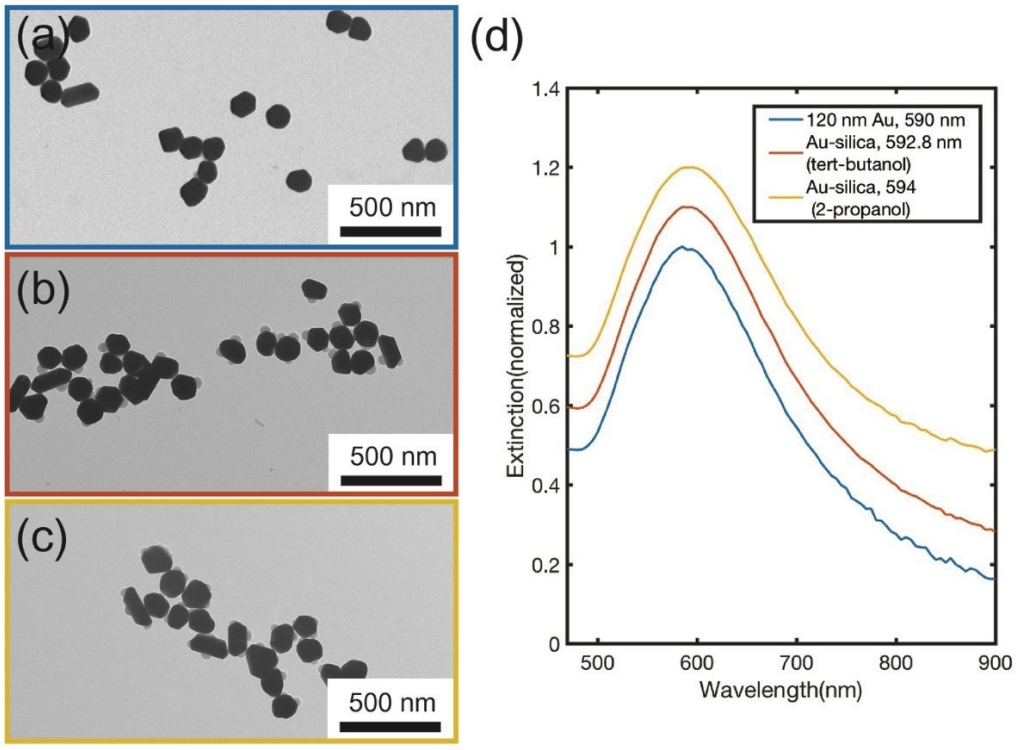

Figure S2: TEM images of a) 120 nm citrate capped Au nanoparticle, 120 nm Au-silica heterostructure synthesized in b) tert-butanol, c) 2-propanol, d) UV-vis spectra of the corresponding structures.

To demonstrate how the dielectric domains would influence the LSPR of an quasi-spherical Au nanoparticle, we synthesized the citrate capped Au nanoparticle with discrete silica domains. The TEM image shows that the 120 nm citrate capped Au nanoparticles are quasi-sphereical and a few of the particles exhibit rod-like shape (Figure S2a). We also controlled the number of silica domains by controlling the reaction kinetics to tune the coverage. The mechanism of reaction kinetics influencing the number of silica domains can be found in Luo et. al's work.[3] The Au-silica heterostructure synthesized in tert-butanol has 1.21 hemispherical silica domains on average as revealed by the TEM image (Figure S2b). The silica domains have an average diameter of 49.4 nm. UV-vis spectra show a red shift from 590 nm to 592.6 nm compared with the bare Au nanoparticle. The Au-silica heterostructure synthesized in 2-propanol has an average number of 2.41 silica domains with an average diameter of 43.3 nm (Figure S2c). Even though the size of silica was slightly smaller compared with Au-silica synthesized in tert-butanol, the LSPR of the Au-silica synthesized in 2-propanol still red shifted to 594 nm due to the increased number of domains (Figure S2d). This observation proves that the LSPR of quasi-spherical or rod-like Au nanoparticles is more sensitive to the change of the dielectric environment.

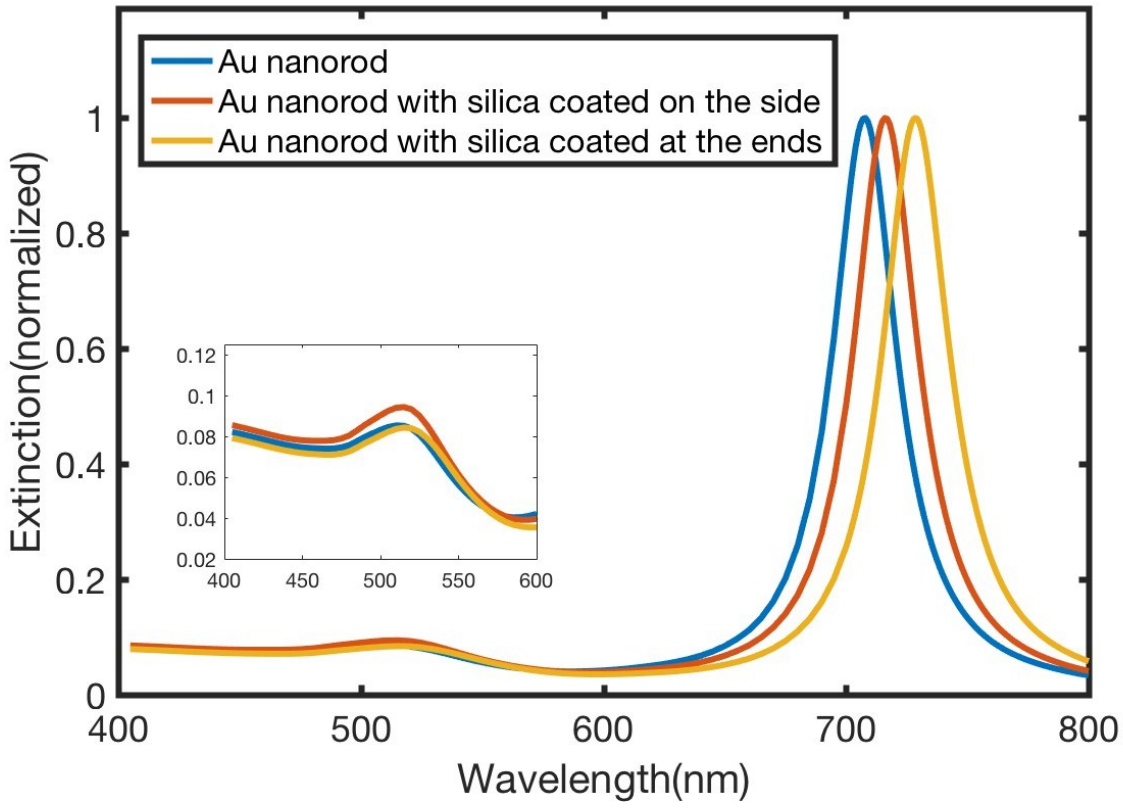

Figure S3: Simulated extinction spectra of Au nanorod (blue), Au nanorod with silica coated on the side (red) and Au nanorod with silica coated at the ends (yellow). The inset figure shows the corresponding simulated extinction spectra of the transverse plasmonic mode only.

Reference

1. Tian, X. D.; Liu, B. J.; Li, J. F.; Yang, Z. L.; Ren, B.; Tian, Z. Q., Shiners and Plasmonic Properties of Au Core Sio2 Shell Nanoparticles with Optimal Core Size and Shell Thickness. *Journal of Raman Spectroscopy* **2013**, *44*, 994-998.

2. Frens, G., Controlled Nucleation for the Regulation of the Particle Size in Monodisperse Gold Suspensions. *Nature* **1973**, *241*, 20-22.

3. Luo, Y. G., Shenghao; Dube, Lacie; Zhao, Jing, Tuning the Valency of Heterogeneous Au-Silica Nanostructure Via Controlled Ostwald Ripening Process. **2018**, under review.