

SUPPORTING INFORMATION

Using Good's Buffers to Control the Anisotropic Structure and Optical Properties of Spiky Gold Nanoparticles for Refractive Index Sensing

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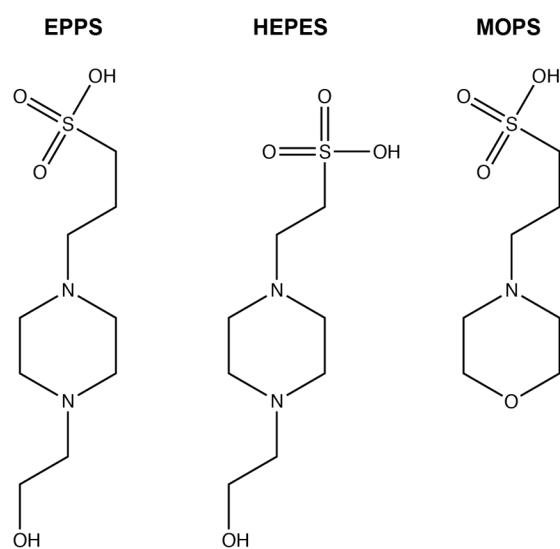


Figure S1. Molecular structures of EPPS, HEPES and MOPS.

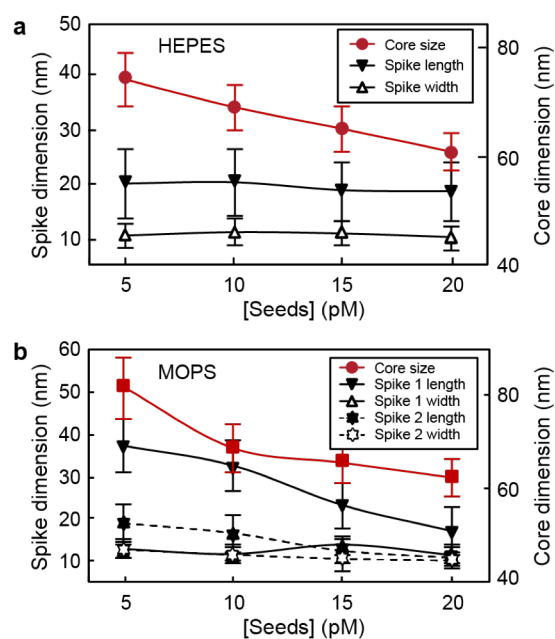


Figure S2. Dimensions of spiky AuNPs grown with HEPES and MOPS.

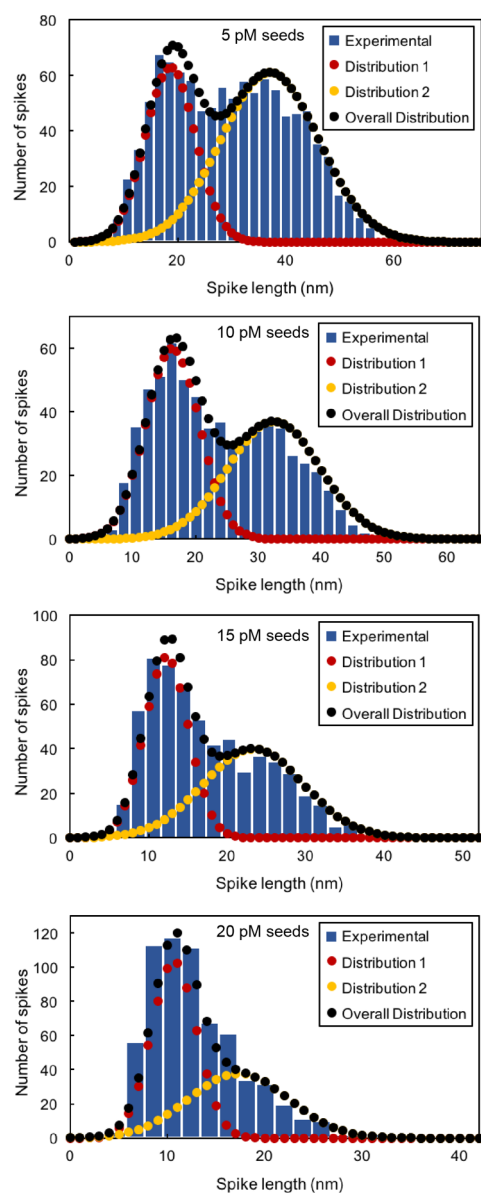


Figure S3. Spiky AuNPs grown with MOPS at pH 7.0 had two different spike length distributions. Blue columns are the experimental values and dots are the values calculated by the model used to analyze the data.

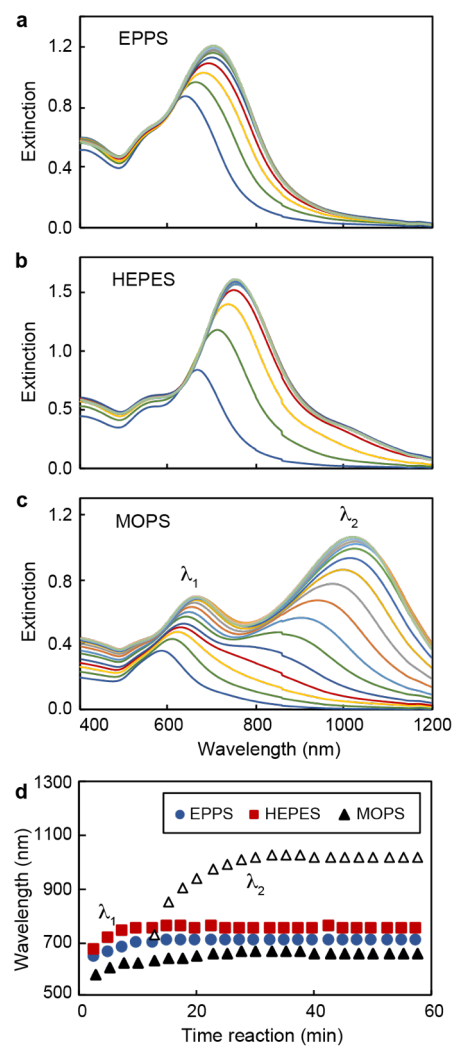


Figure S4. Reaction kinetics of spiky AuNPs. Extinction spectra of spiky AuNPs grown with (a) EPPS, (b) HEPES, and (c) MOPS during the course of the syntheses. (d) Evolution of LSP resonance peaks of the particles during the syntheses.

Table S1. Dimensions of spiky AuNPs grown with EPPS, HEPES and MOPS at pH 7.0 and 10 pM 60-nm seeds

Buffer	Feret diameter (nm)	Core size (nm)	Spike length (nm)	Spike width (nm)
EPPS	96 ± 4	73 ± 5	18 ± 5	11 ± 2
HEPES	94 ± 5	69 ± 4	20 ± 6	12 ± 2
MOPS	96 ± 6	69 ± 5	29 ± 10 19 ± 8	12 ± 2 12 ± 2

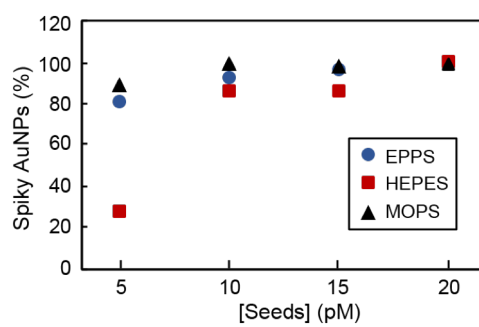


Figure S5. Percent of spiky AuNPs in solution increases with seed concentration. Population of spiky AuNPs grown with EPPS, HEPES and MOPS.

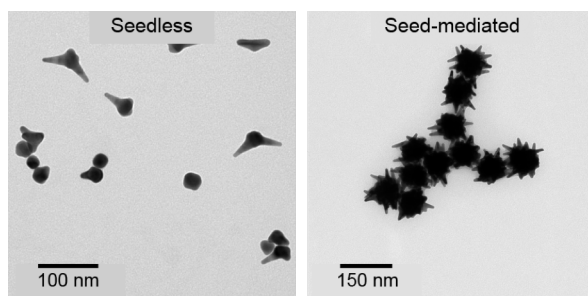


Figure S6. Lower amount of spherical AuNPs were obtained through seed-mediated growth. AuNPs grown with MOPS at pH 7.0 through seedless and seed-mediated method. For seed-mediated 10 pM 60-nm seeds were used.

Table S2. Characterization of spiky AuNPs grown with EPPS and different seed sizes

Seed	Seed size measured by TEM (nm)	Seed concentration in growth solution (pM)	Core size (nm)	Spike length (nm)	Spike width (nm)
30-nm	33 ± 4	2	41 ± 3	18 ± 4	10 ± 2
60-nm	56 ± 4	5	73 ± 5	18 ± 5	11 ± 2
100-nm	105 ± 10	8	112 ± 6	19 ± 4	10 ± 2

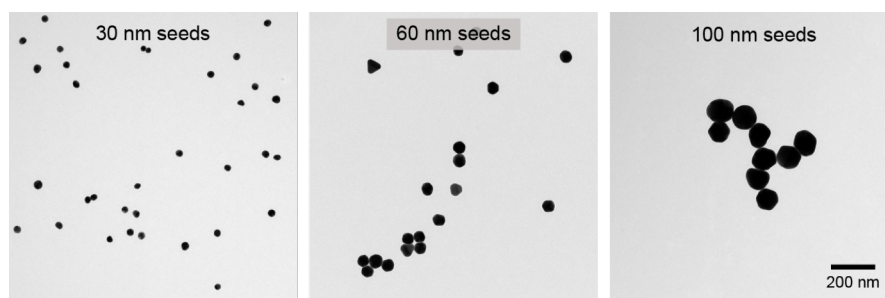


Figure S7. TEM images of the seeds used in the growth of spiky AuNPs.

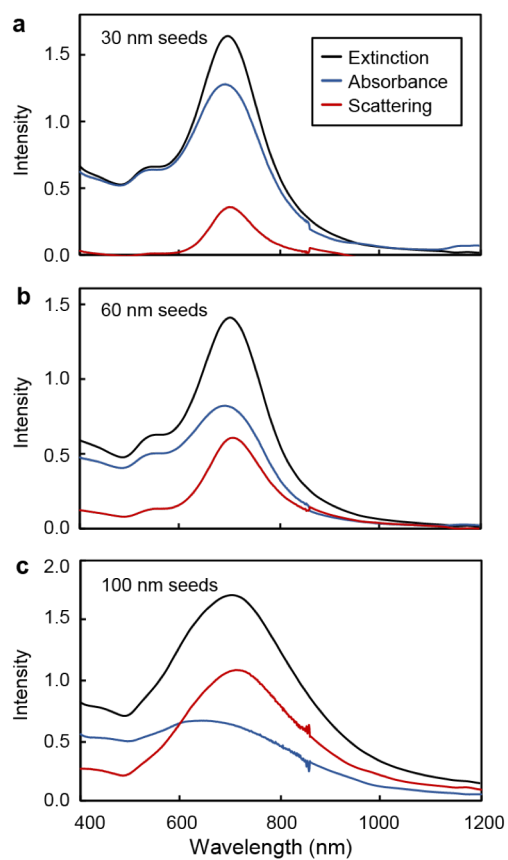


Figure S8. Scattering component of LSP increases with particle size. Extinction, absorption and scattering spectra of spiky AuNPs grown with EPPS and **(a)** 30 nm, **(b)** 60 nm and **(c)** 100 nm seeds. The oscillations around 860 nm in the spectra originate from switching between the two spectrophotometer detectors.

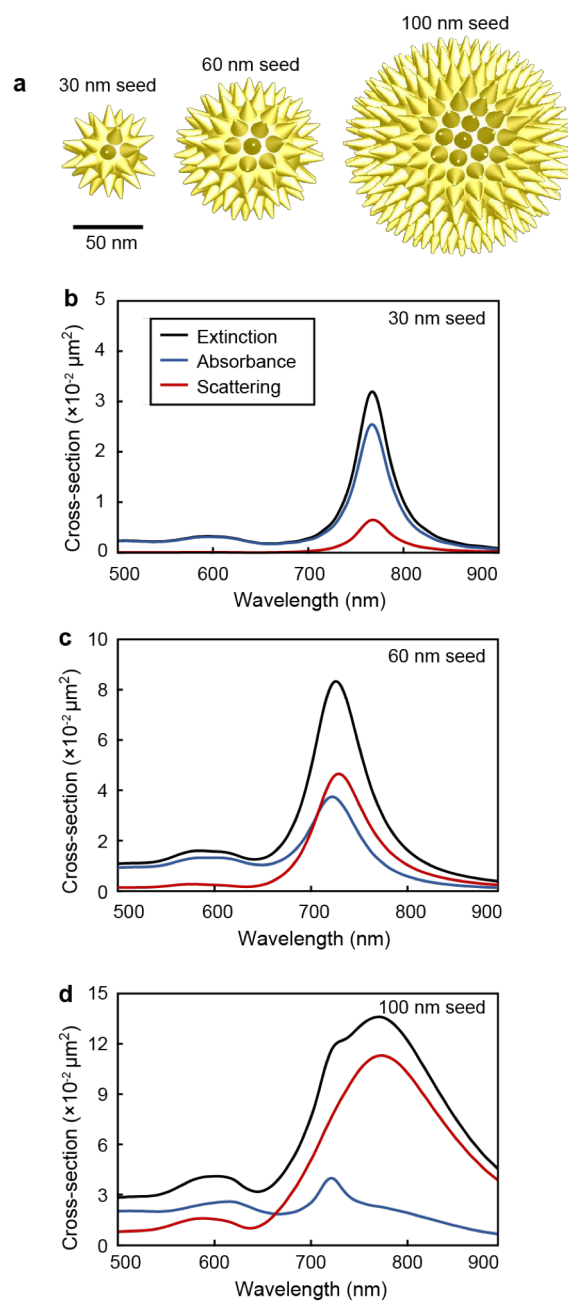


Figure S9. FDTD simulations of spiky AuNPs with different core sizes. (a) 3D models of spiky AuNPs used in the simulations. Extinction, absorption and scattering spectra of simulated spiky AuNPs grown with EPPS and **(b)** 30 nm, **(c)** 60 nm and **(d)** 100 nm seeds.

Table S3. Refractive index of different water-glycerol solutions at 20 °C

Glycerol (%)	Refractive index ¹
0	1.33303
20	1.35749
40	1.38413
60	1.41299
80	1.44290
100	1.47399

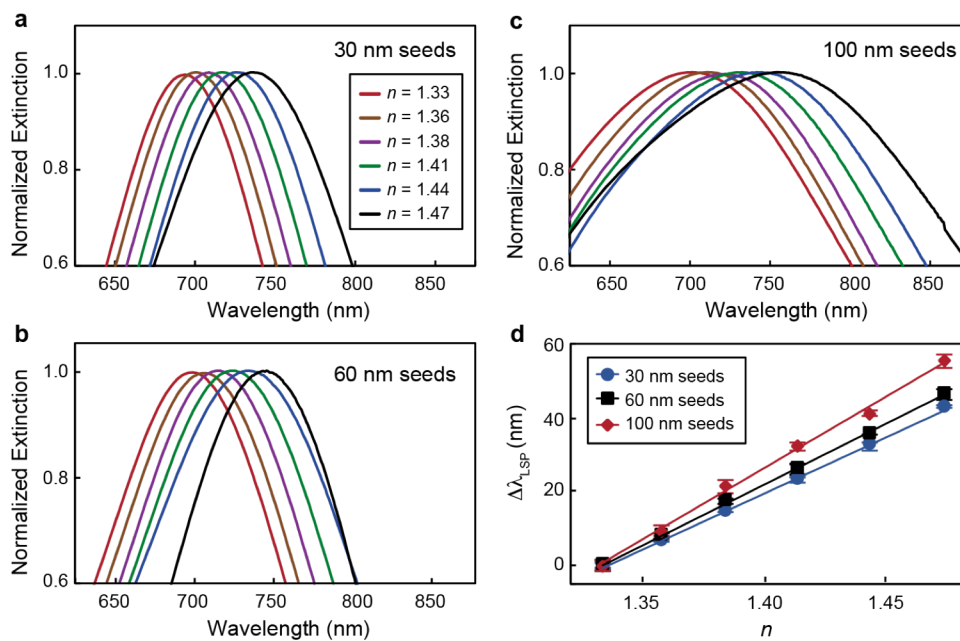


Figure S10. Particle size has small effect on refractive index sensitivity. UV-Vis spectra of spiky AuNPs grown with (a) 30 nm, (b) 60 nm and (c) 100 nm seeds in different refractive index environments. (d) Shift of the LSP band of different particles as function of refractive index.

Supporting Information References

(1) Hoyt, L. F. New Table of the Refractive Index of Pure Glycerol at 20°C. *Industrial & Engineering Chemistry* **1934**, 26 (3), 329-332.