Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information for

A Nanofabricated Plasmonic Core-Shell Nanoparticle Library

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1. Core-shell nanostructures fabricated following the soft sacrificial layer route

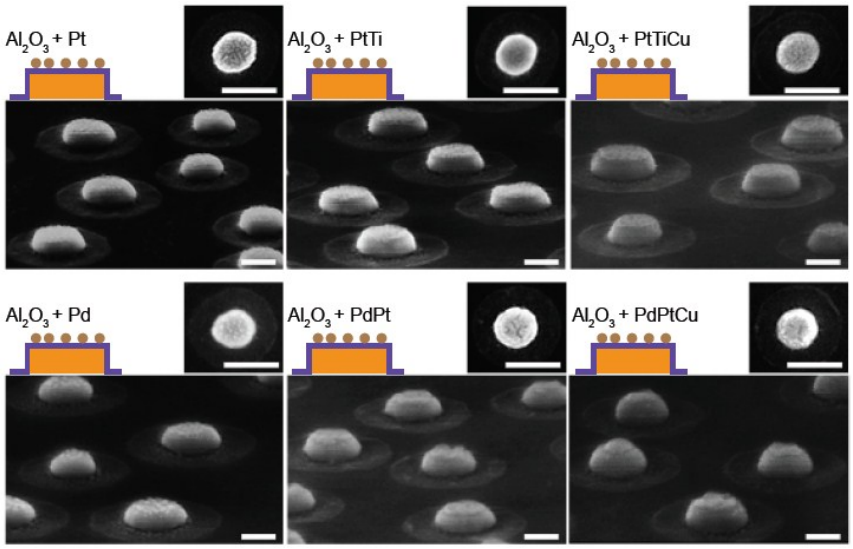

Figure S1. *Core-shell nanostructure examples fabricated using the soft sacrificial layer route and OPTION I. The scale bars are 100 nm.*

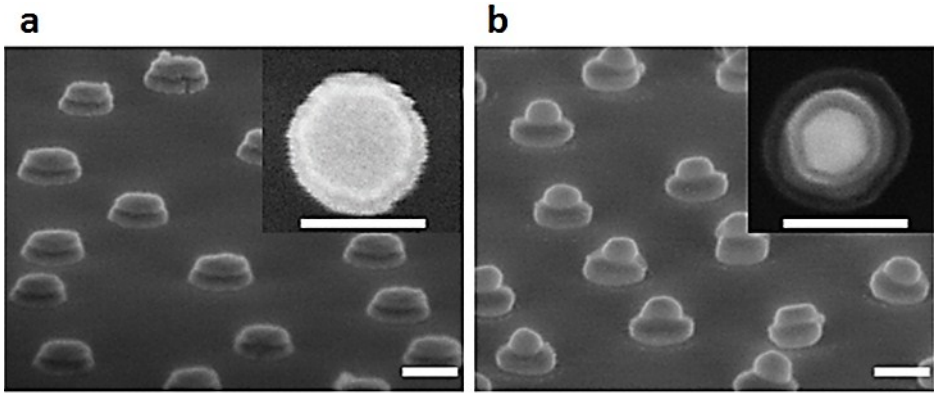

Figure S2. *Core-shell nanostructure example fabricated using the soft sacrificial layer route and OPTION I to produce a facetted Pt crystal on top of the Au core - 5 nm SiO_2 shell structure. (a) depicts the sample before and (b) after treatment in 9% CO & 9% O_2 in Ar at 350 ^oC. The scale bars are 100 nm.*

2. Plasmonic core particle size distributions

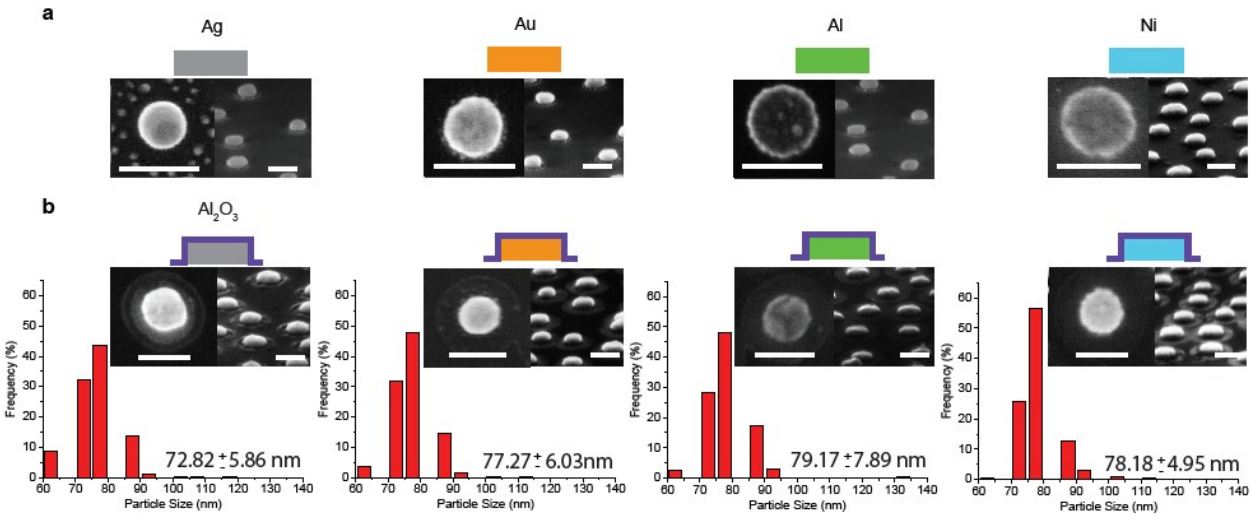

Figure S3. *The histograms were derived from SEM images for different metal cores (a) Ag, (b) Au, (c) Al, and (d) Ni, all encapsulated by a 3 nm Al_2O_3 shell.*

3. Small metal particle size distribution

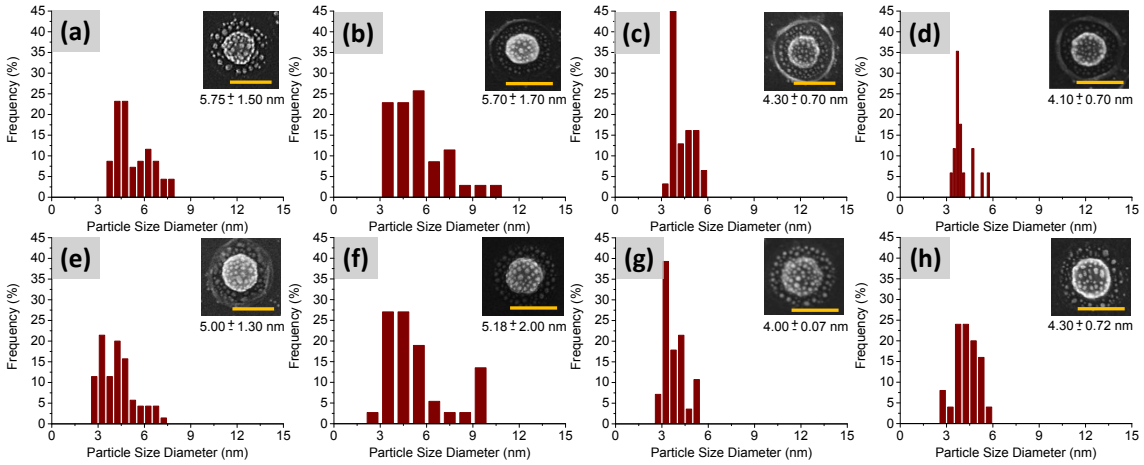

Figure S4. *Particle size distribution histograms derived from SEM images for small Pd particles grown onto different metal cores, all encapsulated in (first row) Al_2O_3 and (second row) & SiN_x: (a, e) Ag, (b, f) Au, (c, g) Al, and (d, h) Ni. Scale bar in all SEM inset images is 100 nm.*

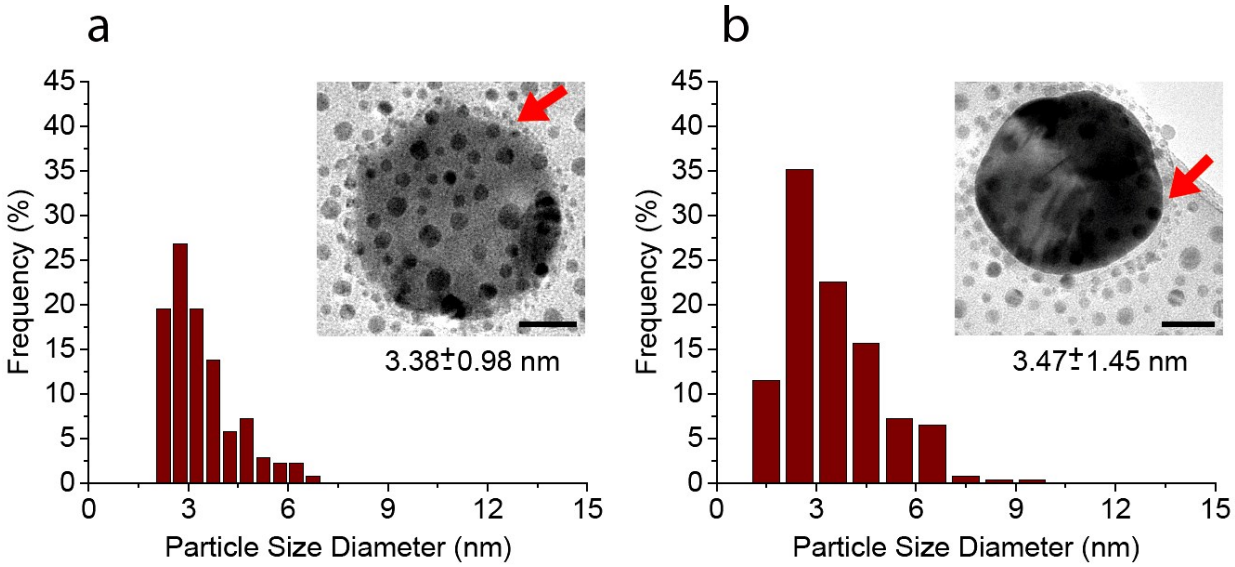

Figure S5. *Particle size distribution histograms derived from TEM images for Pd grown onto (a) Au@ SiN_x and (b) Ni@Al_2O_3 and localized around the sides of the core structures (red arrows). Scale bar in all SEM inset images is 100 nm.*

4. Optical extinction spectra of the core-shell heterodimers

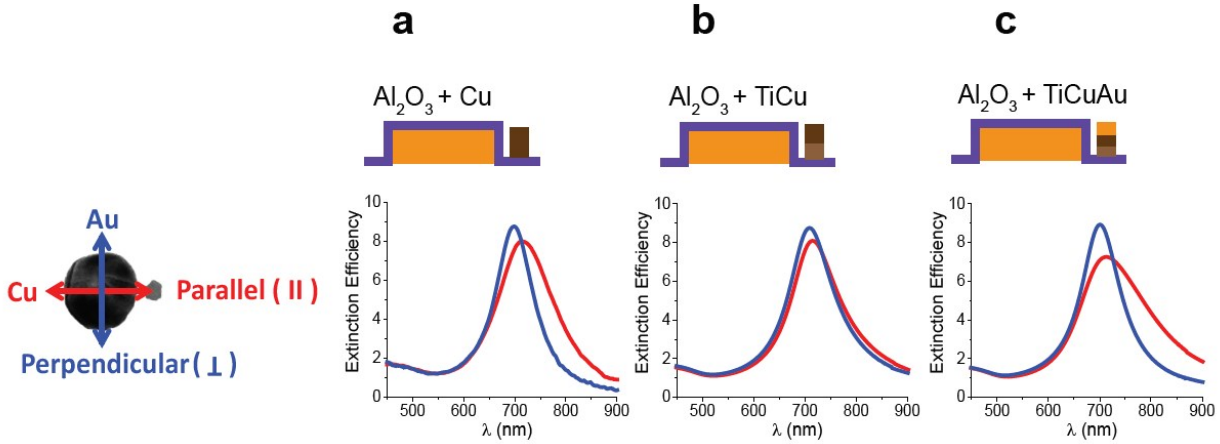

Figure S6*. (a-c) Polarization-dependent experimental optical extinction spectra of Au@Al_2O_3 core-shell nanoparticles with adjacent (a) Cu, (b) TiCu, and (c) TiCuAu nanoparticles.*

5. Al@WO_3 core-shell particles

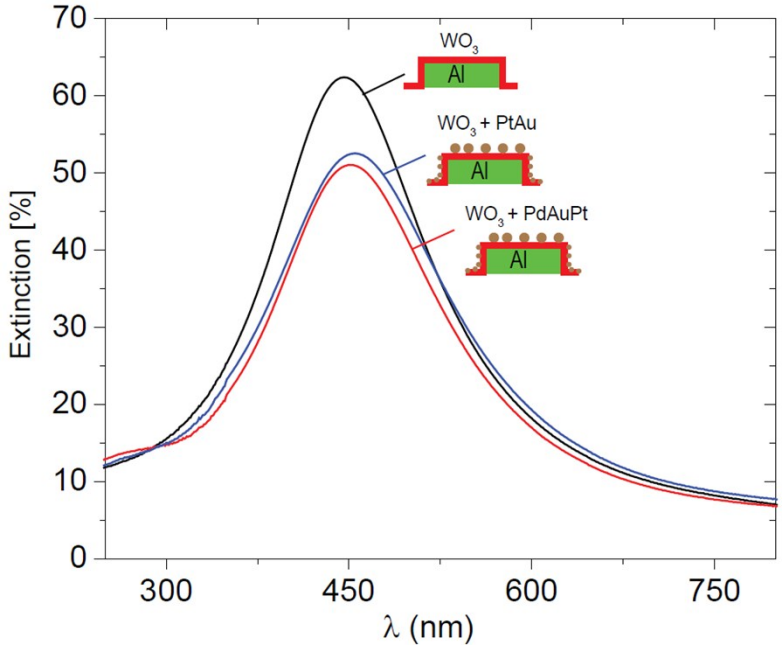

Figure S7*. Experimental optical extinction spectra of (black line) blank Al@WO_3 core-shell nanoparticles, and the same structures additionally decorated with (blue line) PtAu and (red line) PdAuPt nanoparticles.*

6. Absorption enhancement in Pd nanoparticles as function of their size

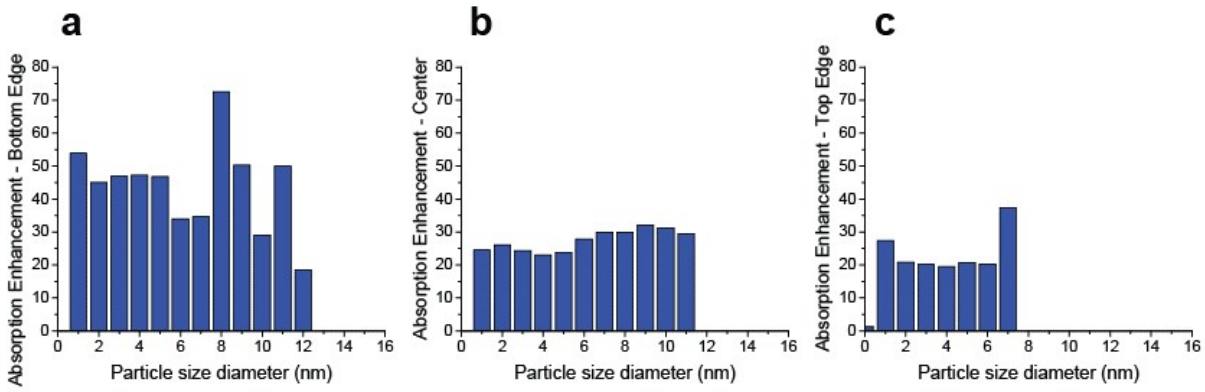

Figure S8. *FDTD-simulated absorption enhancement in Pd nanoparticles driven by a 80 nm Ag core capped with a 5 nm thin Al_2O_3 layer plotted as function of Pd particle size for different positions around the core: (a) along the bottom edge at the interface to the substrate; (b) at the center (on top) of the core; (c) along the top edge.*

7. *FDTD-calculated wavelength-resolved average absorption cross-section*

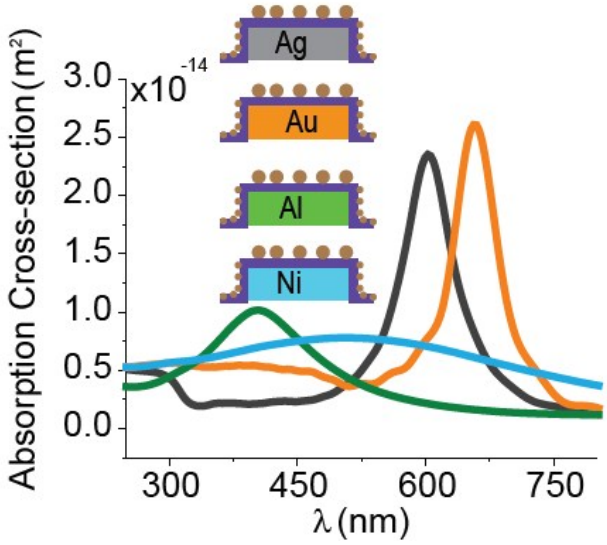

Figure S9. *FDTD-calculated wavelength-resolved average absorption cross-section in the small Pd nanoparticles of core-shell structures driven by Ag (gray), Au (orange), Al (green), and Ni (light blue) cores encapsulated in 5 nm Al_2O_3.*

8. Calculated absorption cross sections of single spherical Pd nanoparticles on a substrate.

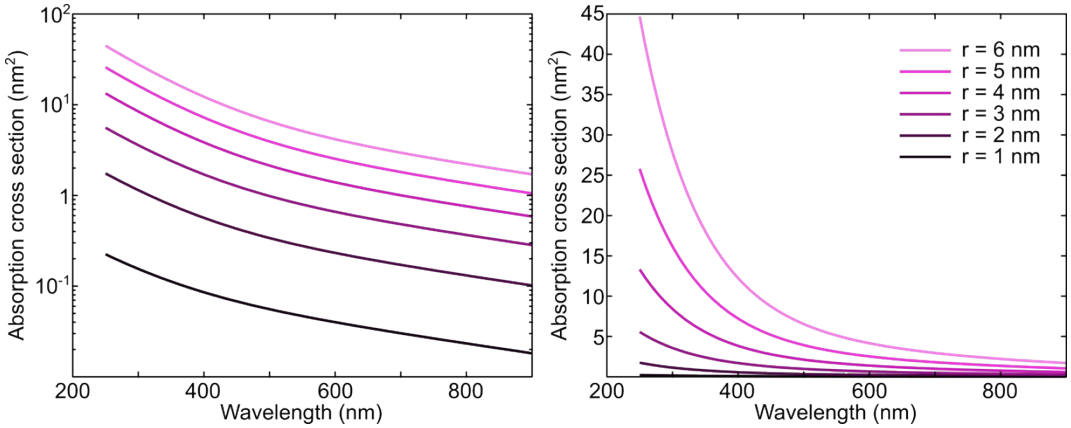

Figure S10. *Computed cross sections for absorption of spherical Pd nanoparticles placed on a substrate plotted in semi-log scale (left) and linear scale (right) for easy comparison.*

9. Experimentally measured optical extinction efficiency

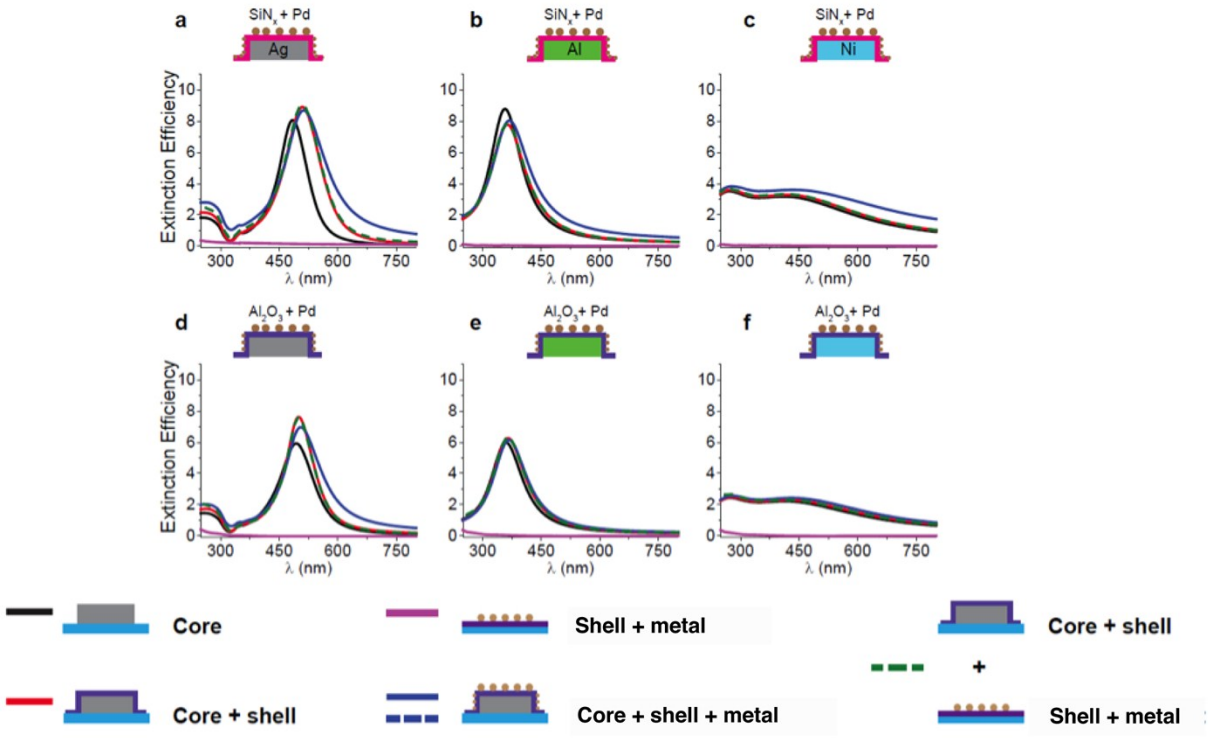

Figure S11. *Experimentally measured optical extinction efficiencies of core-shell-small metal particle architectures and their constituent layers for Ag, Al and Ni nanodisk cores with 80 nm mean diameter and 20 nm thickness, encapsulated in a. 5 nm SiNx (a-e) or Al_2O_3 (f-j) shell decorated with Pd nanoparticles in the 5 nm size range. These spectra are plotted together with the corresponding spectra of the constituent layers and particles, that is, the core nanoantenna alone, the core nanoantenna encapsulated in the dielectric shell layer, and patches of shell-layer-supported metal nanoparticles nanofabricated in the same way as the complete structures but without nanoantenna core.*

10. Experimentally measured absorption efficiency for different shell thickness

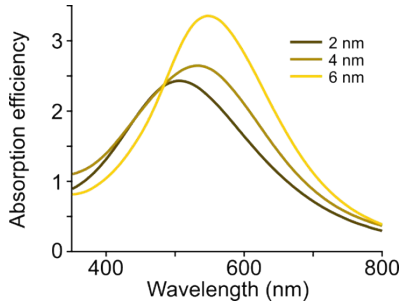

Figure S12. *Experimentally measured absorption efficiency for the $Ag@Al_2O_3$ system for different Al_2O_3 shell thicknesses (2 nm, 4 nm, and 6 nm).*