Growing Gold Nanostars on SiO_2 Nanoparticles: Easily Accessible, NIR Active Core–Shell Nanostructures from PVP/DMF Reduction

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S1. Powder diffraction of SiO_2(82nm)-NP and SiO_2(82nm)@AuNP

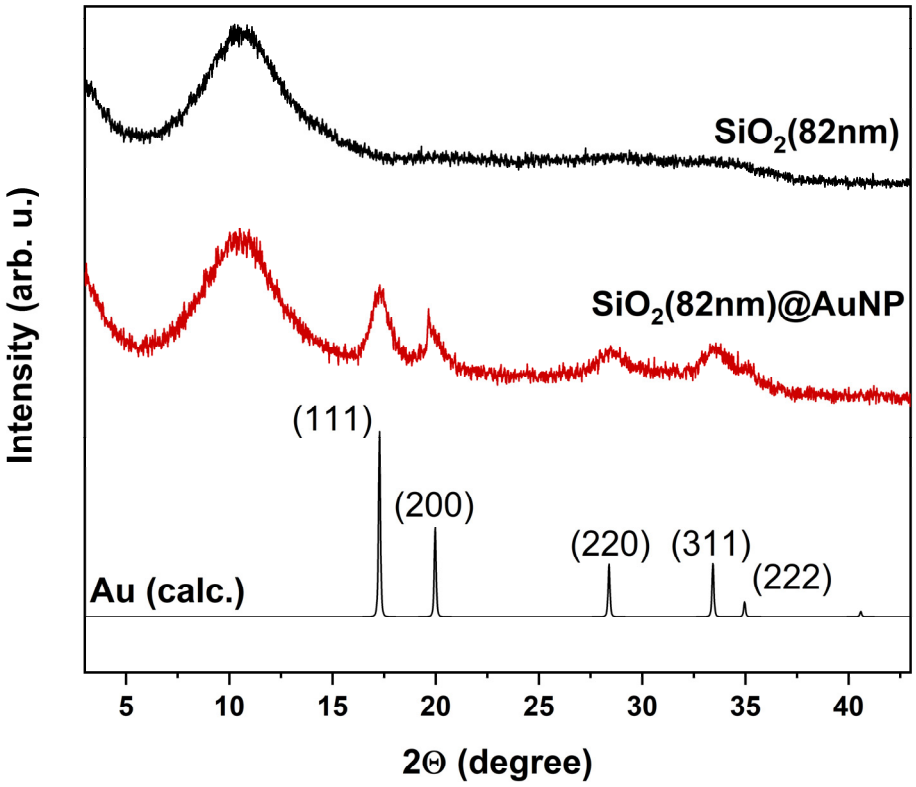

Figure. S1 PXRD pattern of SiO_2(82nm) in black, SiO_2(82nm)@AuNP in red and the theoretical pattern for the face-centred cubic structure of metallic Au with the space group *Fm-3m*

S2. TEM image of SiO_2@AuNS in high yields

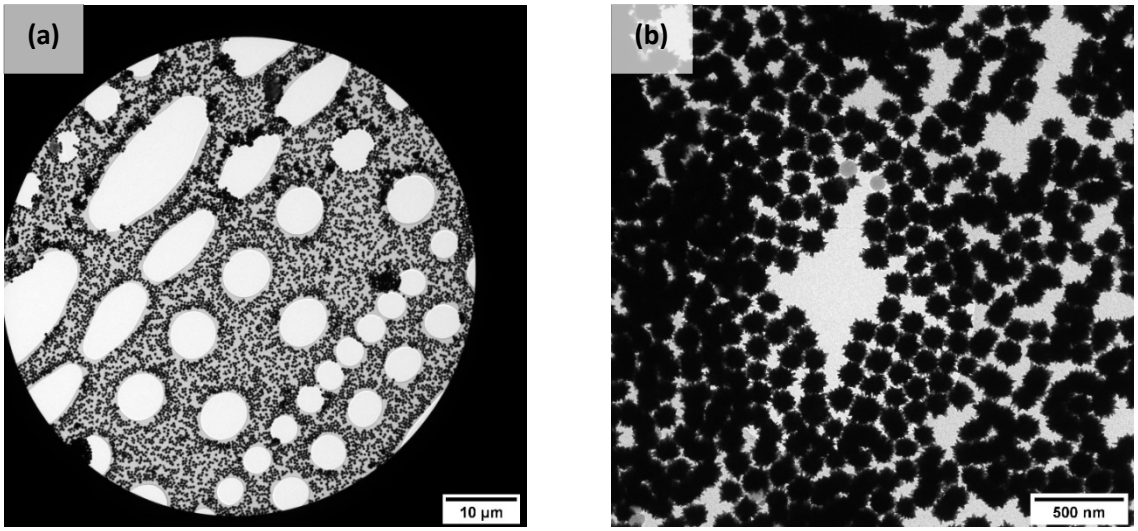

Figure. S2 TEM image sections of SiO_2@AuNS(*R* = 128.0) demonstrating the high ratio of coated SiO_2 nanoparticles with 4,000 times magnification (a) and 10,000 times magnification (b).

S3. Stability of SiO_2@AuNS after several month

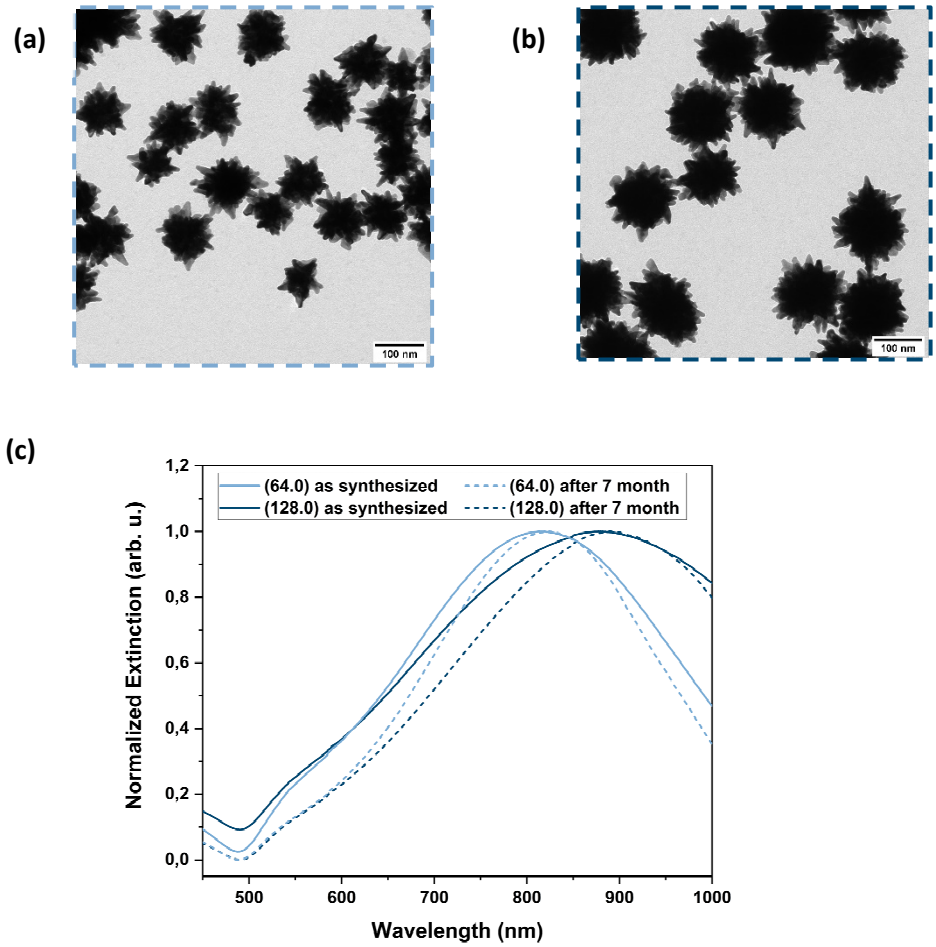

Figure. S3 TEM images of SiO_2@AuNS(*R* = 64.0, light blue) (a), and SiO_2@AuNS(*R* = 128.0, dark blue) (b) stored for seven month in ethanol and corresponding extinction spectra of the nanostructures (c). Solid lines show the initial spectra while dashed lines mark the spectra of the nanostructures recorded after seven month.

S4. Extinction spectra and TEM images of additional [$HAuCl_4$]/[seed] mass ratios

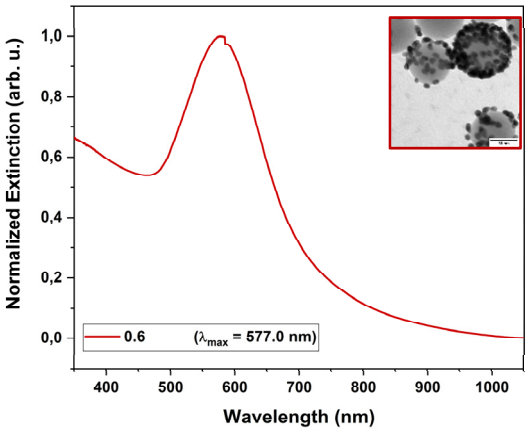

Figure. S4–1 Extinction spectrum and TEM image of the SiO_2@AuNS for *R* = 0.6 (500.0 µL of the seed solution) with a gold nanostructure size of 11.3 ± 1.9 nm.

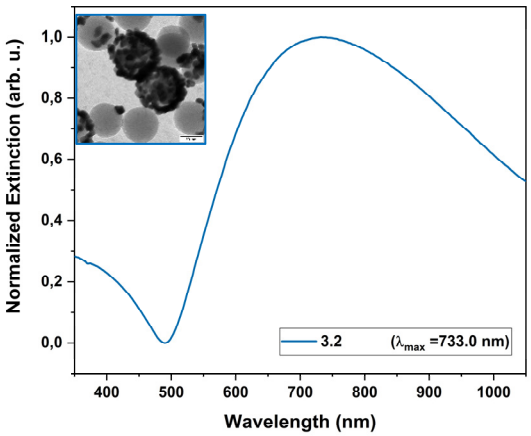

Figure. S4–2 Extinction spectrum and TEM image of the SiO_2@AuNS for *R* = 3.2 (100.0 µL of the seed solution) with a gold nanostructure size of 20.4 ± 4.6 nm.

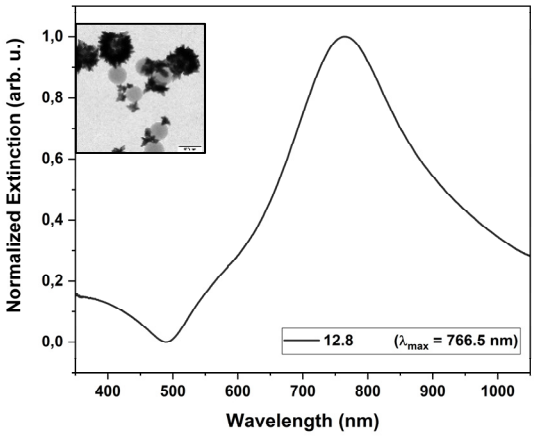

Figure. S4–3 Extinction spectrum and TEM image of the SiO_2@AuNS for *R* = 12.8 (25.0 µL of the seed solution) with a gold nanostructure size of 46.0 ± 12.8 nm.

S5. Histograms of the core and total diameters of SiO_2@AuNS (TEM)

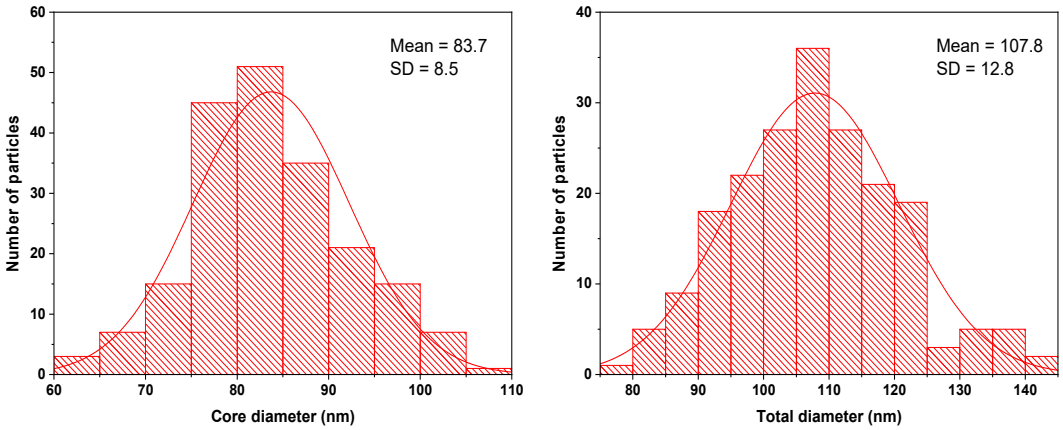

Figure. S5–1 Histograms of the core and the total diameter of SiO_2@AuNS (C) with a mass ratio of 64.0 (5.0 µL of the seed solution) determined by TEM.

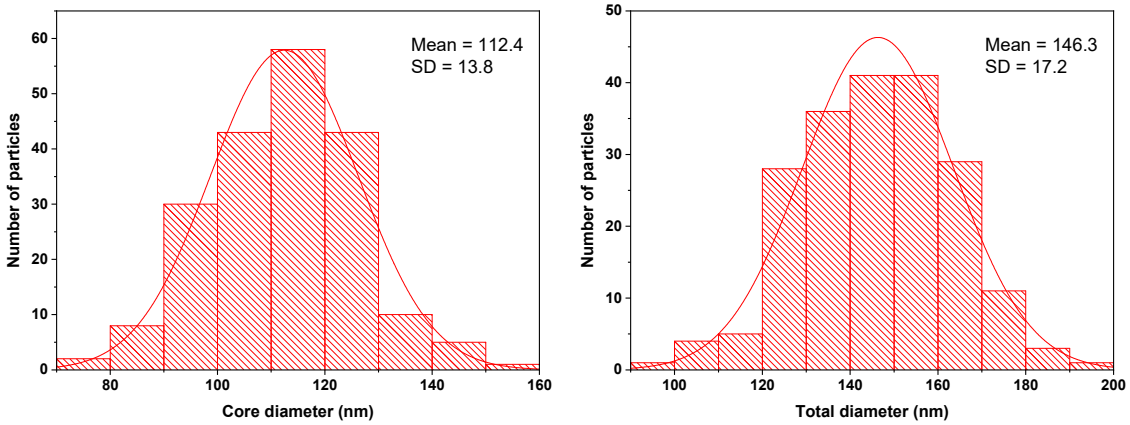

Figure. S5–2 Histograms of the core and the total diameter of SiO_2@AuNS (D) with a mass ratio of 128.0 (2.5 µL of the seed solution determined by TEM).

S6. Hydrodynamic diameters of SiO_2@AuNS obtained by DLS measurements

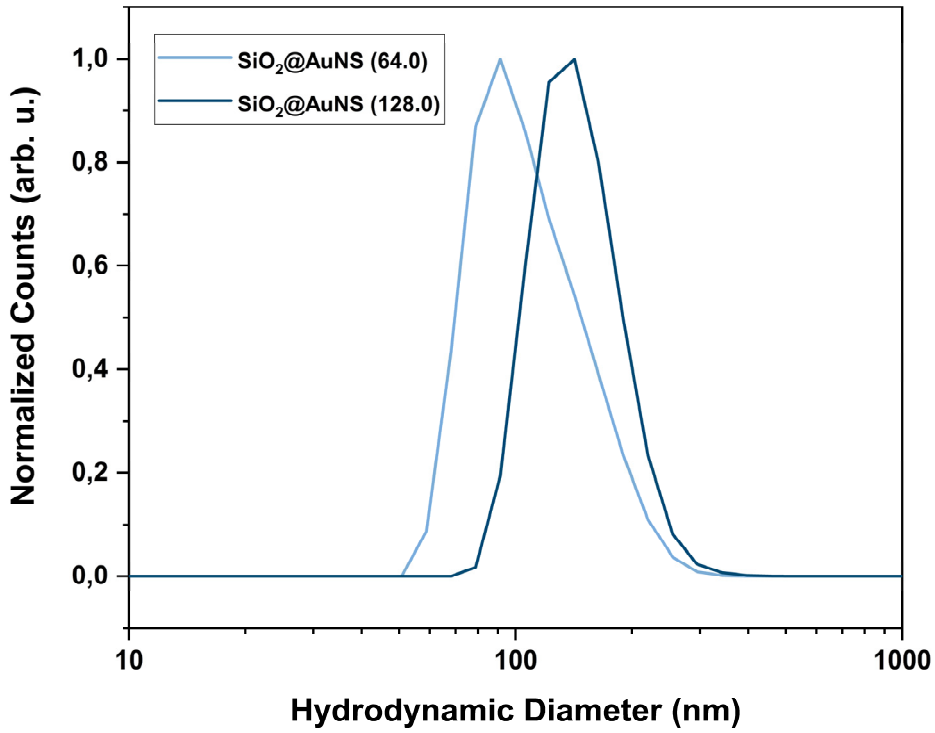

Figure. S6 Normalized number-averaged DLS profiles of SiO_2@AuNS (R = 64.0) and SiO_2@AuNS (R = 128.0) dispersed in ethanol.