Supporting Information

Tailoring the Photoluminescence of AIE-Type Gold Nanoclusters via Biomineralization-Inspired Polymorphism

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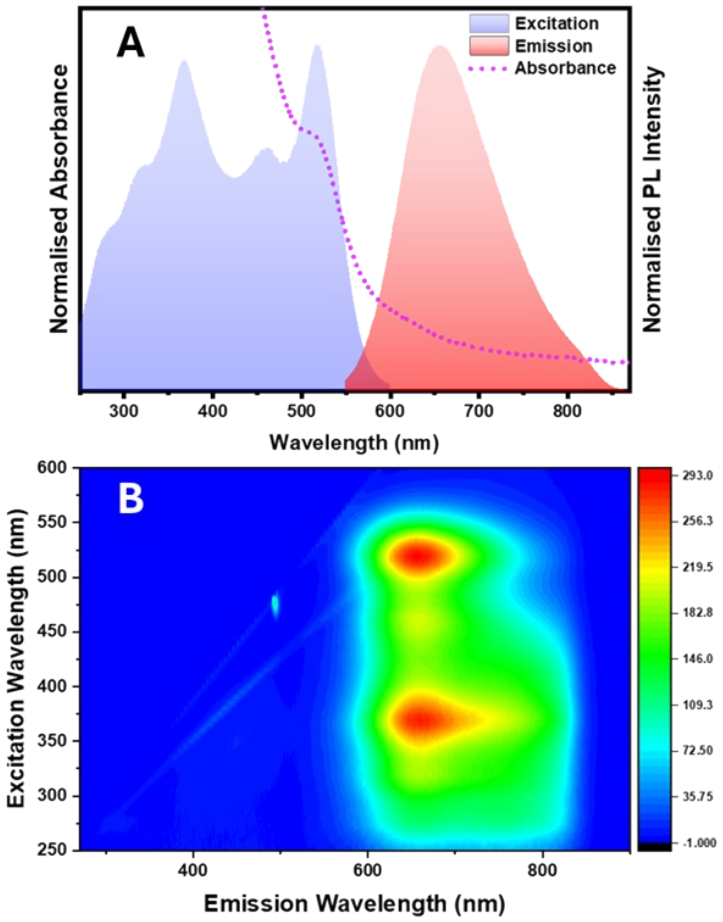

Fig. S1. (A) Excitation, Emission and Absorbance spectrum of $Au_{22}SG_{18}$. (B) 2D Excitation Emission spectra of $Au_{22}SG_{18}$. (λ_{ex} =520 nm)

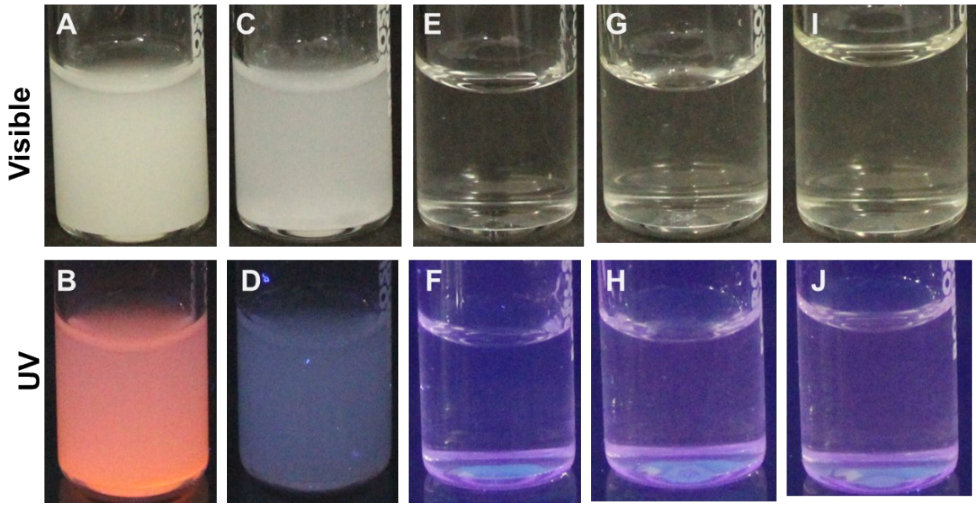

Fig. S2. Photographic images of $Au_{22}SG_{18}$ @$CaCO_3$-Cube(A-B), $CaCO_3$- Cube(C-D), $CaCl_2$ in EG/water(E-F), $Au_{22}SG_{18}$/$CaCl_2$ in EG/water (G-H), $Au_{22}SG_{18}$ in EG/water(I-J) under UV and visible light.

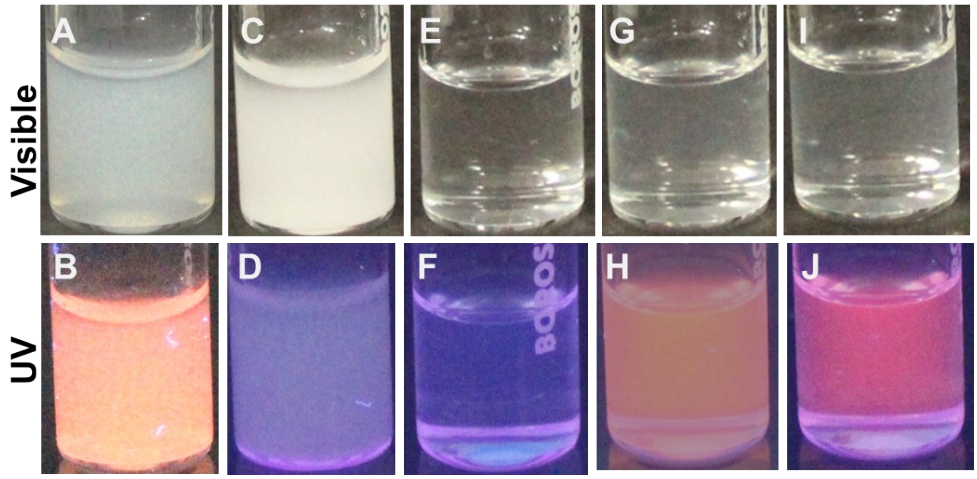

Fig. S3. Photographic images of $Au_{22}SG_{18}$ @$CaCO_3$-Cube/Sphere(A-B), $CaCO_3$-Cube/Sphere(C-D), $CaCl_2$ in water-ethanol (E-F), $Au_{22}SG_{18}$/ $CaCl_2$ in water-ethanol (G-H), $Au_{22}SG_{18}$ in water-ethanol(I-J)

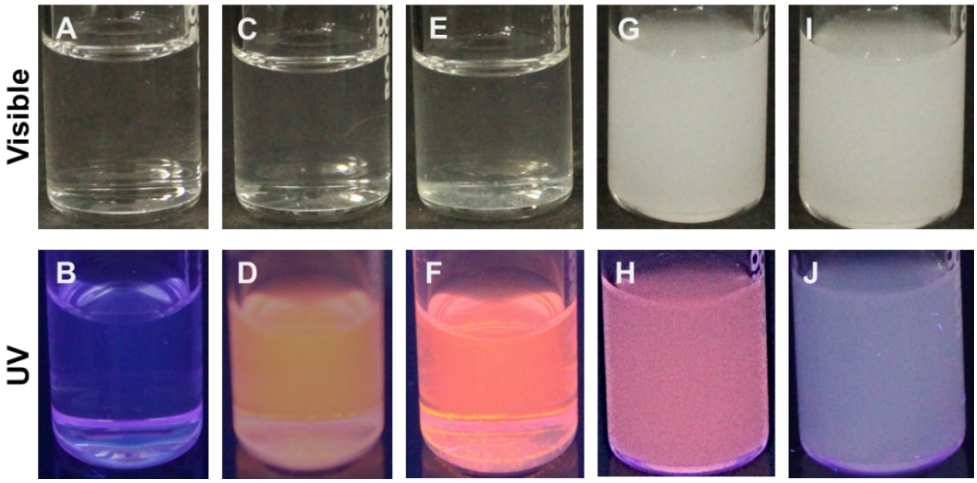

Fig. S4. Photographic images of $CaCl_2$ in ethanol/water (A-B), $Au_{22}SG_{18}$/$CaCl_2$ in ethanol/water(C-D), $Au_{22}SG_{18}$ in ethanol/water (E-F), $Au_{22}SG_{18}$ @$CaCO_3$ -sphere (G-H), $CaCO_3$ -Sphere(I-J)

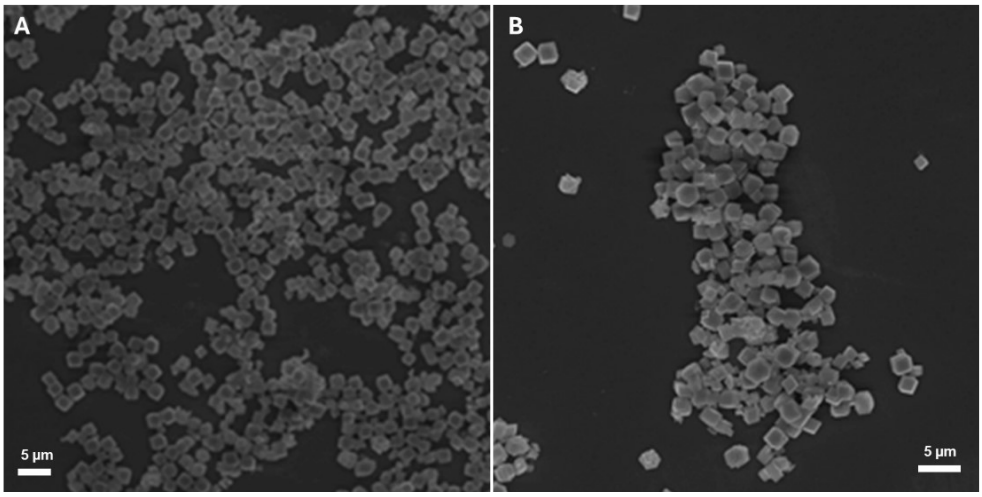

Fig. S5. FESEM images of $CaCO_3$-Cube-control

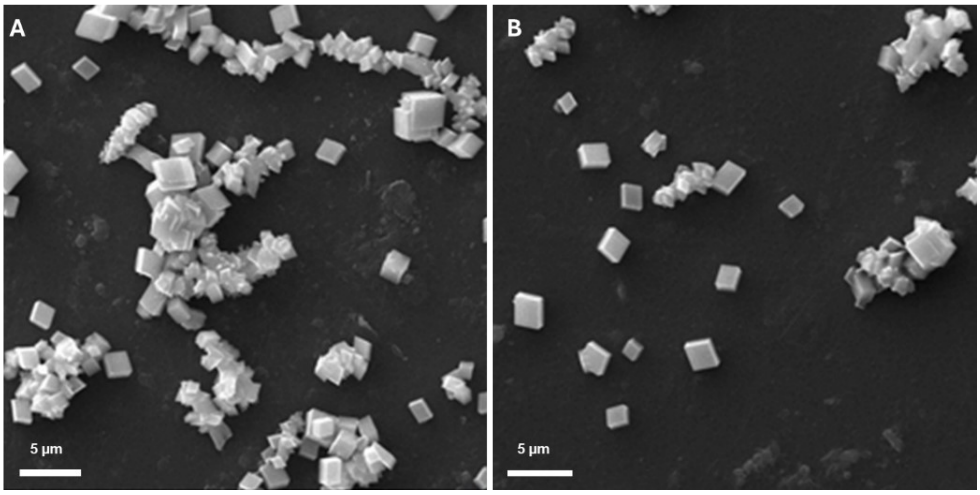

Fig. S6. FESEM image of $CaCO_3$-Cube/Sphere-control

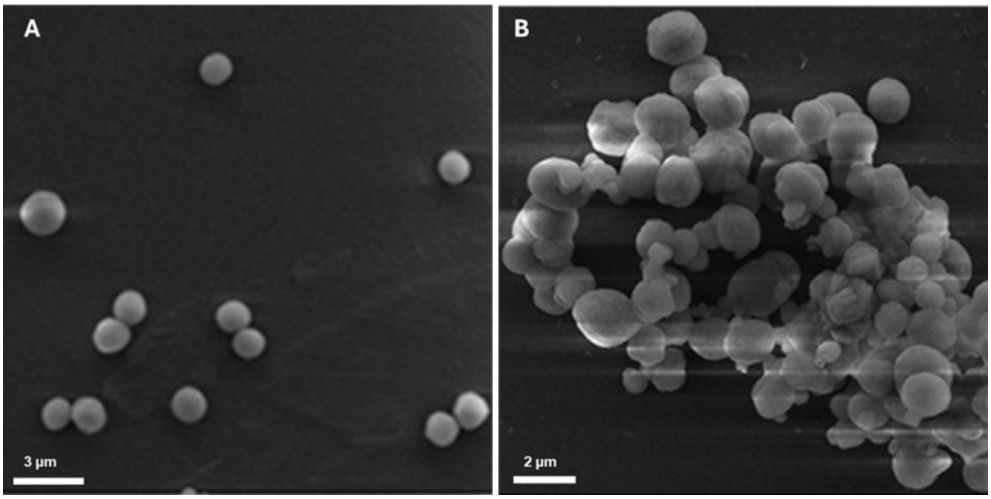

Fig. S7. FESEM images of $CaCO_3$-Sphere-Control

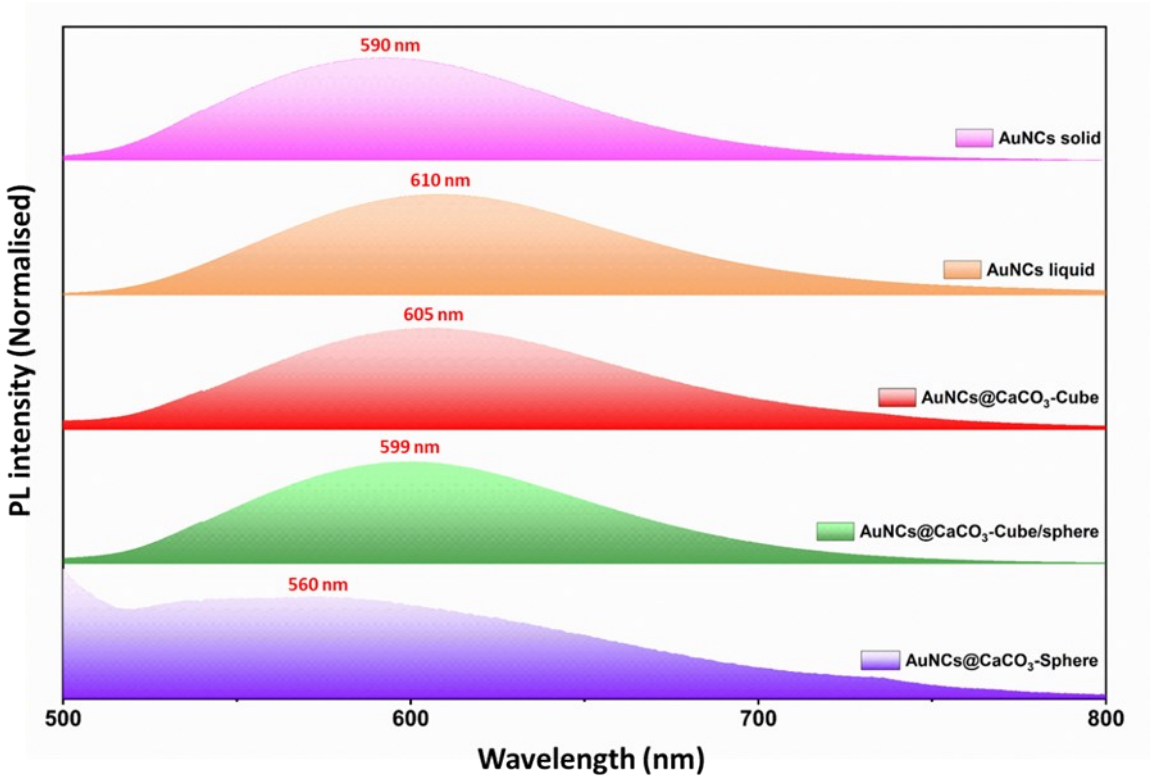

Fig. S8. PL intensity of AuNCs@$CaCO_3$-composites (excitation wavelength = 375 nm).

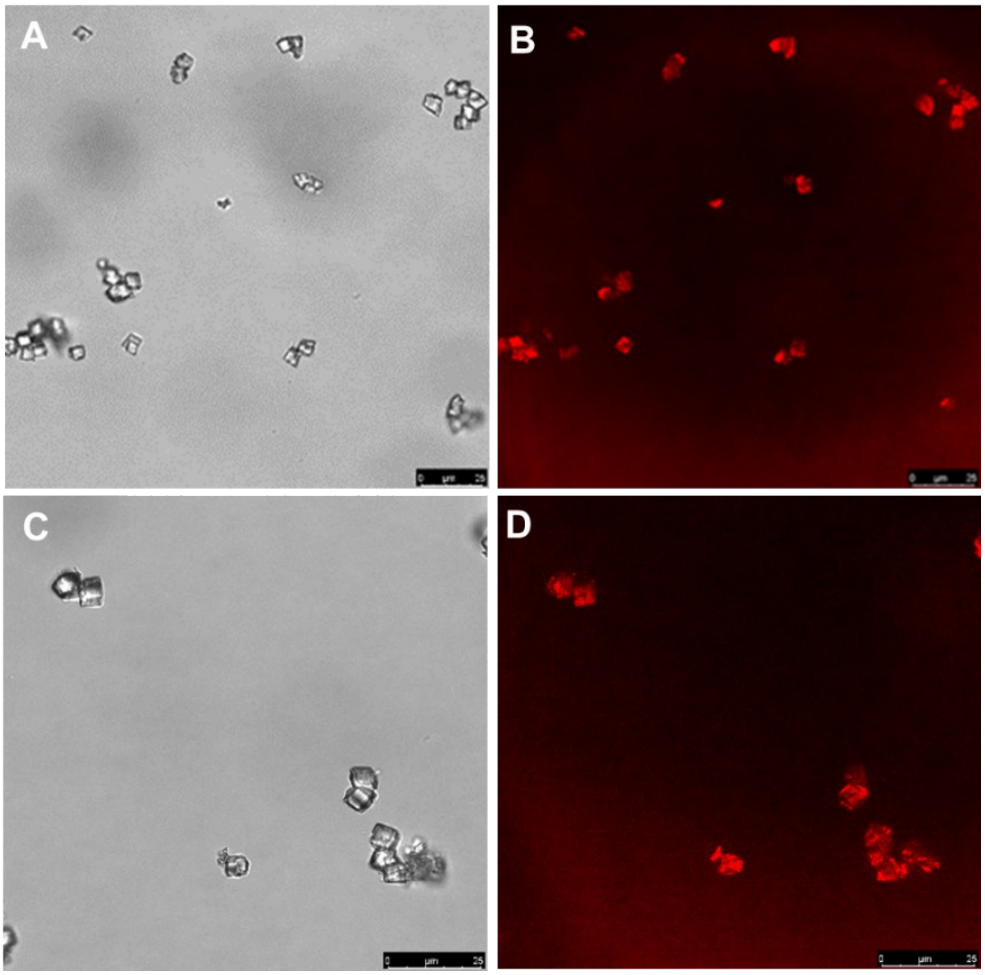

Fig. S9. Confocal microscopic images of $Au_{22}SG_{18}$@$CaCO_3$-Cube

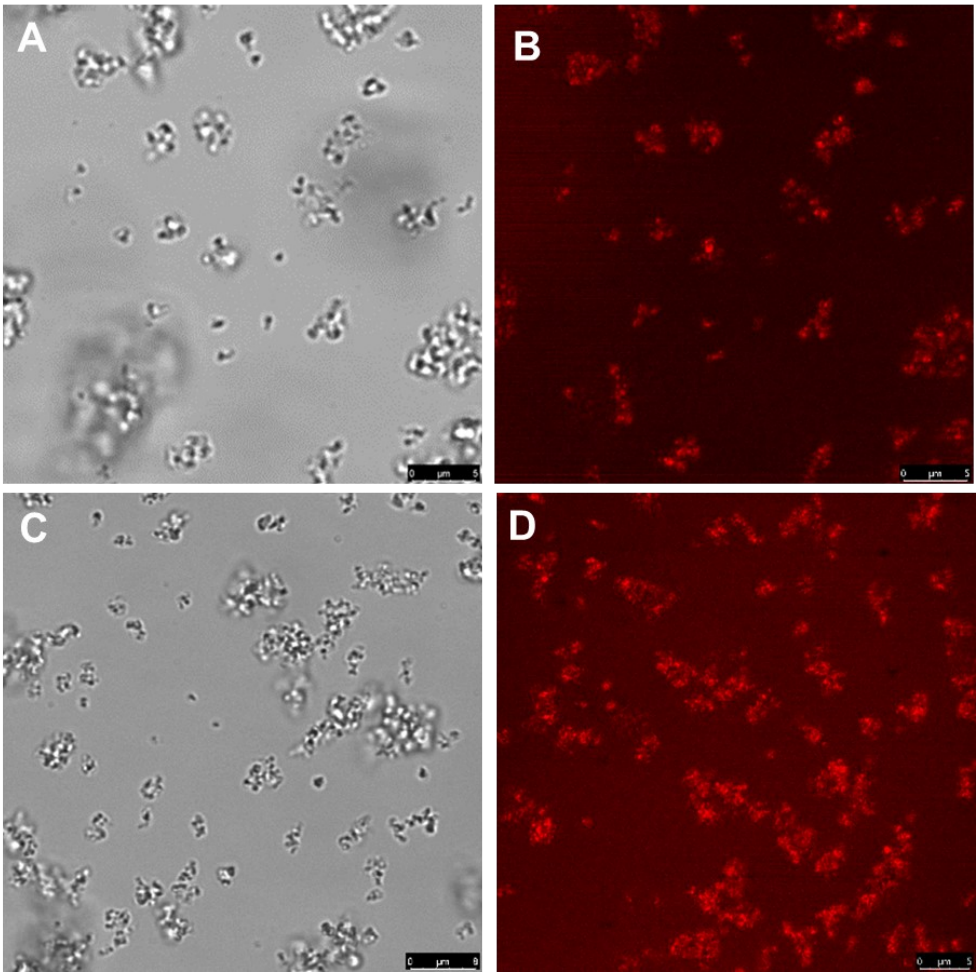

Fig. S10. Confocal microscopic image of $Au_{22}SG_{18}$@$CaCO_3$-Sphere

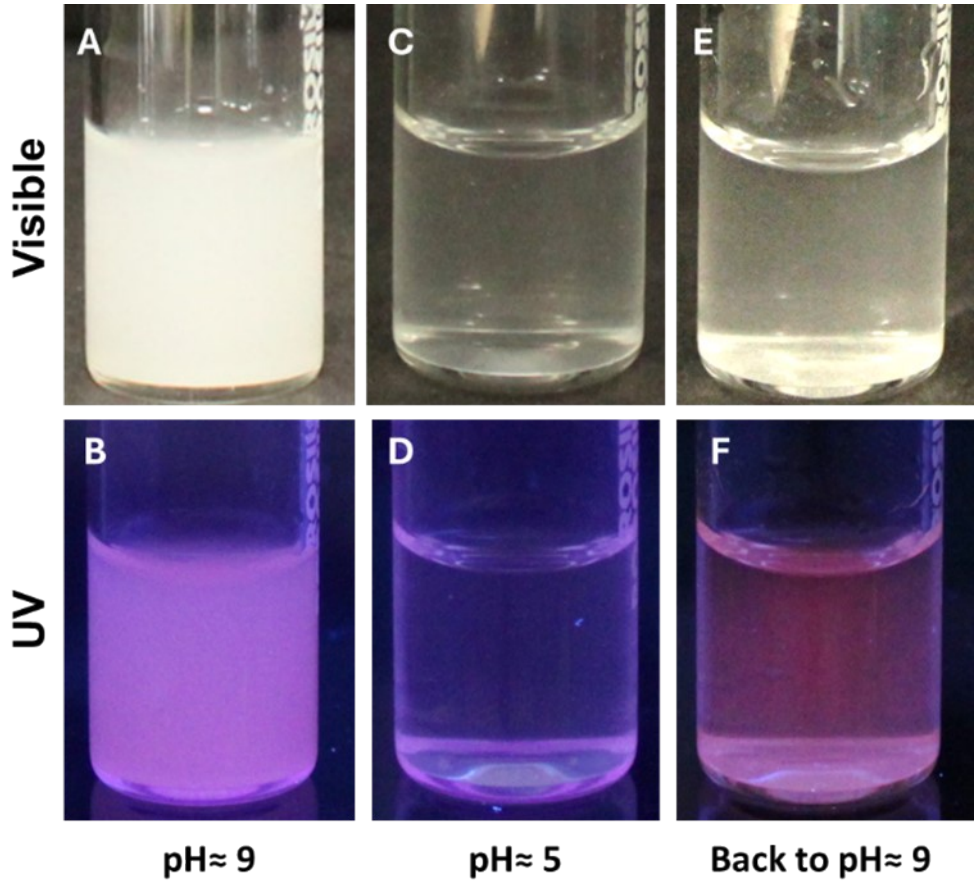

Fig. S11. Photographic images of $Au_{22}SG_{18}$ @$CaCO_3$ -Cube at different pH under visible and UV light, at pH ≈ 9 (A-B), pH ≈ 5 (E-D), back to pH ≈ 9 (E-F).

Table S1. Summery of lifetime values of as synthesized $Au_{22}SG_{18}$ NCs embedded $CaCO_3$ matrices in microsecond time scale. Excitation wavelength = 375 nm; emission wavelength = 660 nm.

Samples	A_1	τ_1(ns)	A_2	τ_2(ns)	A_3	τ_3(ns)	τ_{avg} (ns)
$Au_{22}SG_{18}$@$CaCO_3$-Cube	1049.07	1477.57	4074.15	8988.54	0	0	7450.53
$Au_{22}SG_{18}$@$CaCO_3$-Cube/Sphere	2976.56	2580.48	2425.08	10433.34	0	0	6106.04
$Au_{22}SG_{18}$@$CaCO_3$-Sphere	3628.95	1963.96	1734.56	9179.09	0	0	4297.33
$Au_{22}SG_{18}$	2734	209.5	1980	1038	548.4	3426	856.51

Table S2. Summery of lifetime values of as synthesized $Au_{22}SG_{18}$ NCs embedded $CaCO_3$ matrices in nanosecond time scale. Excitation wavelength = 375 nm; emission wavelength = 660 nm.

Samples	A_1	τ_1(ns)	A_2	τ_2(ns)	A_1+A_2	$A_1/(A_1+A_2)$	$A_2/(A_1+A_2)$	τ_{avg} (ns)
$Au_{22}SG_{18}$@$CaCO_3$-Cube	0.010	76.714	0	0	0.01	1	0	76.714
$Au_{22}SG_{18}$@$CaCO_3$-Cube/Sphere	0.011	45.746	0	0	0.011	1	0	45.746
$Au_{22}SG_{18}$@$CaCO_3$-Sphere	0.026	1.233	0.009	35.7956	0.035	0.743	0.257	10.121
$Au_{22}SG_{18}$ solid	0.005	25.387	0	0	0.005	1	0	25.387
$Au_{22}SG_{18}$ liquid	0.035	1.150	0.016	38.565	0.051	0.686	0.314	12.887

Table S3: The atomic concentration of gold in each composite determined by ICP-OES.

Material	Amount of Au in 1 mg composite (mg)
$Au_{22}SG_{18}$@$CaCO_3$-Cube	1.591×10^{-2}
$Au_{22}SG_{18}$@$CaCO_3$-Cube/Sphere	0.684×10^{-2}
$Au_{22}SG_{18}$@$CaCO_3$-Sphere	0.796×10^{-2}