Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Tunable Photoluminescence and SERS behaviour of additively manufactured Au nanoparticle patterns

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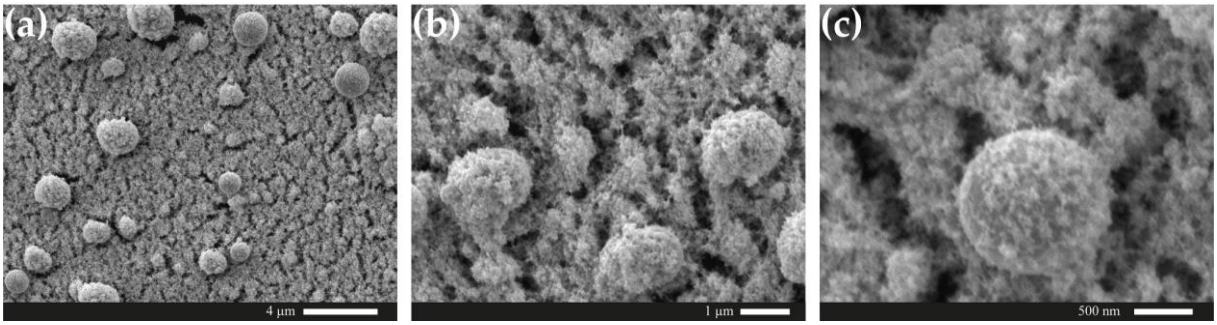

Figure S 1. SEM images of the AuNPs deposited on a silicon substrate with SAM voltage/current setting of V=0.9 kV, I=5 mA a) Low magnification of Microparticles together with agglomeration of primary nanoparticles , and high magnification of b) agglomeration of primary nanoparticles on the microparticles and , c) microparticles in the film of AuNPs.

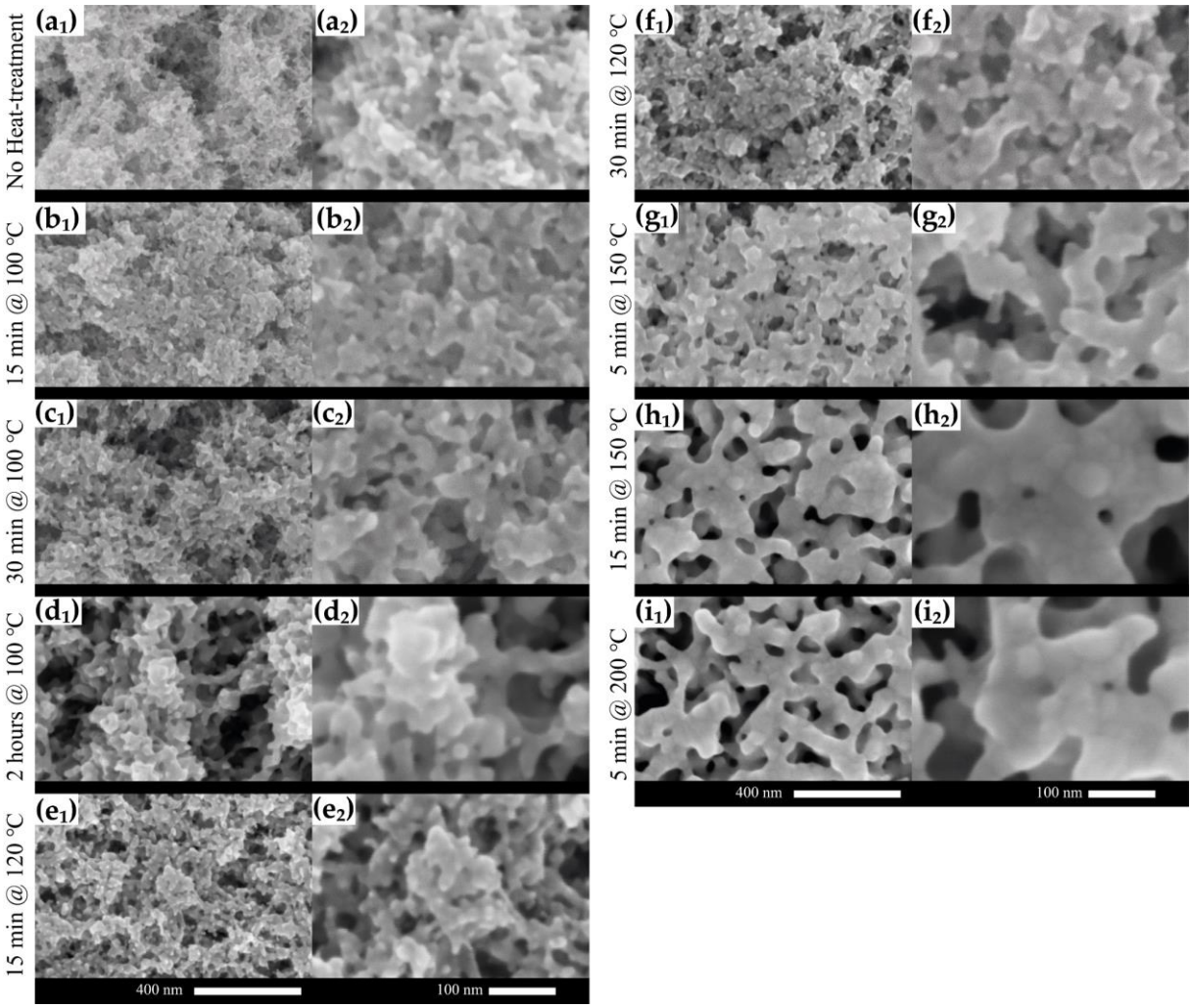

Figure S 2. (a1, a2) SEM images of the morphology of AuNPs deposited on centric region of the line and the boundary (Sample 1), and the same comparison for thermal treated samples as (b1, b2) 15 minutes at 100 ℃ (Sample 2), (c1, c2) 30 minutes at 100 ℃ (Sample 3), (d1, d2) 120 minutes at 100 ℃ (Sample 4), (e1,e2) 15 minutes at 120 ℃ (Sample 5), (f1, f2) 30 minutes at 120 ℃ (Sample 6), (g1, g2) 5 minutes at 150 ℃ (Sample 7), (h1, h2) 15 minutes at 150 ℃ (Sample 8), (i1, i2) 5 minutes at 200 ℃ (Sample 9). All AuNPs deposited with SAM voltage/current setting of V = 0.9 kV and I = 5 mA.

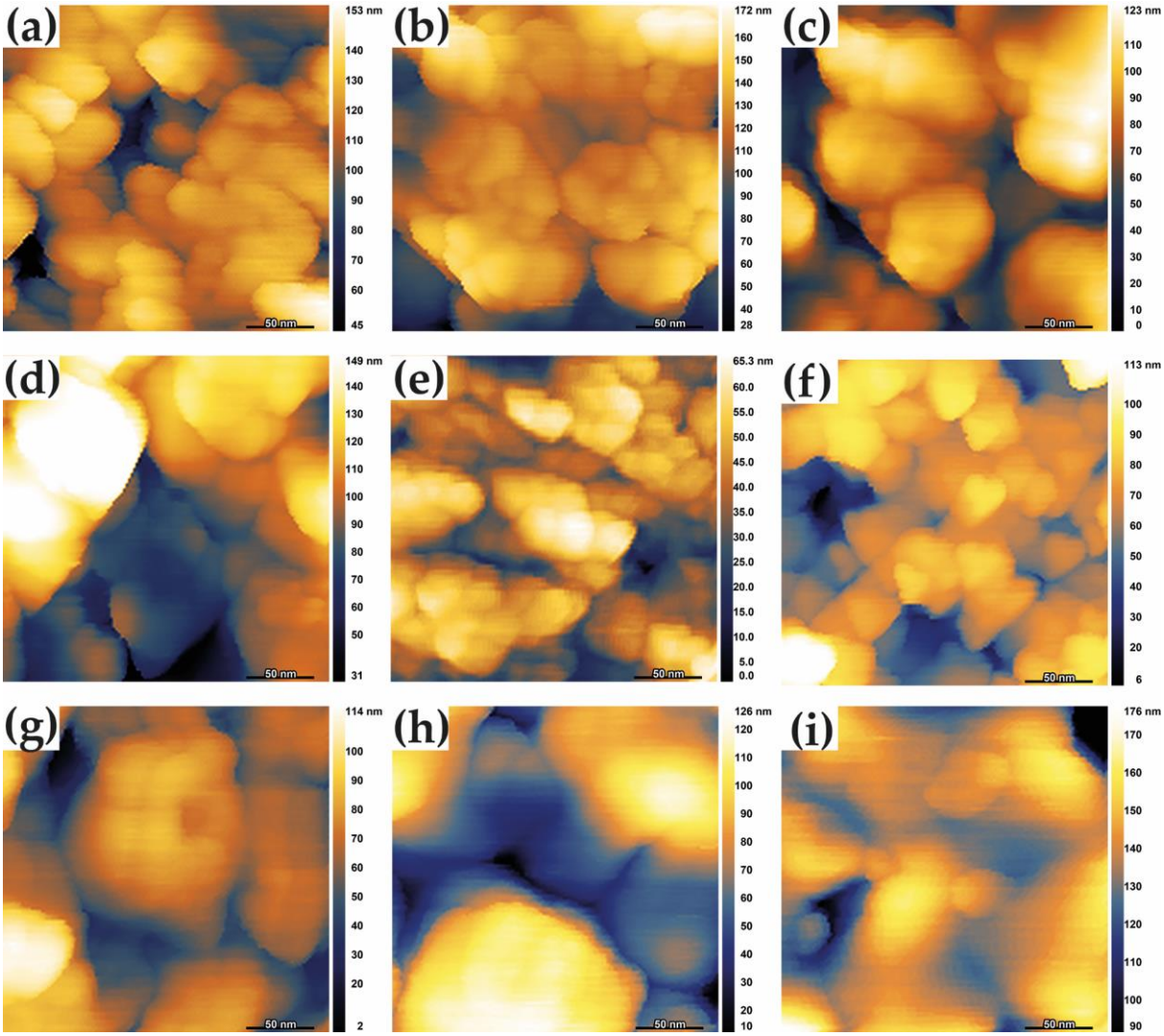

Figure S 3. AFM morphology of 250 × 250 nm2 areas of a) non-heat treated samples (b) 15 minutes at 100 °C, (c) 30 minutes at 100 °C, (d) 120 minutes at 100 °C, (e) 15 minutes at 120 °C, (f) 30 minutes at 120 °C, (g) 5 minutes at 150 °C, (h) 15 minutes at 150 °C, (i) 5 minutes at 200 °C.

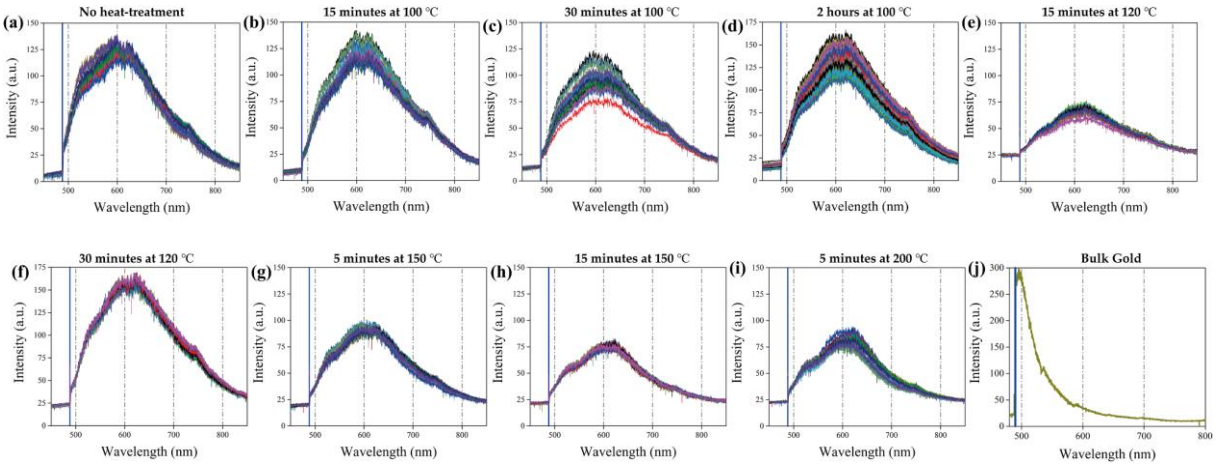

Figure S 4. The photoluminescence response spectra of a) non-thermally treated sample, b) 15 minutes at 100 °C, c) 30 minutes at 100 °C, d) 120 minutes at 100 °C, e) 15 minutes at 120 °C, f) 30 minutes at 120 °C, g) 5 minutes at 150 °C, h) 15 minutes at 150 °C, i) 5 minutes at 200 °C, and j) Bulk gold, under laser excitation 488 nm. PL measurement conditions: grating

of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 20 s, integration time = 1. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA

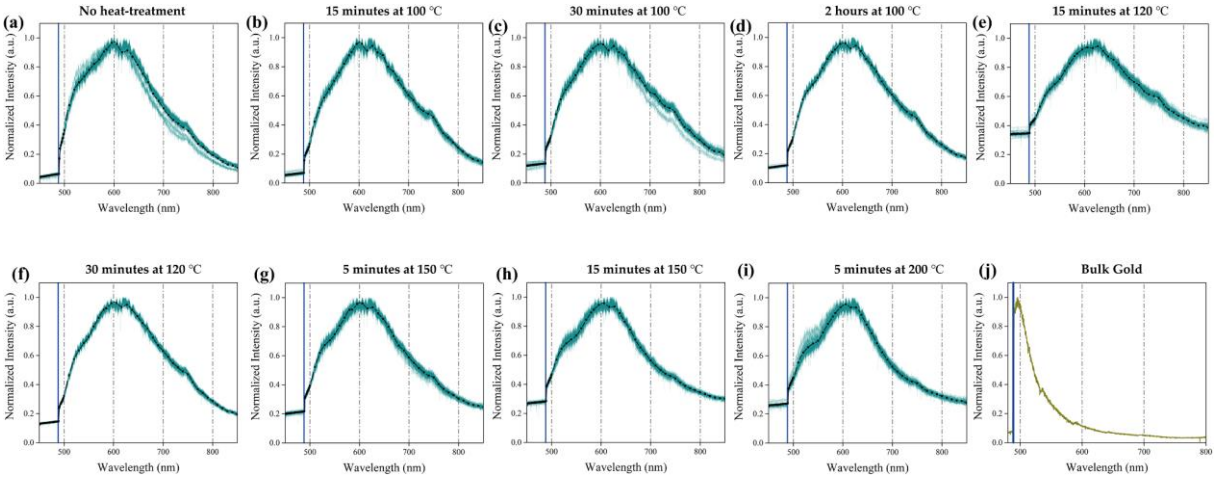

Figure S 5. The normalized photoluminescence response spectra with peak of a) non-thermally treated sample, b) 15 minutes at 100 °C, c) 30 minutes at 100 °C, d) 120 minutes at 100 °C, e) 15 minutes at 120 °C, f) 30 minutes at 120 °C, g) 5 minutes at 150 °C, h) 15 minutes at 150 °C, i) 5 minutes at 200 °C, and j) Bulk gold, under laser excitation 488 nm. PL measurement conditions: grating of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 20 s, integration time = 1. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA.

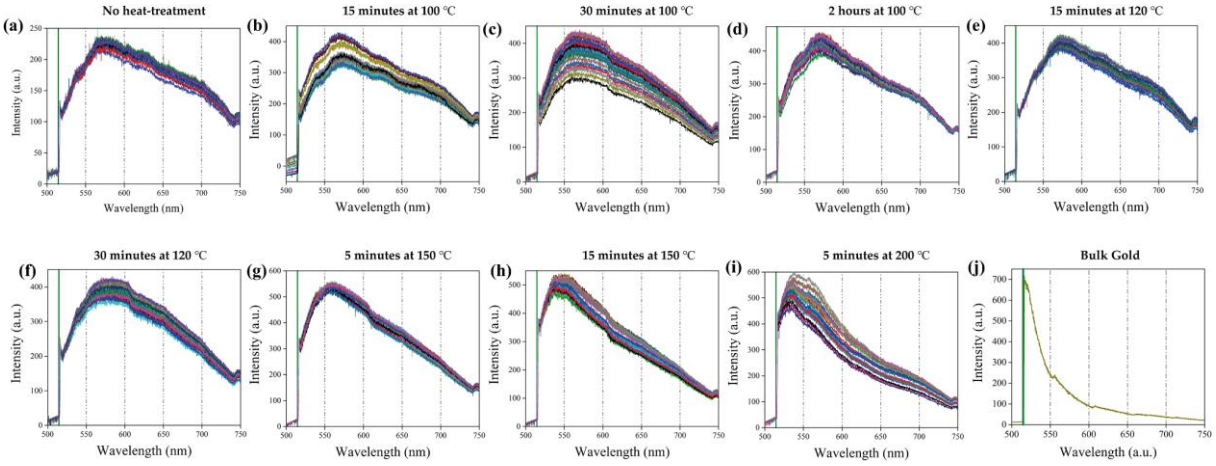

Figure S 6. The photoluminescence response spectra of a) non-thermally treated sample, b) 15 minutes at 100 °C, c) 30 minutes at 100 °C, d) 120 minutes at 100 °C, e) 15 minutes at 120 °C, f) 30 minutes at 120 °C, g) 5 minutes at 150 °C, h) 15 minutes at 150 °C, i) 5 minutes at 200 °C, and j) Bulk gold, under laser excitation 514 nm. PL measurement conditions: grating of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 10 s, integration time = 2. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA.

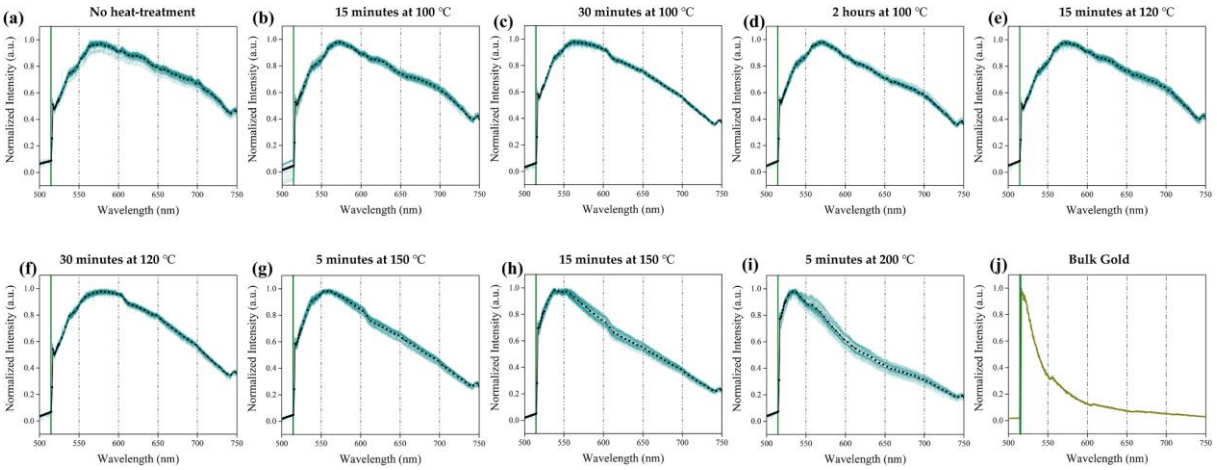

Figure S 7. The normalized photoluminescence response spectra with peak of a) non-thermally treated sample, b) 15 minutes at 100 ℃, c) 30 minutes at 100 ℃, d) 120 minutes at 100 ℃, e) 15 minutes at 120 ℃, f) 30 minutes at 120 ℃, g) 5 minutes at 150 ℃, h) 15 minutes at 150 ℃, i) 5 minutes at 200 ℃, and j) Bulk gold, under laser excitation 514 nm. PL measurement conditions: grating of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 10 s, integration time = 2. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA.

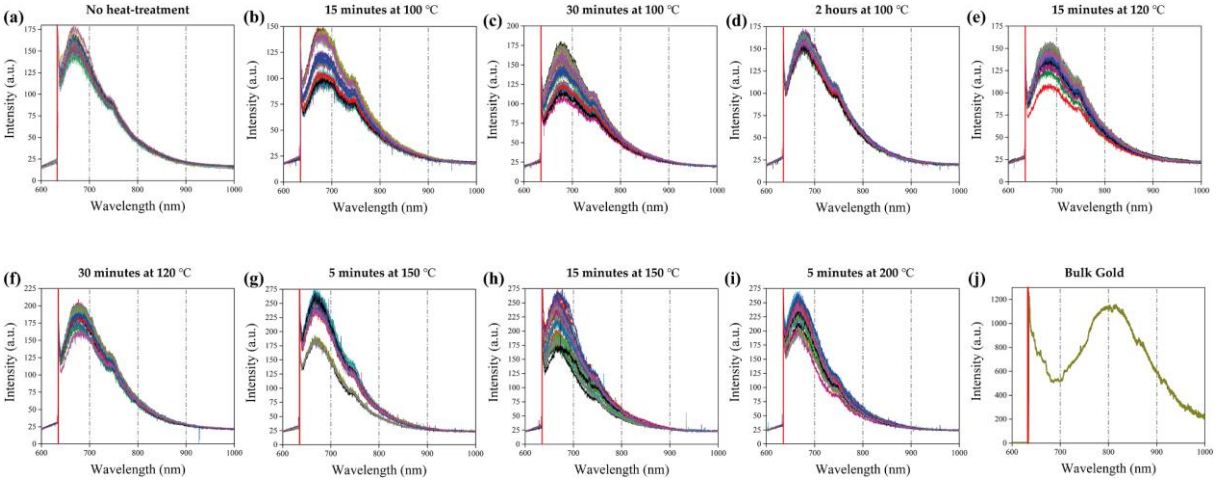

Figure S 8. The photoluminescence response spectra of a) non-thermally treated sample, b) 15 minutes at 100 ℃, c) 30 minutes at 100 ℃, d) 120 minutes at 100 ℃, e) 15 minutes at 120 ℃, f) 30 minutes at 120 ℃, g) 5 minutes at 150 ℃, h) 15 minutes at 150 ℃, i) 5 minutes at 200 ℃, and j) Bulk gold, under laser excitation 633 nm. PL measurement conditions: grating of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 10 s, integration time = 1. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA.

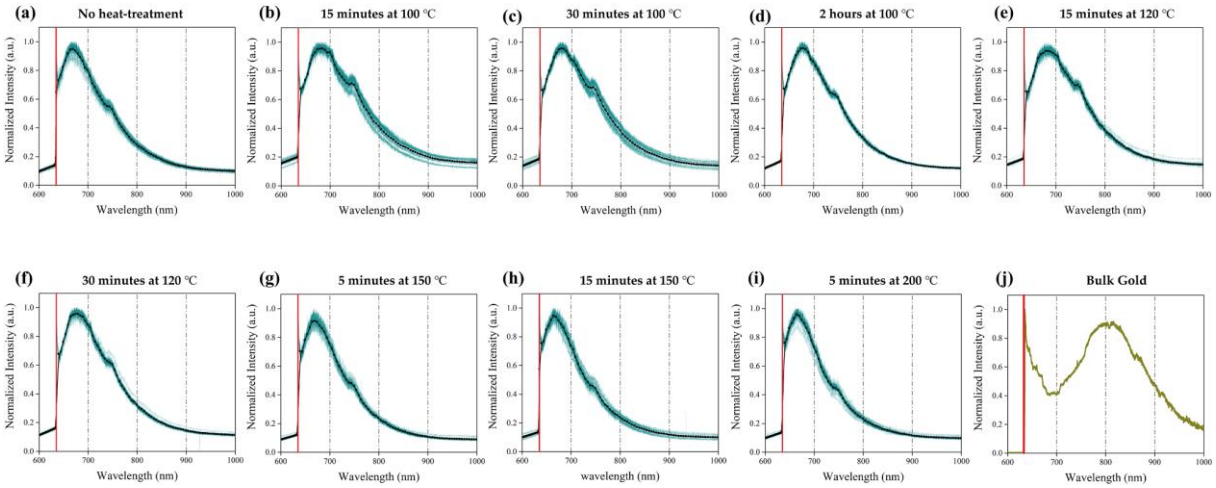

Figure S 9. The normalized photoluminescence response spectra with peak of a) non-thermally treated sample, b) 15 minutes at 100 ℃, c) 30 minutes at 100 ℃, d) 120 minutes at 100 ℃, e) 15 minutes at 120 ℃, f) 30 minutes at 120 ℃, g) 5 minutes at 150 ℃, h) 15 minutes at 150 ℃, i) 5 minutes at 200 ℃, and j) Bulk gold, under laser excitation 633 nm. PL measurement conditions: grating of 600 gr cm-3, objective lens = 10× (NA = 0.25); acquisition time = 10 s, integration time = 1. For all lasers, 30 measurements (3 in length × 10 in cross-section) were performed. All AuNPs deposited with SAM voltage/current setting of V=0.9 kV and I=5mA.