Electronic Supplementary Material (ESI) for RSC Advances


# Electronic Supplementary Information (ESI)

# Formation of Large $H_2O_2$-Reduced Gold Nanosheets via Starch-Induced Two-Dimensional Oriented Attachment

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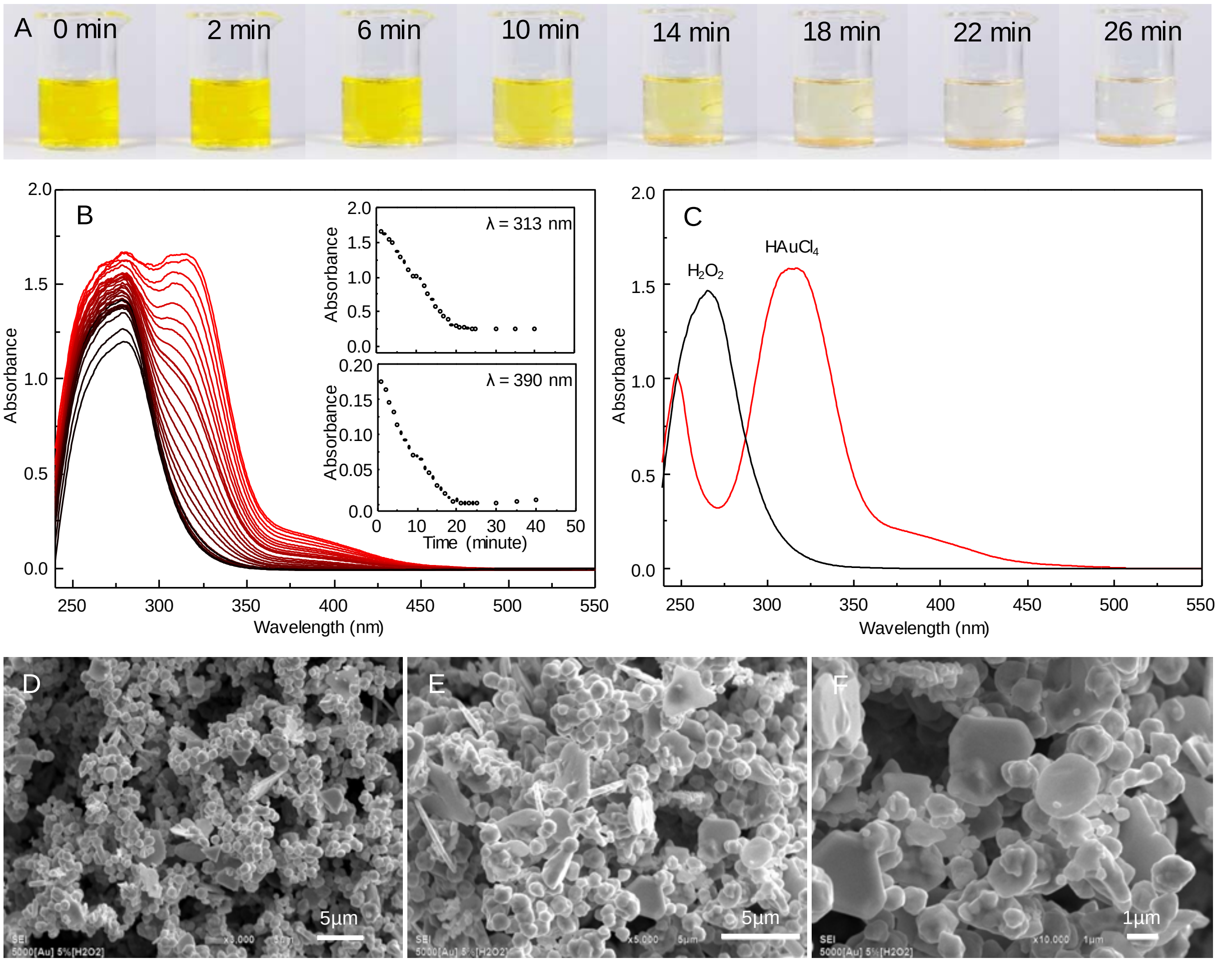


**Figure S1.** (A) Selected digital photographs of the solution containing $HAuCl_4$ (25.4 mM) and $H_2O_2$ (1,600 mM). A significant fading of the yellow color of the gold complex as well as a partial precipitation of gold particles were observed 10 min after mixing. At 26 min after mixing, gold ions were completely reduced while all gold particles precipitated. (B, C) UV-visible spectra of the solution corroborate the visual observation as the absorption of gold complex continuously decreases and completely disappears within 20 min. Due to its high concentration, $H_2O_2$ was partially consumed. (D-F) The obtained gold particles are hexagonal microplates and quasi-microspheres. Due to an absent of a stabilizer, fusions among microplates and microspheres induce rapid a precipitation.

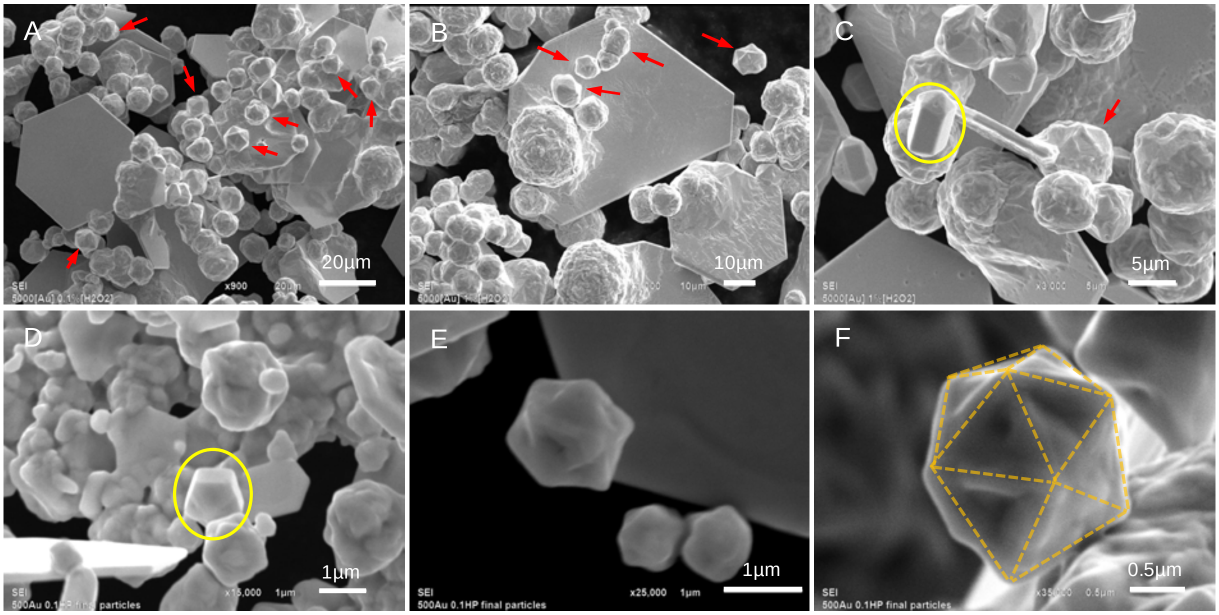


**Figure S2.** SEM micrograph of gold microparticles obtained from the reaction of $HAuCl_4$ (25.4 mM) and $H_2O_2$ concentration at 32 mM (A, D-F) and 320 mM (B and C) without starch stabilizer. The red arrows in (A), (B) and (C) indicate icosahedron gold quasi-microspheres. The yellow circles in (C) and (D) indicate pentagonal rods. (E and F) icosahedron quasi-microspheres generated during the growth process.

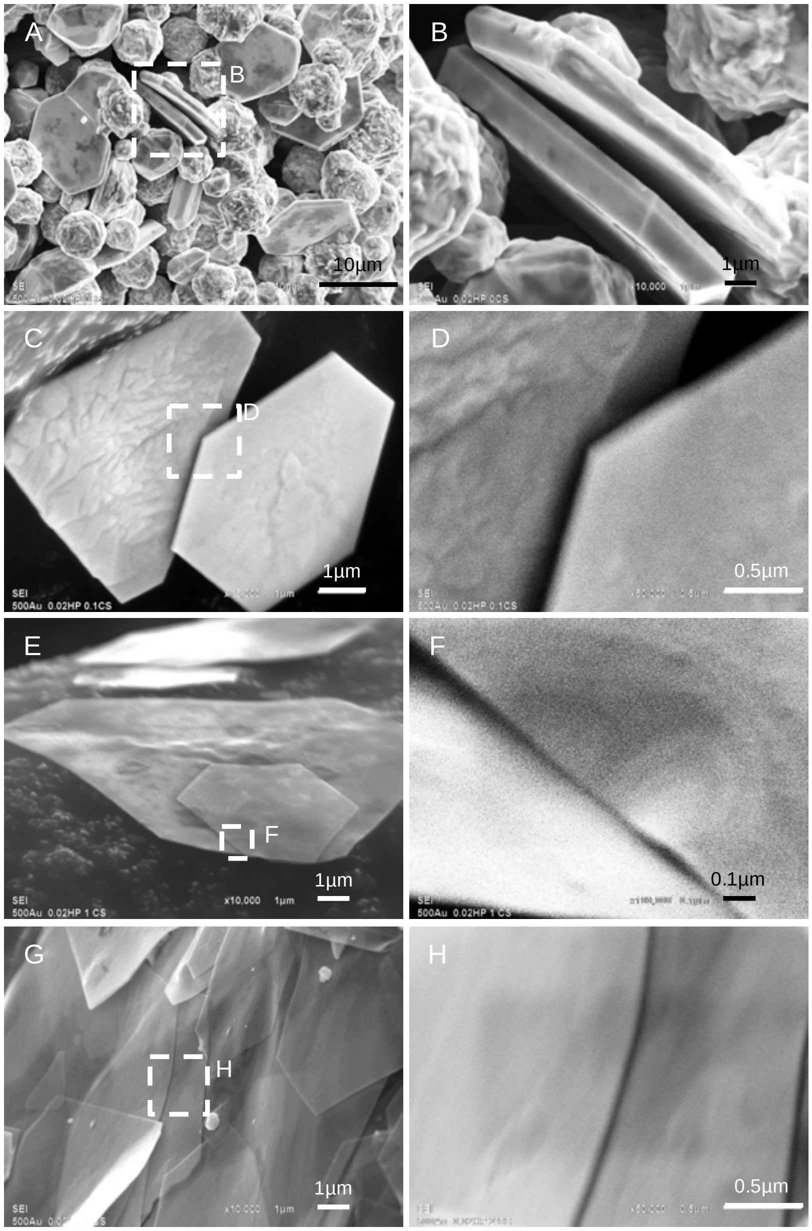


**Figure S3.** SEM micrographs of gold quasi-microspheres, microplates and nanosheets. The thickness of the nanosheets decreases as the concentrations of starch stabilizer was increased. Gold nanosheets were obtained from the reaction of 2.54 mM $HAuCl_4$, 6.4 mM $H_2O_2$ and starch: (A, B) 0%, (C, D) 0.1%, (E, F) 1% and (G, H) 2% w/v.

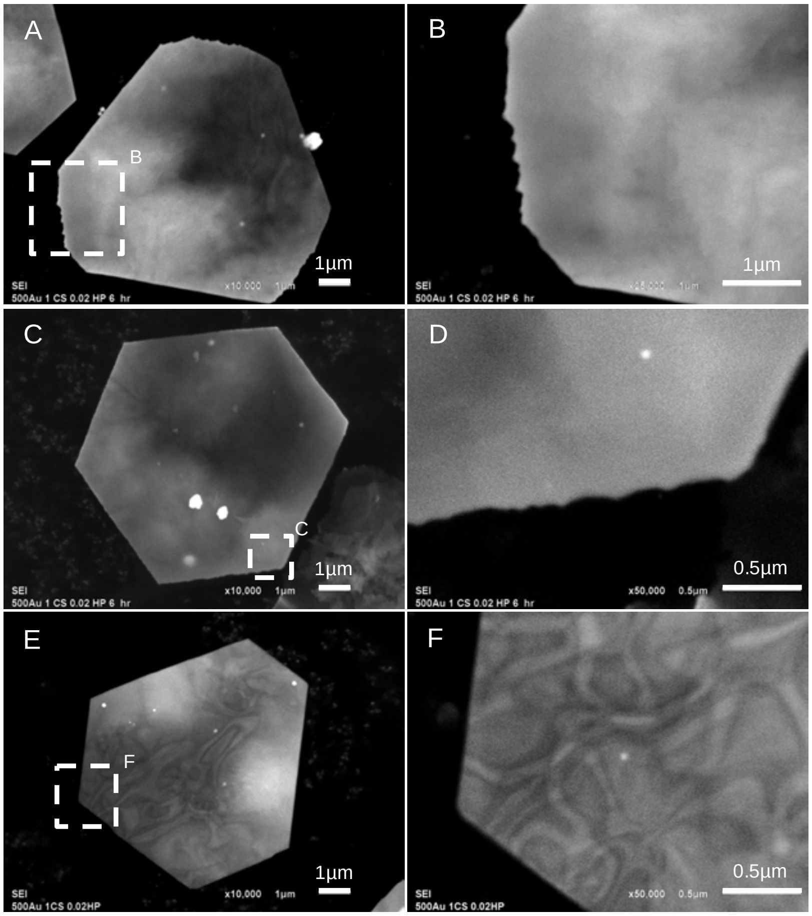


**Figure S4.** SEM micrographs show rough edges of growing gold nanosheets. During the growth process (6 h reaction time, A -D), the edges of the gold nanosheets can be etched by $O_2/Cl^-$.[1] The recrystallization process smooth the rough edges after a prolong reaction time of 10 h (E, F). Gold nanosheets were obtained from the reaction of 2.54 mM $HAuCl_4$, 6.4 mM $H_2O_2$ and 1% w/v starch.

## Reference

1. Z. Guo, Y. Zhang, A. Xu, M. Wang, L. Huang, K. Xu and N. Gu, *J. Phys. Chem. C*, 2008, **112**, 12638.

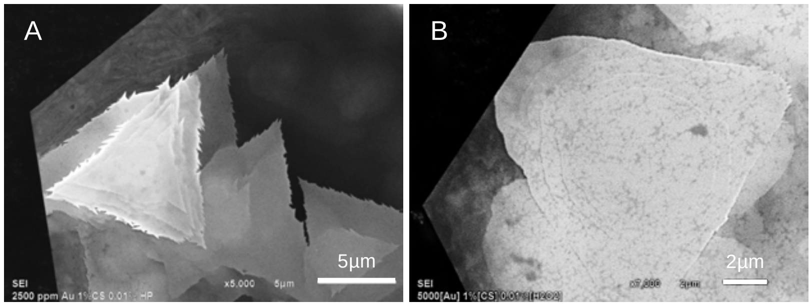


**Figure S5.** SEM micrographs show layer-by-layer epitaxial growth of gold film on the basal planes of gold nanosheets. The growth always ceases at the edge of the basal planes. Gold nanosheets were obtained from the reaction of (A) 12.7 mM and (B) 25.4 mM $HAuCl_4$, 3.2 mM $H_2O_2$ and 1% w/v starch.

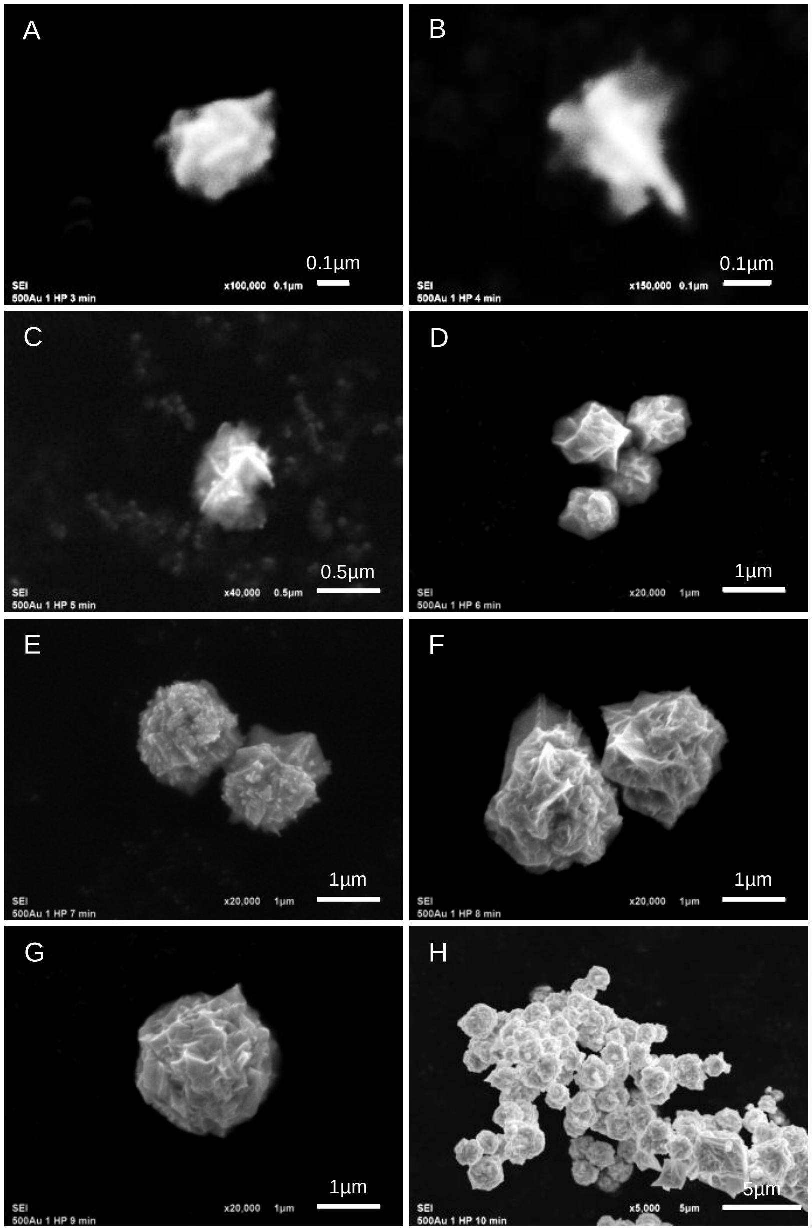


**Figure S6.** Time-dependent SEM micrographs show the development of quasi-spherical gold microparticles. The quasi-spherical gold microparticles were obtained from the reaction of $HAuCl_4$ (2.54 mM) and $H_2O_2$ (320 mM) without the starch stabilizer. The SEM micrograph were recorded at (A) 3, (B) 4, (C) 5, (D) 6, (E) 7, (F) 8, (G) 9 and (H) 10 min reaction time.

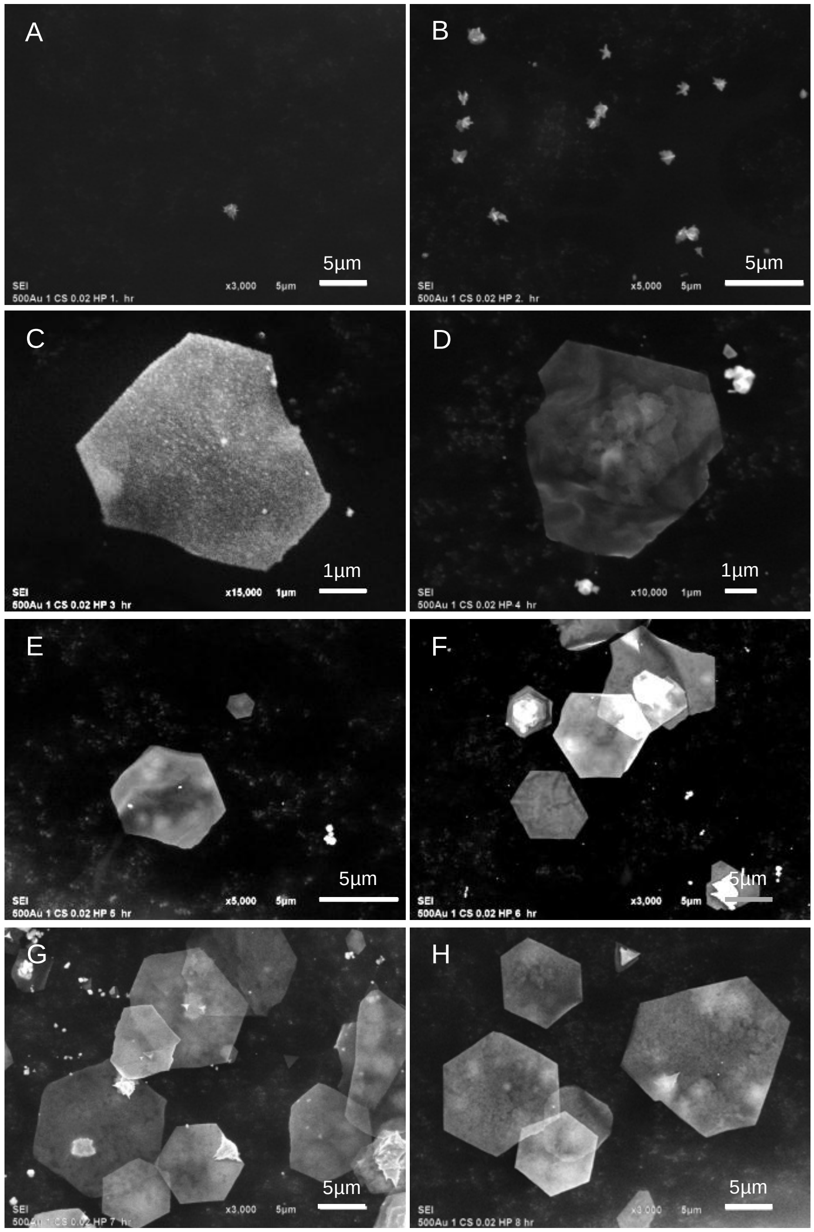


**Figure S7.** Time-dependent SEM micrographs show the development of gold nanosheets. The nanosheets were obtained from the reaction of $HAuCl_4$ (2.54 mM), $H_2O_2$ (6.4 mM), and starch (1% w/V). The SEM micrograph were recorded at (A) 1, (B) 2, (C) 3, (D) 4, (E) 5, (F) 6, (G) 7 and (H) 8 h reaction time.

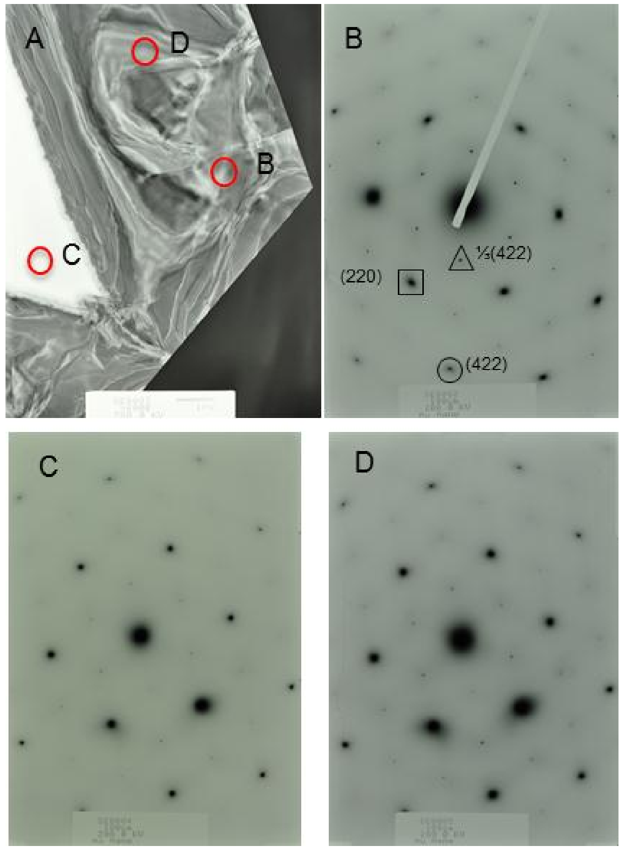


**Figure S8**. (A) TEM image of a nanosheet. The big nanosheets fill up the TEM frame even at a low resolution. (B-D) The corresponding selected area electron diffraction (SAED) pattern of a nanosheets. The positions for the SAED measurements are indicated in the TEM image. The same SAED patterns with hexagonal diffraction spots confirm that the nanosheet is a single crystal bound by {111} facets.