Supporting Information

Gold Nanospirals

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In this study, more than 500 experiments have been carried out to optimize the reaction in the synthesis of AuNSs. By changing the surfactants, stoichiometry of reactants or reaction temperature, the products with different morphology were obtained. Some illustrations are shown in below.

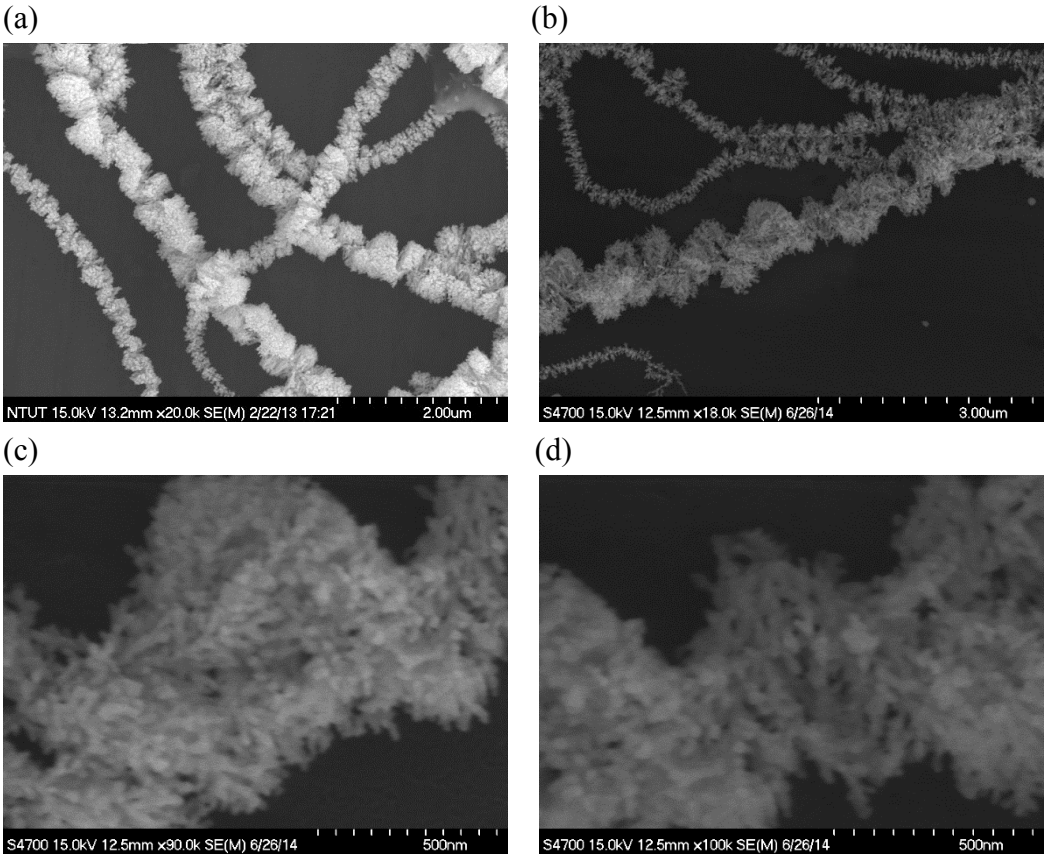
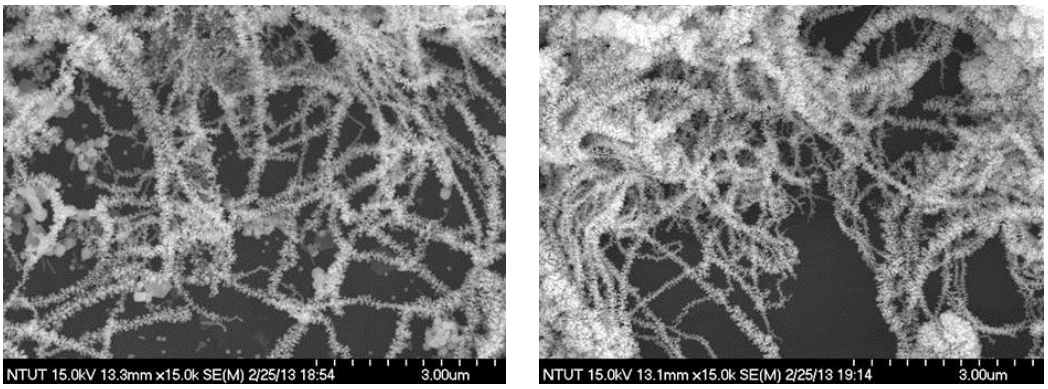


Fig S1 SEM images of as-synthesized AuNSs at (a), (b) lower magnification and (c), (d) higher magnification images of two regions in image (b).

(a) (b)



(c) (d)

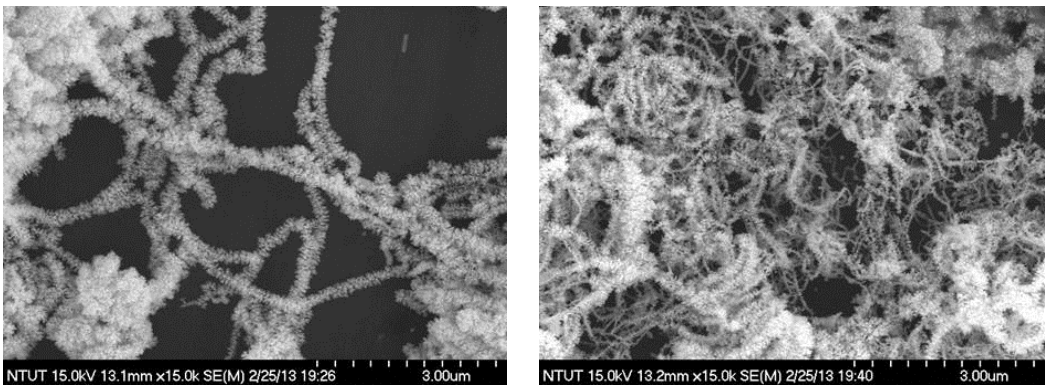
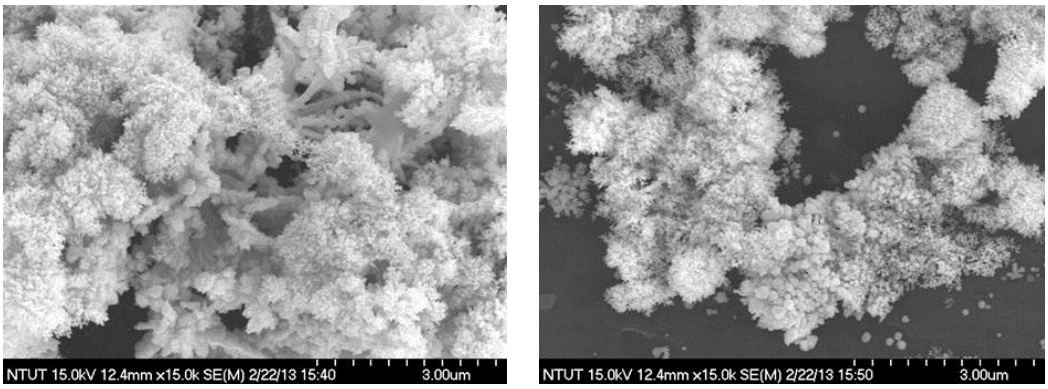


Fig S2 SEM images of AuNSs synthesized at 17 °C with different concentration of CTAB: (a) 1 mM; (b) 2 mM; (c) 3 mM; (d) 4 mM. The yield of AuNSs formation is relatively lower compared to the reaction carried out at 21 °C. The concentration of $HAuCl_4$, PEG and PVP is 1.5 mM, 1 mM and 0.5 mM, respectively.

(a) (b)



(c) (d)

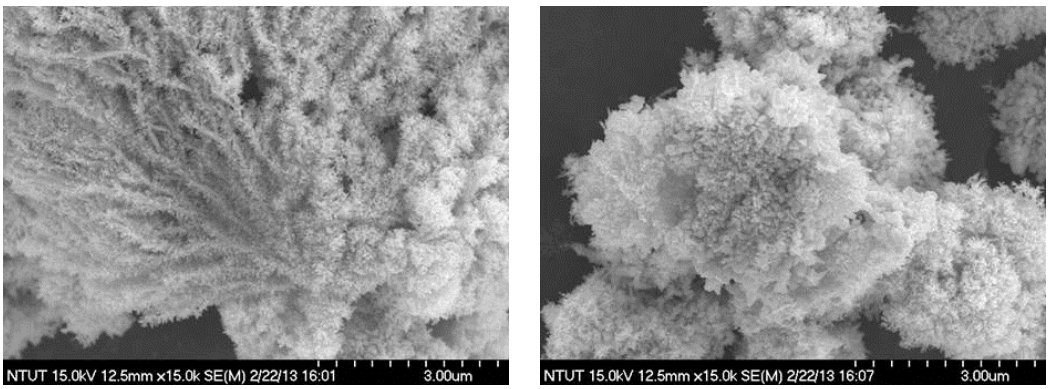
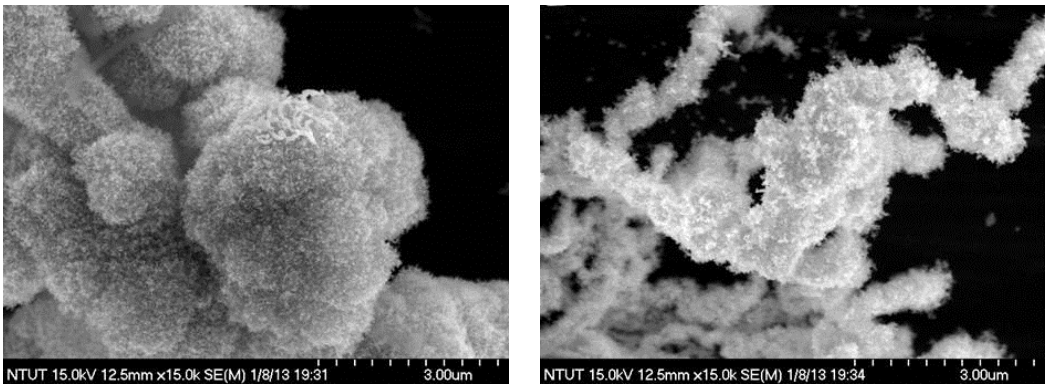


Fig S3 SEM images of Au materials synthesized with different molar ratio of $HAuCl_4$ to CTAB: (a) 1 mM/1mM; (b) 1 mM/2 mM; (c) 1 mM/3 mM; (d) 1 mM/4 mM. The concentration of PEG and PVP is 1 mM and 0.5 mM, respectively.

(a) (b)



(c) (d)

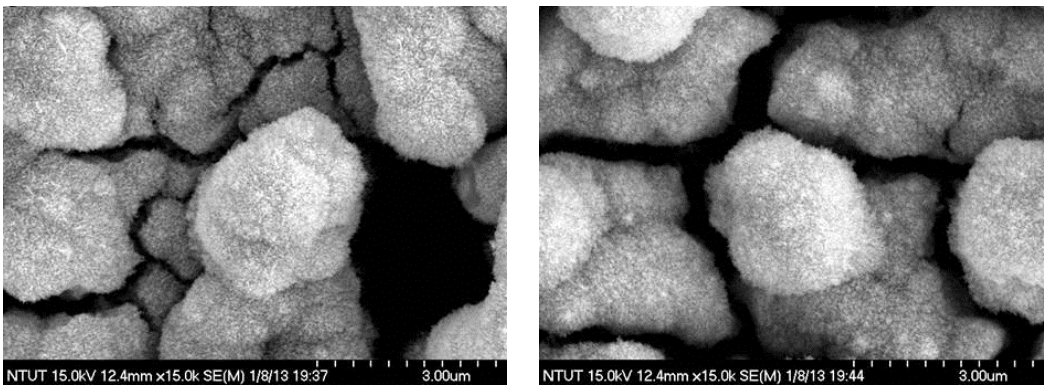


Fig S4 SEM images of Au materials synthesized with different concentration of PEG: (a) 1.5 mM; (b) 3 mM; (c) 5 mM; (d) 9 mM. The concentration of $HAuCl_4$, CTAB and PVP is 1 mM, 1.5 mM and 0 mM, respectively.

(a) (b) (c)

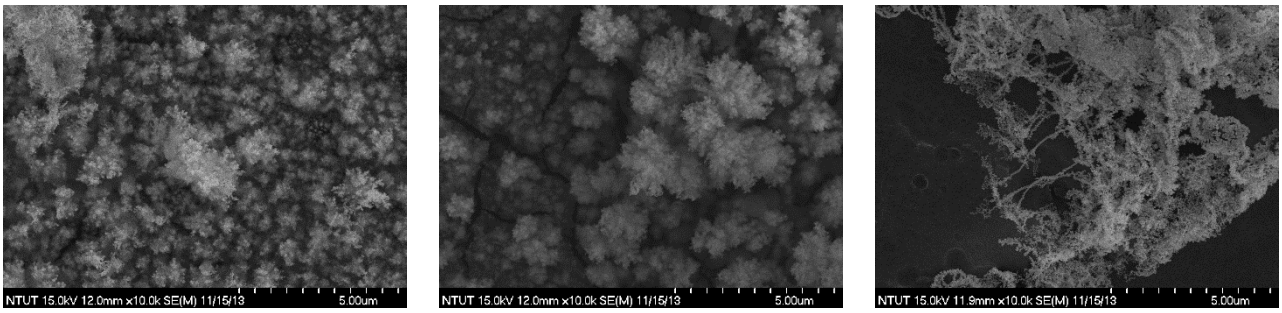


Fig S5 SEM images of Au materials synthesized with different concentration of CTAB: (a) 0.5 mM; (b) 2.0 mM; (c) 4.0 mM. The concentration of $HAuCl_4$, PVP and PEG is 1.5 mM, 0 mM and 0 mM, respectively.

(a) (b) (c)

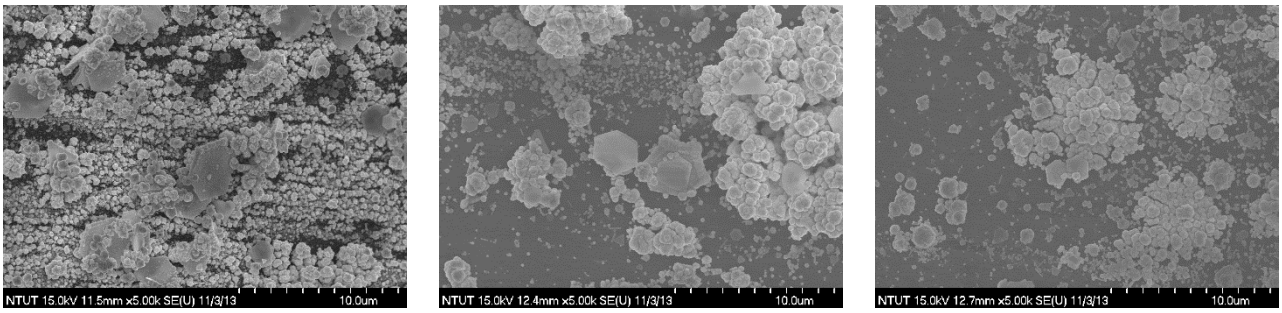


Fig S6 SEM images of Au materials synthesized with different concentration of PVP: (a) 1.0 mM; (b) 3.0 mM; (c) 4.0 mM. The concentration of $HAuCl_4$, CTAB and PEG is 1.5 mM, 0 mM and 0 mM, respectively.

(a) (b) (c)

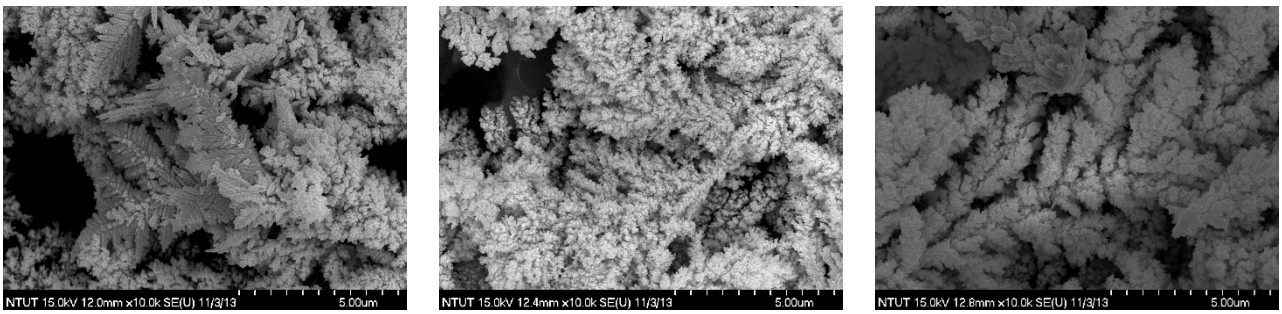


Fig S7 SEM images of Au materials synthesized with different concentration of PEG: (a) 1.5 mM; (b) 2.5 mM; (c) 4.0 mM. The concentration of $HAuCl_4$, CTAB and PVP is 1.5 mM, 0 mM and 0 mM, respectively.

(a) (b) (c)

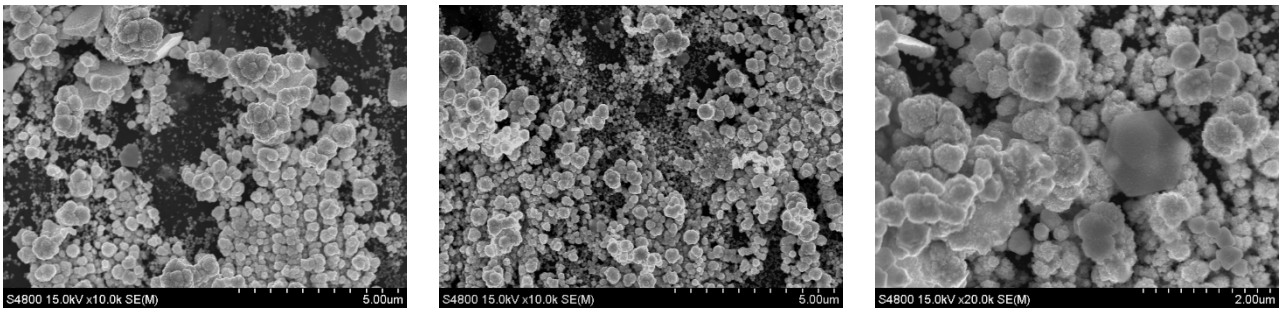


Fig S8 SEM images of Au materials synthesized with different molar ratio of PVP to PEG: (a) 0.5 mM/1.0 mM; (b) 0.5 mM/2.5 mM; (c) 0.5 mM/3.5 mM. The concentration of $HAuCl_4$, CTAB is 1.5 mM and 0 mM, respectively.

(a) (b) (c)

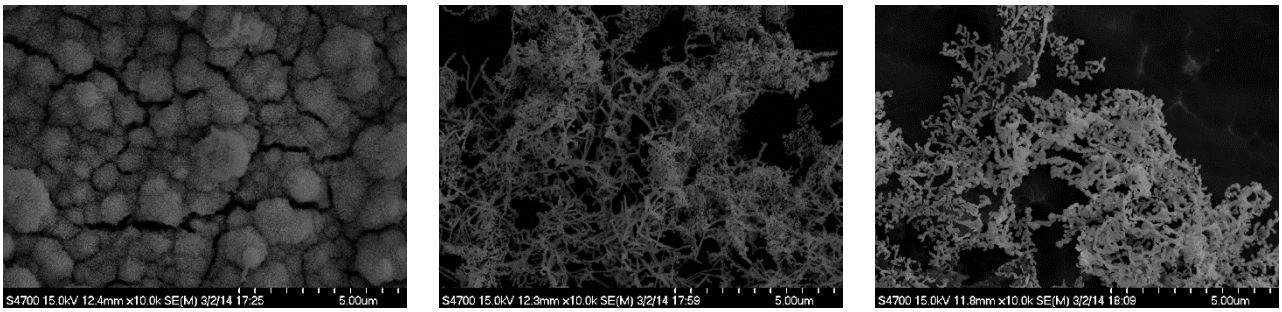


Fig S9 SEM images of Au materials synthesized with different molar ratio of CTAB to PEG: (a) 1.0 mM/1.0 mM; (b) 4.0 mM/1.0 mM; (c) 8.0 mM/1.0 mM. The concentration of $HAuCl_4$, CTAB is 1.5 mM and 0 mM, respectively.

(a)

(b)

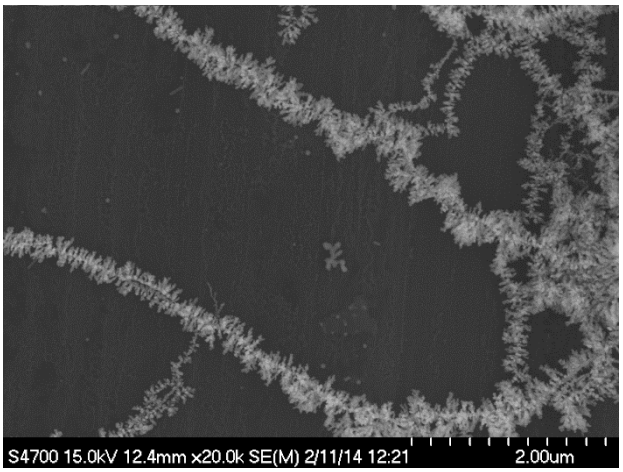


Fig S10 SEM images of one-dimensional Au nanomaterials synthesized by using CTAB (3.5 mM) and PVP (0.5 mM) as the capping agents at 25 °C; (a) lower magnification and (b) higher magnification images. The concentration of $HAuCl_4$, PEG is 2.0 mM and 0 mM, respectively. The circled areas in Fig. S10a show that the Al substrate is etched after Au atoms deposit on the top surface of Al. A trace of products are also found of the bottom of Al substrate.