Enhanced thermal effect of plasmonic nanostructures which confined in discoidal porous silicon particles

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1. Element mapping analysis of Au-DPS particles.

Energy Dispersive X-Ray spectroscopy (EDS) elemental analysis is applied on a scanning electron microscope (SEM) system. Silicon and gold elements are pointed out in the mapping images.

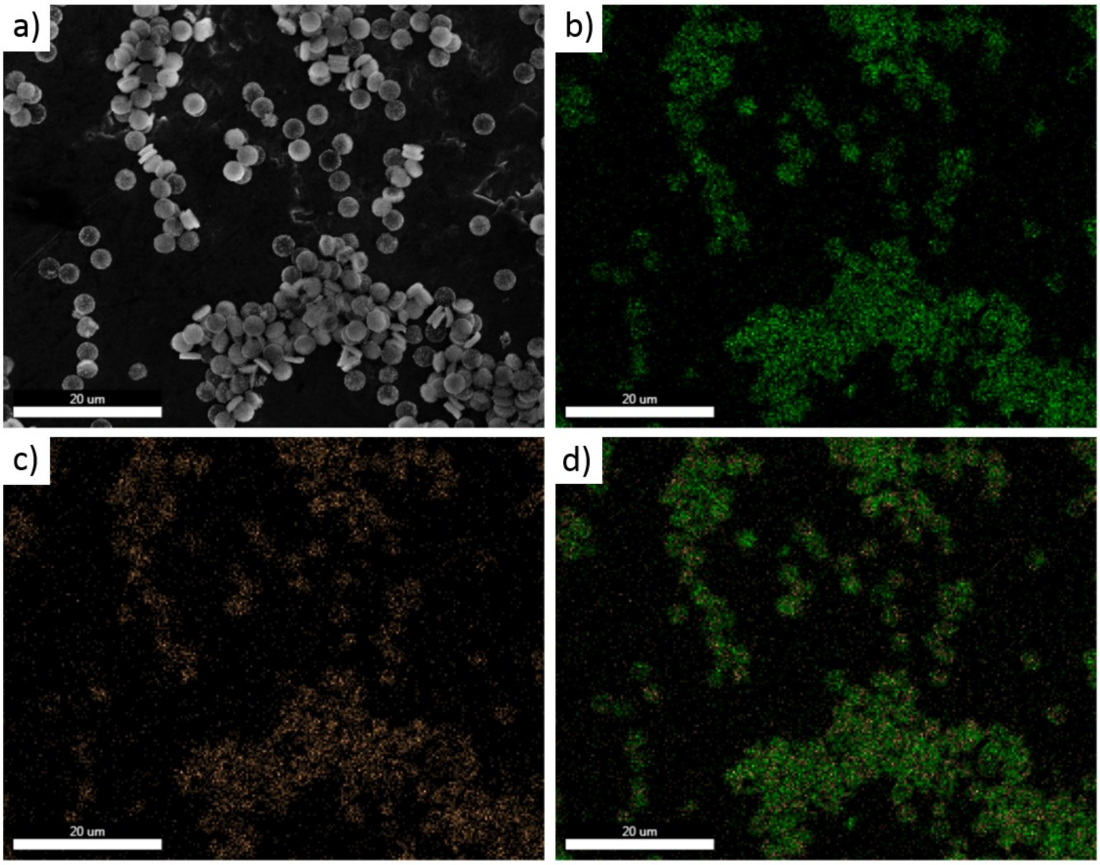

Figure S1. Element mapping analysis. (a) The SEM image of Au-DPS particles. (b) The mapping image of silicon elements. (c) The mapping Image of gold elements. (d) Overlay image of gold and silicon elements mapping.

2. Size of gold nanoparticles in Au-DPS particles

The size of gold nanoparticles was counted by measuring about 100 particles in SEM images. And the standard error of the mean particle size was calculated. The mean size is 7.92±0.74 nm for Au-DPS I particles, 11.86±1.48 nm for Au-DPS II particles, and 13.51±1.87 nm for Au-DPS III particles, respectively.

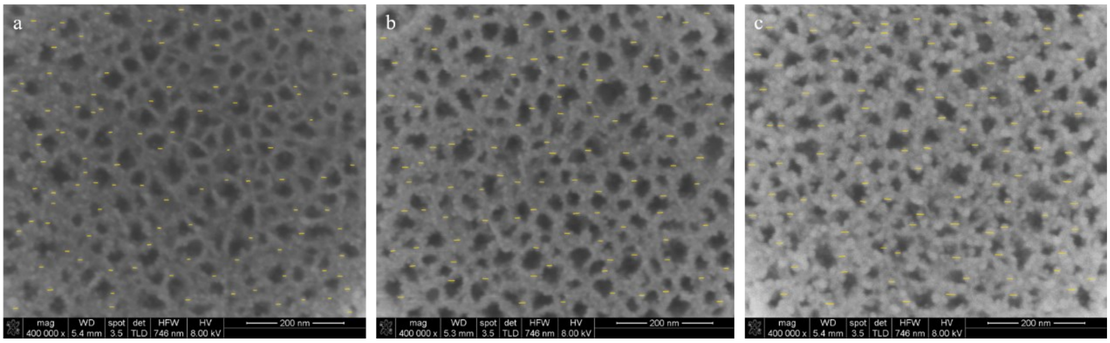

Figure S2. The SEM images for Au-DPS particles in different reaction conditions. One hundred Au particles were counted in each sample for statistical average particle size. a) Au-DPS I. b) Au-DPS II. c) Au-DPS III. The scale bar is 200 nm.

3. Capping agent effects

Owing to the hydrophobic surroundings of the pores of DPS particles, a capping agent (PVP) was necessary to disperse the gold ion into the pores of silicon particles. Moreover, the size and morphological characteristics of gold NPs were also controlled by PVP. As demonstrated by SEM, the intensity of the arrangement of gold nanoparticles on Au-DPS particles changes with capping agent. A PVP concentration of 10% lead to the formation of more densely arranged gold NPs with a uniform diameter. (Figure S3b).

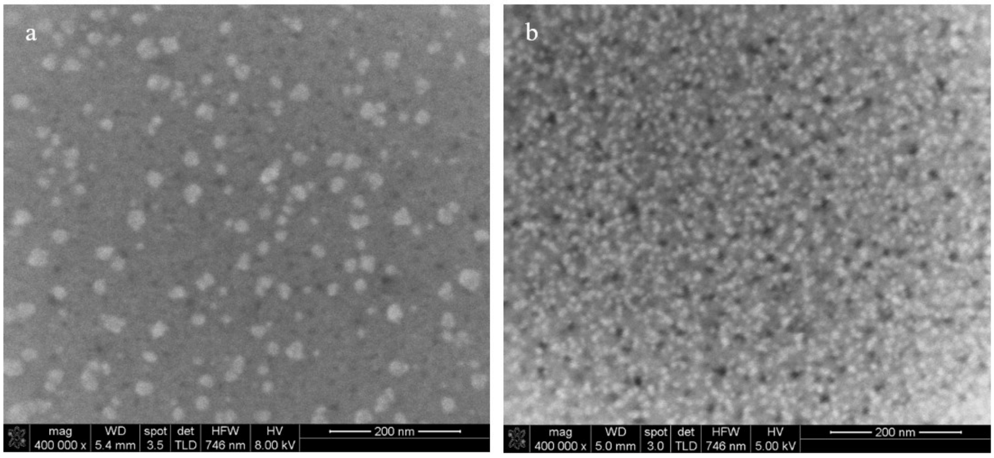

Figure S3. SEM images of gold nanoparticle morphology on DPS particles: a) none PVP, b) 10% PVP.

4. Thermal stability of Au-DPS particles

AuNPs deposited on DPS particles significantly stabilized the Au-DPS particles. As shown in SEM images, the structure of Au-DPS remains intact even after 10 cycles of laser heating. After the immobilization of gold nanoparticles in the silicon particles, the stability of the DPS nanostructure increased considerably. One cycle is 15 min irradiation with a 10 min cooling gap.

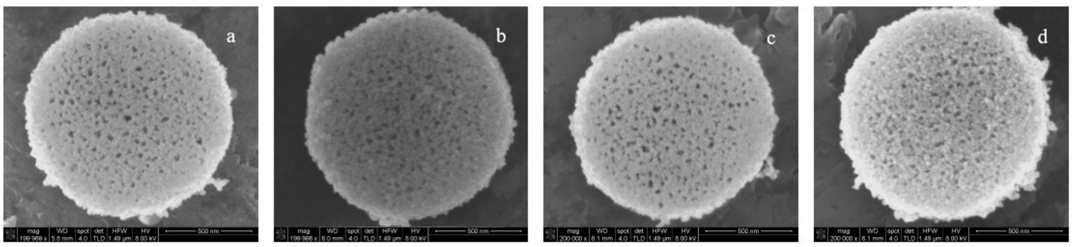

Figure S4. SEM images of Au-DPS III particles after laser irradiation a) 1 cycle; b) 3 cycles; c) 6 cycles; and d) 10 cycles.

5. Impact of AuNPs and pDOX on cell viability

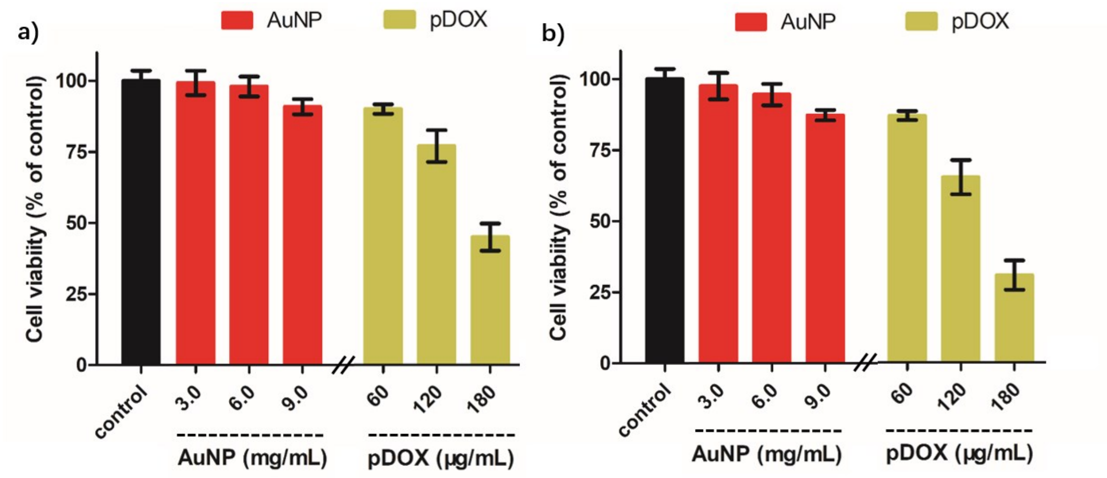

Figure S5. Comparing the effect of inducing A549 cell apoptosis between AuNPs, pDOX, a) Without laser photothermal therapy. b) With laser photothermal therapy. The concentration of AuNP and pDOX were calculated by the corresponding content of pDox-Au-DPS particles.