Supplementary Information

Synergizing the multiple plasmons resonance coupling and quantum effects to obtain enhanced SERS and PEC performance simultaneously on noble metal-semiconductor substrate

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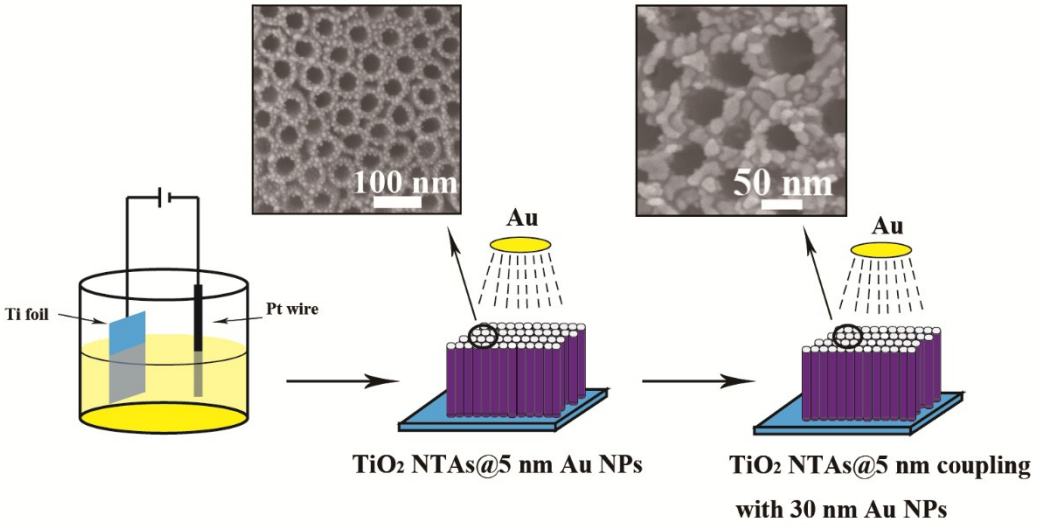
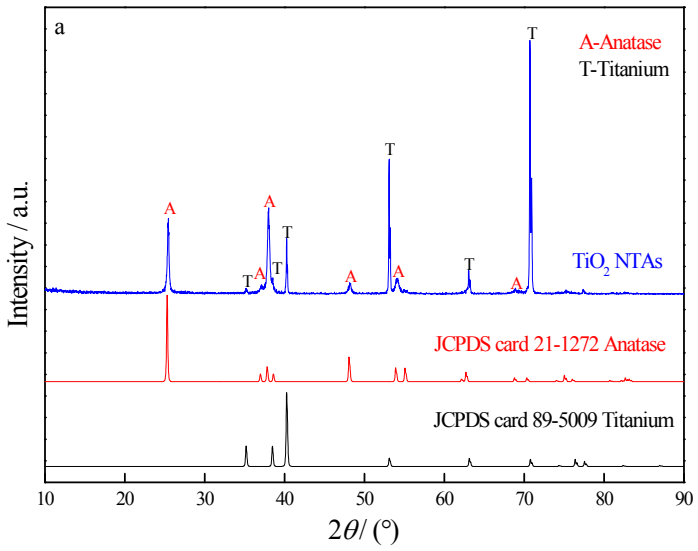


Figure S1. Scheme of the fabrication process of TiO_2 NTAs@hybrid Au NPs.



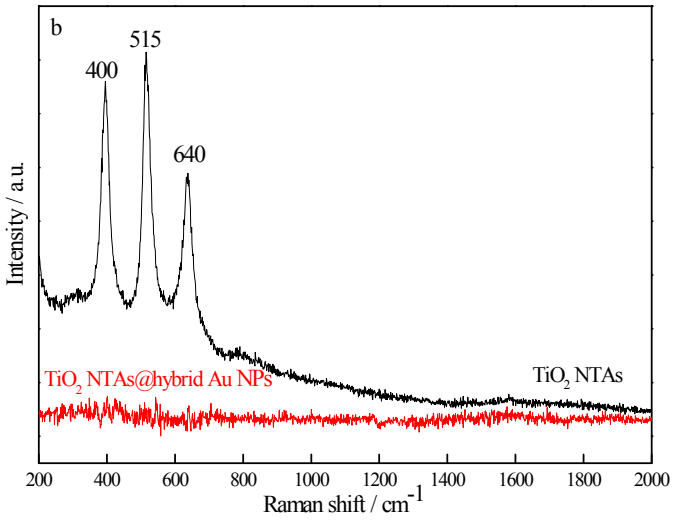
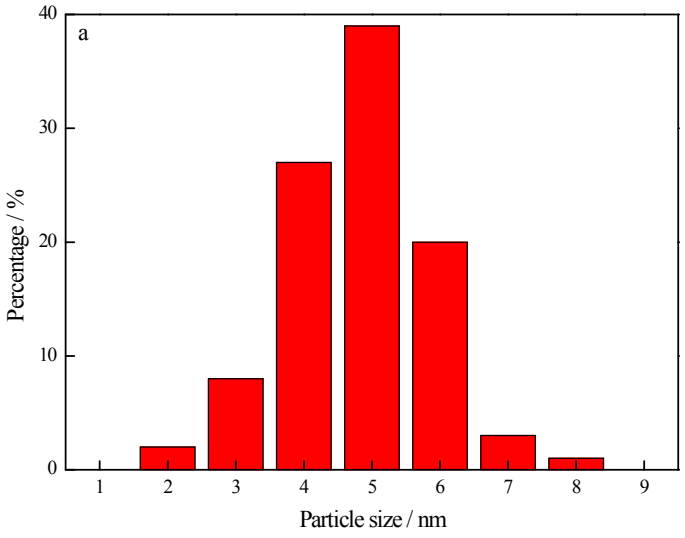


Figure S2. (a) XRD patterns of the synthesized sample. (b) Normal unenhanced Raman of TiO_2 NTAs and TiO_2 NTAs@hybrid Au NPs.



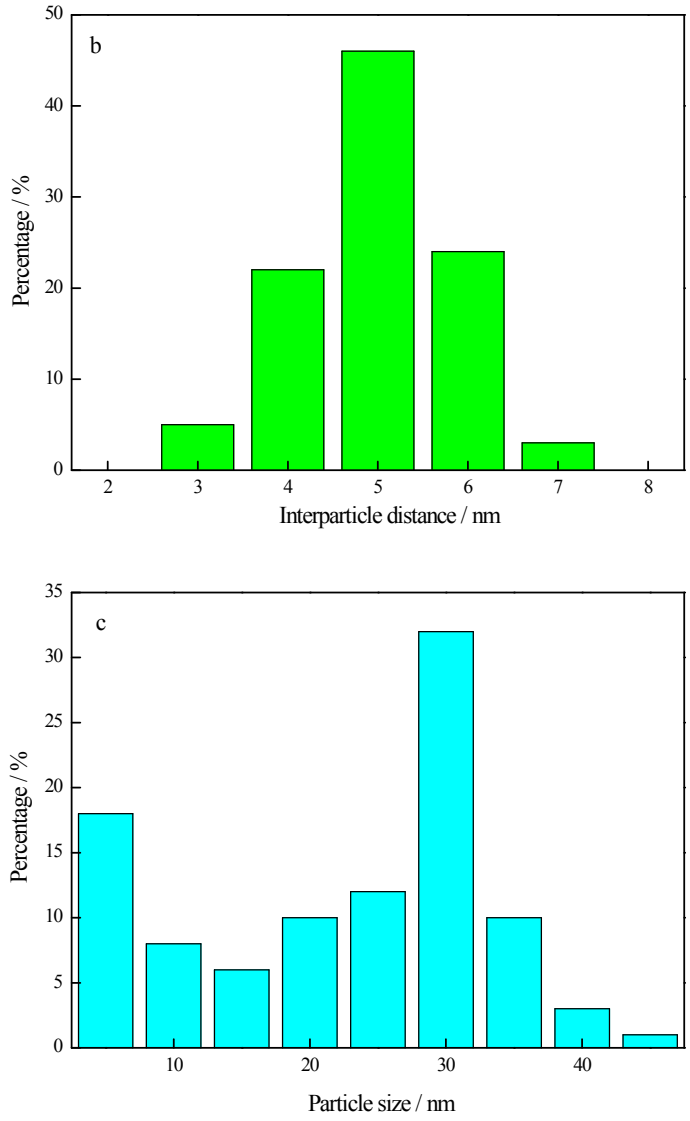


Figure S3. Au particle size distribution histograms of (a) TiO_2 NTAs@5 nm Au NPs (c) TiO_2 NTAs@5 nm coupling with 30 nm Au NPs. (b) distance-distribution histogram of interparticle (Au–Au) gap.

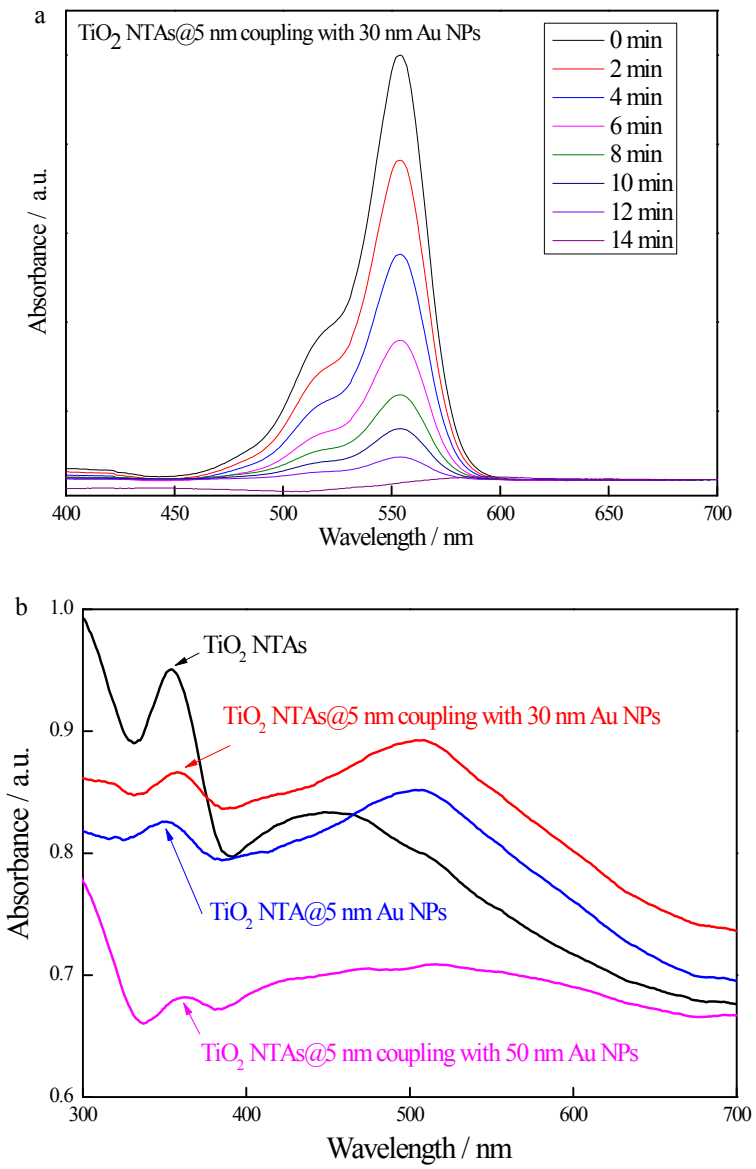


Figure S4. (a) UV-vis spectra of RhB dye after irradiation for different time in the presence of TiO_2 NTAs@5 nm coupling with 30 nm Au NPs. (b) The absorption spectra of different samples.

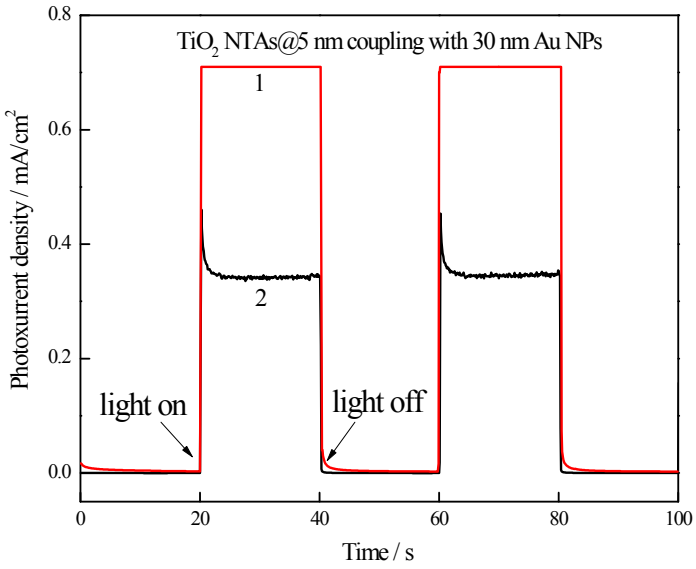


Figure S5. Photoresponse of TiO_2 NTAs@5 nm coupling with 30 nm Au NPs (1) with and (2) without a bias potential of 1 V (*vs.* SCE). All the results above were obtained under UV-cut Xe lamp irradiation (I_0 = 100 mW·cm^{-2})

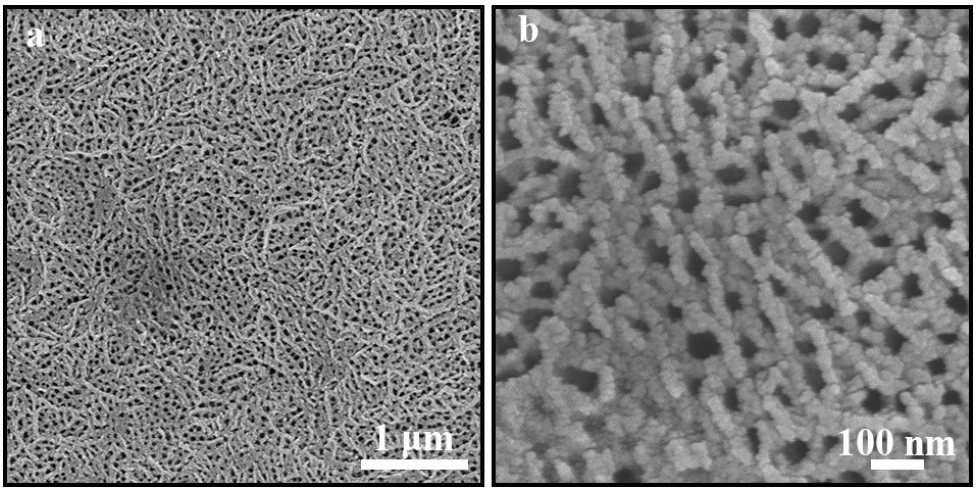


Figure S6. SEM images of TiO_2 NTAs@5nm coupling with 50 nm Au NPs.

Table S1. The SERS signal intensities of the peaks of 1340 cm^{-1} using RhB with concentration from 10^{-6} M to 10^{-10} M.

concentration ($mol \cdot L^{-1}$)	intensity (counts)
10^{-6}	31744
10^{-7}	15846
10^{-8}	6488
10^{-9}	1415
10^{-10}	568