Plasmonic resonance energy transfer-based nanospectroscopy for sensitive and selective detection of TNT

Supporting information

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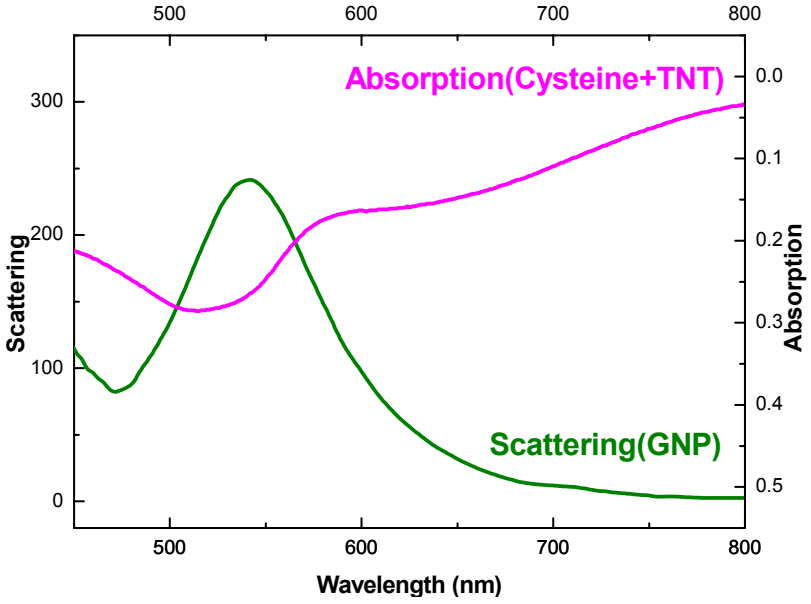

Figure S1. The spectral overlap between the Rayleigh scattering spectrum of gold nanoparticles and the absorption spectrum of the Meisenheimer complex formed from cysteine and TNT.

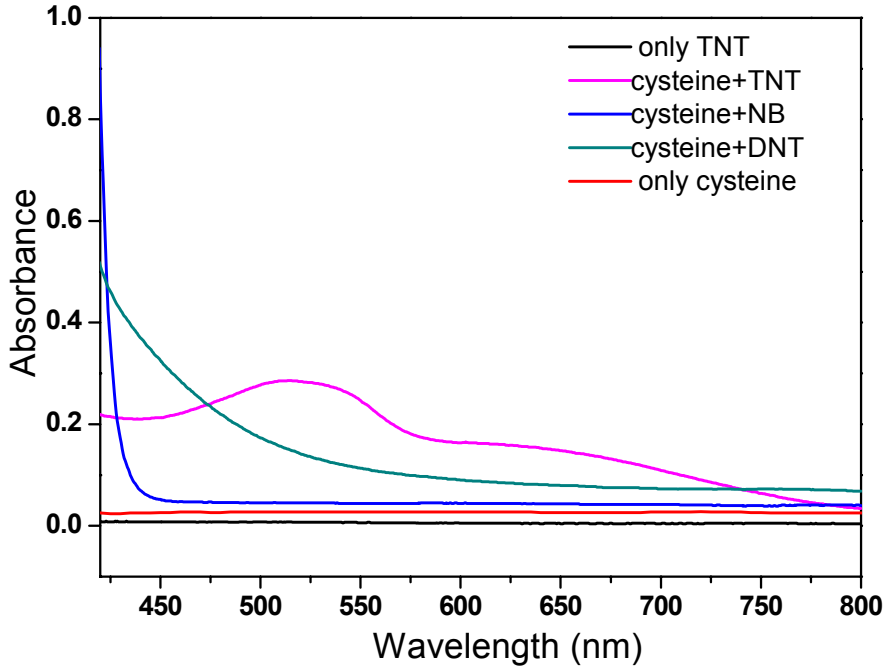

Figure S2. (a) Absorption spectra of cysteine, 2,4,6-Trinitrotoluene (TNT), cysteine + 2,4-dinitrotoluene (DNT), cysteine + nitrobenzene (NB) and cysteine + TNT. The spectrum of TNT + cysteine shows two new absorption peaks at 530 and 630 nm because of the donor–acceptor complex formed. But no absorption bands can be observed for other samples, indicating that DNT and NB are not able to form the donor–acceptor complex with cysteine.

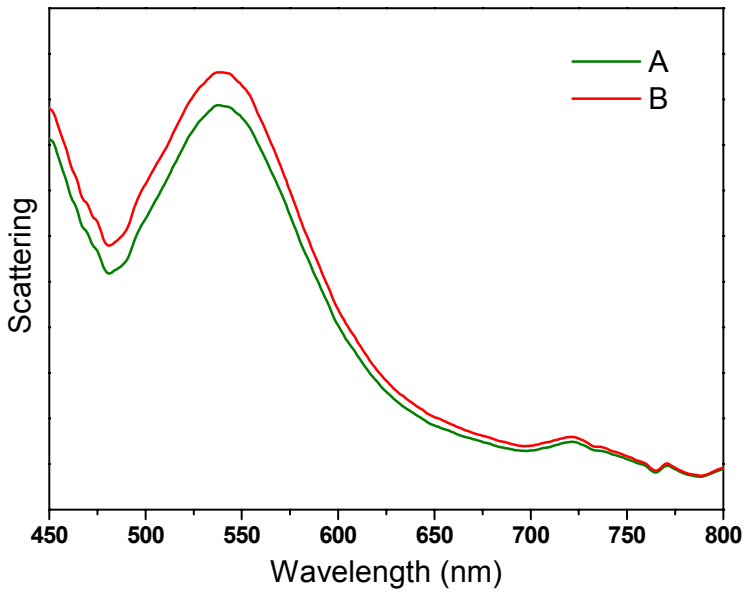

Figure S3 Normalized scattering spectra of cysteine-modified gold nanoparticles (A) and native gold nanoparticles (B). The spectra exhibit no noticeable spectral shift

between sample (A) and (B). In addition, the slight decrease in intensity due to the subtle changes in concentration by adding cysteine solution has no influence on this case.

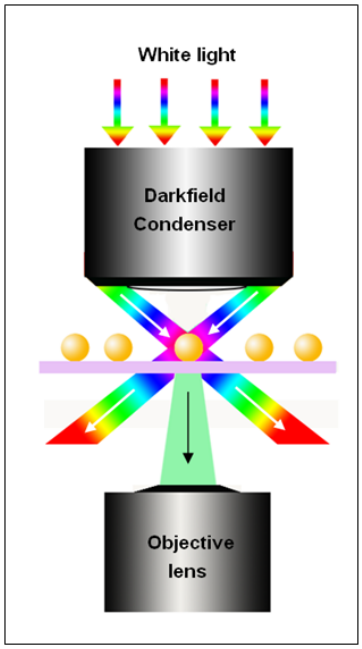

Figure S4. The detailed experimental configuration of a dark-field microscopy system. The white light is irradiated on the nanoplasmonic particles with an oblique angle by the dark-field condenser lens. The scattering alone is collected by a microscope objective lens with a numerical aperture and the collected scattering light is imaged by a true color charge-coupled device (CCD) camera and analyzed by a spectrometer.

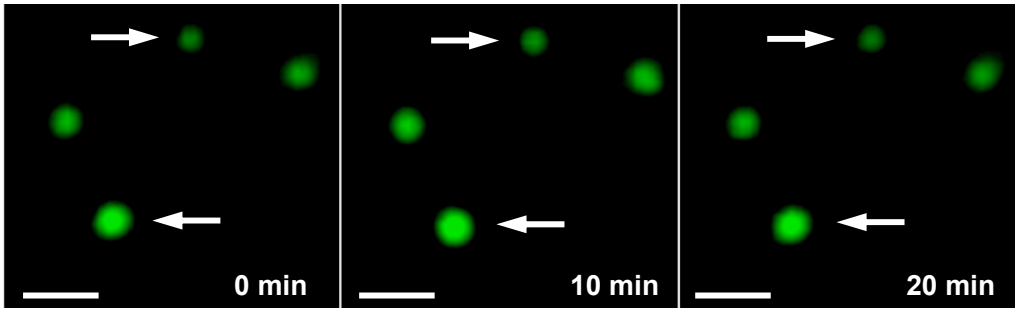

Figure S5. Dark-field images of native gold nanoparticles after exposure with 1 mM TNT. The Rayleigh scattering intensity of the gold nanoparticles has no noticeable decrease even after 20 min of exposure to TNT, indicating that the plasmonic quenching is uniquely due to the PRET from gold nanoparticles to the Meisenheimer complex. The scale bars are 1 μm.

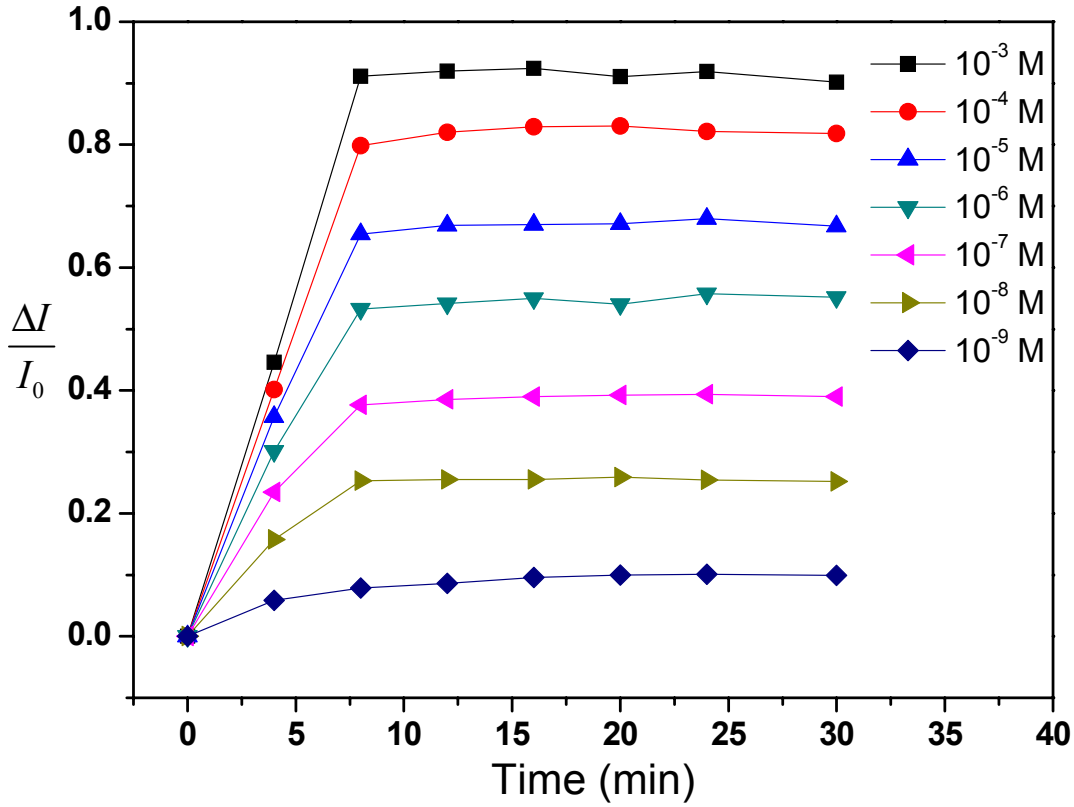

Figure S6 Real-time detection of TNT. Plot of normalized scattering intensity at the scattering maximum (λmax), ΔI(t)/Io versus time for cysteine modified gold NPs and control for concentrations of TNT ranging from 1 nM to 1 mM. It could be observed that the scattered light intensity of the gold NPs decreases rapidly in 10 min and then kept stable for at least 30 min when adding TNT solutions.

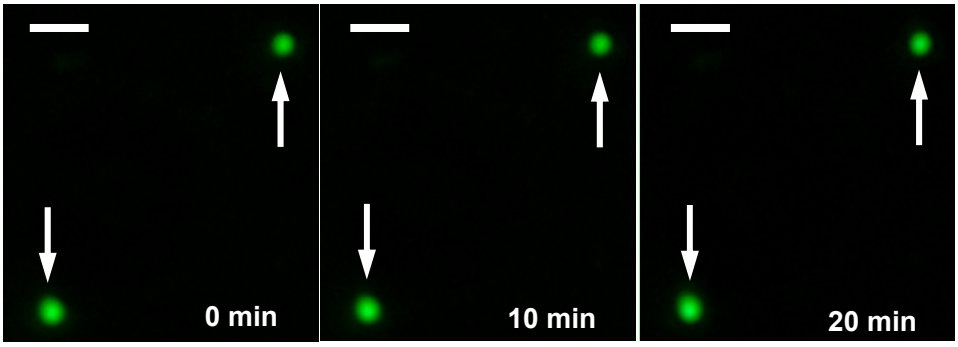

Figure S7. Time-dependent true colour images of cysteine modified gold nanoparticles after exposure with 0.1 M DNT. No plasmonic quenching could be

observed after 20 min of exposure to DNT, confirming the selectivity of the probe. The scale bars are 1 μm.

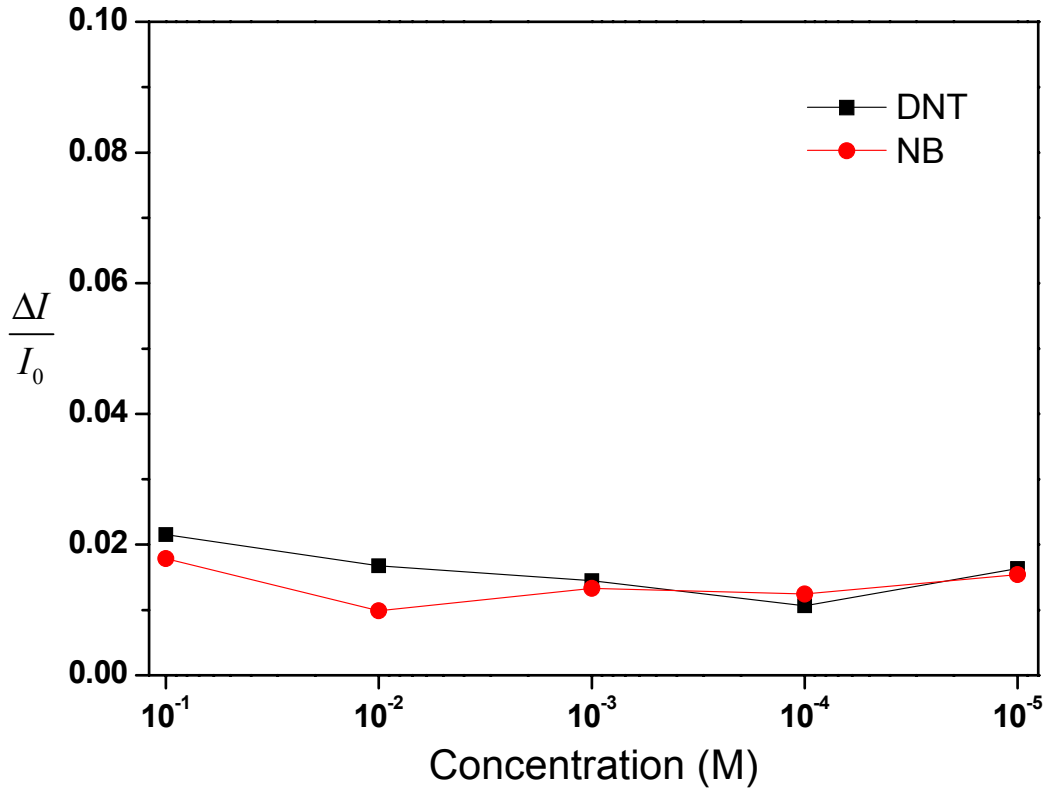

Figure S8 Detection performance of the gold nanoplasmonic probe. Equilibrium differential scattering intensity change of $\Delta I/I_0$ as a function of DNT (black dot) and NB (red dot) concentration. The scattering light intensity of these two systems is only reduced by about 2% at various concentrations, which should be attributed to the drift in scattered light intensity of gold NPs.

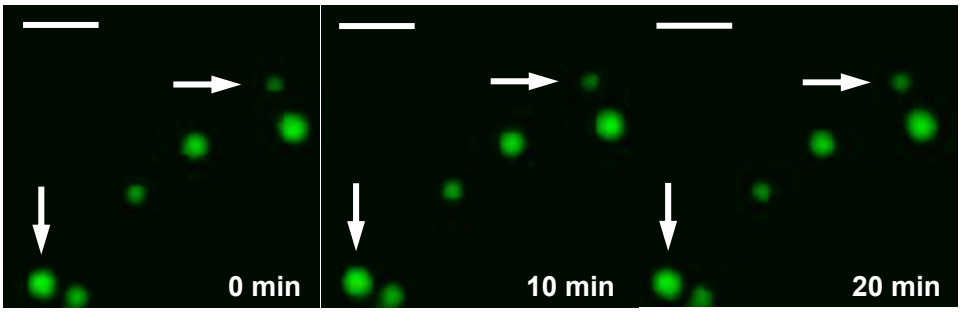

Figure S9. Dark-field images of cysteine modified gold nanoparticles after exposure with 1 mM $CuSO_4$. The imaging signal in dark-field has no noticeable decrease

indicates that Cu^{2+} has no influence on present probe system. The scale bars are 1 μm.

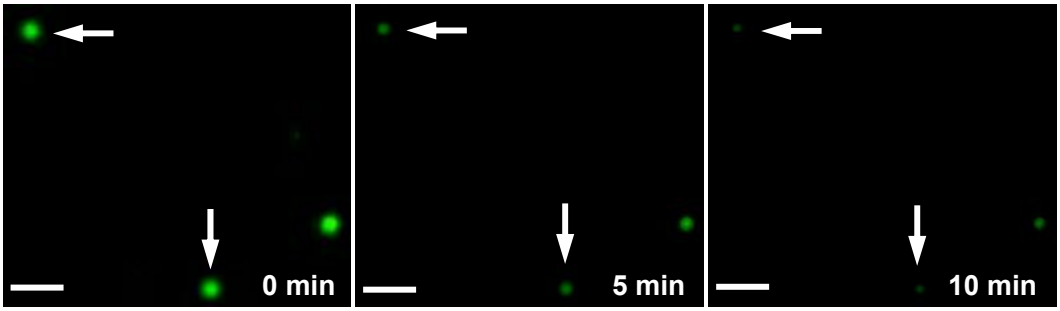

Figure S10. Time-dependent true color images of cysteine modified gold nanoparticles after exposure with 1 mM the mixed sample composed of TNT, DNT and NB. The Rayleigh scattering intensity of the gold nanoparticles exhibits substantial decrease only after 5 min, meaning that the PRET between the gold nanoparticles and the Meisenheimer complex occurred. The scale bars are 1 μm.