

## Supporting information

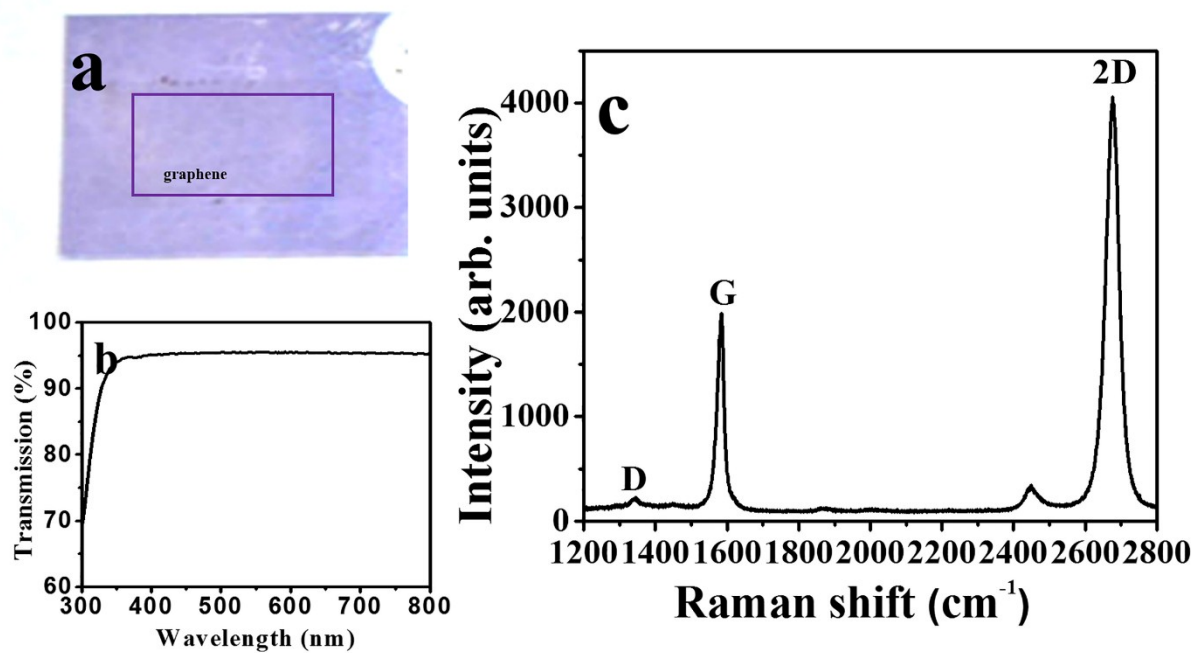
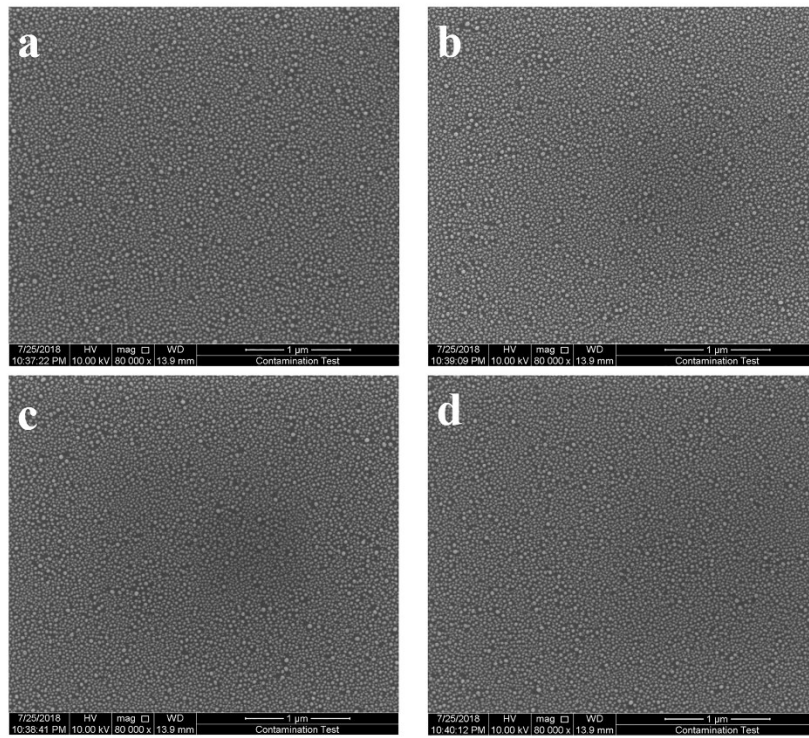
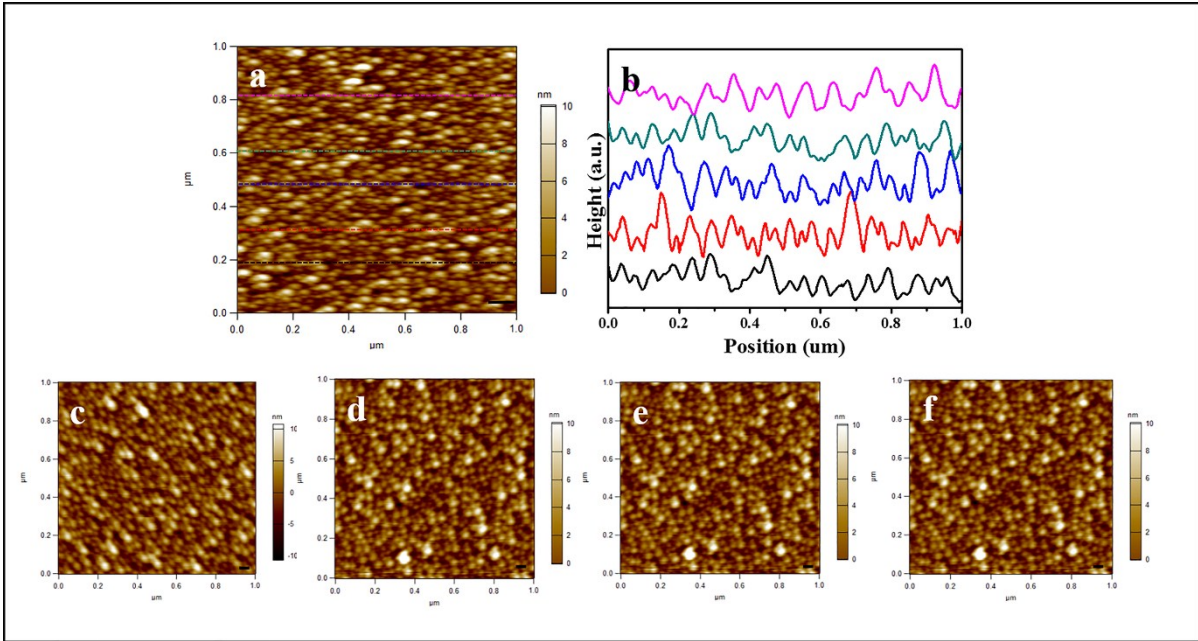


Figure S1 (a) The photographs of transparent graphene-metal NPs samples. (b) The optical transmission of graphene film. (c) Raman spectrum of CVD graphene.



*Figure S2: SEM images of Au NPs on SiO<sub>2</sub>/Si substrates which were fabricated in different batches. The scale bar is 1 μm.*



*Figure S3: AFM images of Au NPs on SiO<sub>2</sub>/Si substrates which were fabricated in different batches. Figure (b) shows the corresponding height profiles of five lines in figure (a), reflecting the size distribution of the Au NPs.*

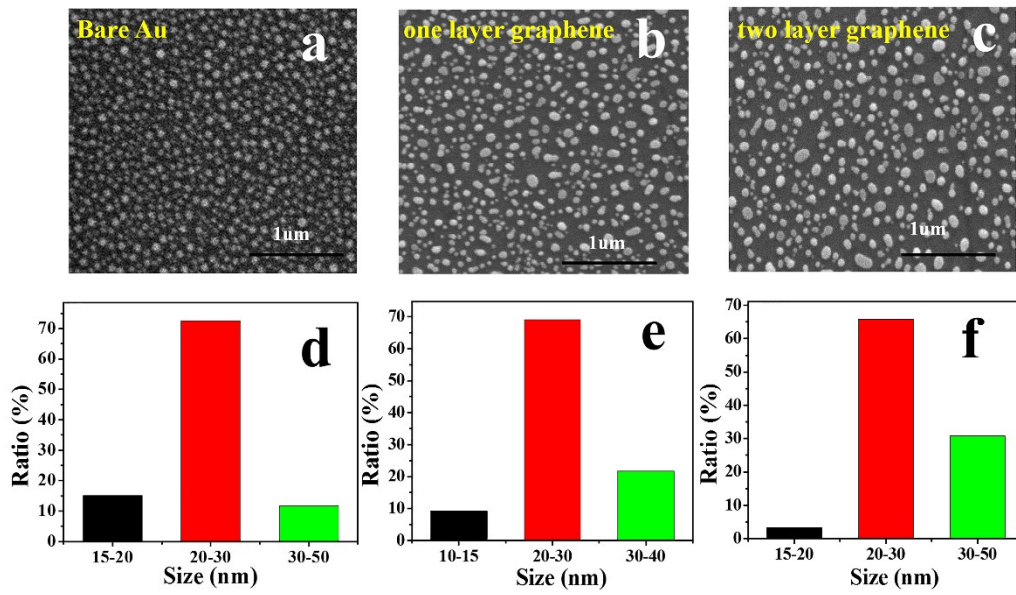


Figure S4: SEM images of bare gold NPs(a), gold NPs covered by one layer graphene film(b) and gold NPs encapsulated by two layers graphene (c). (d-f) The columnar statistical distribution of Au NPs for different setup schemes.

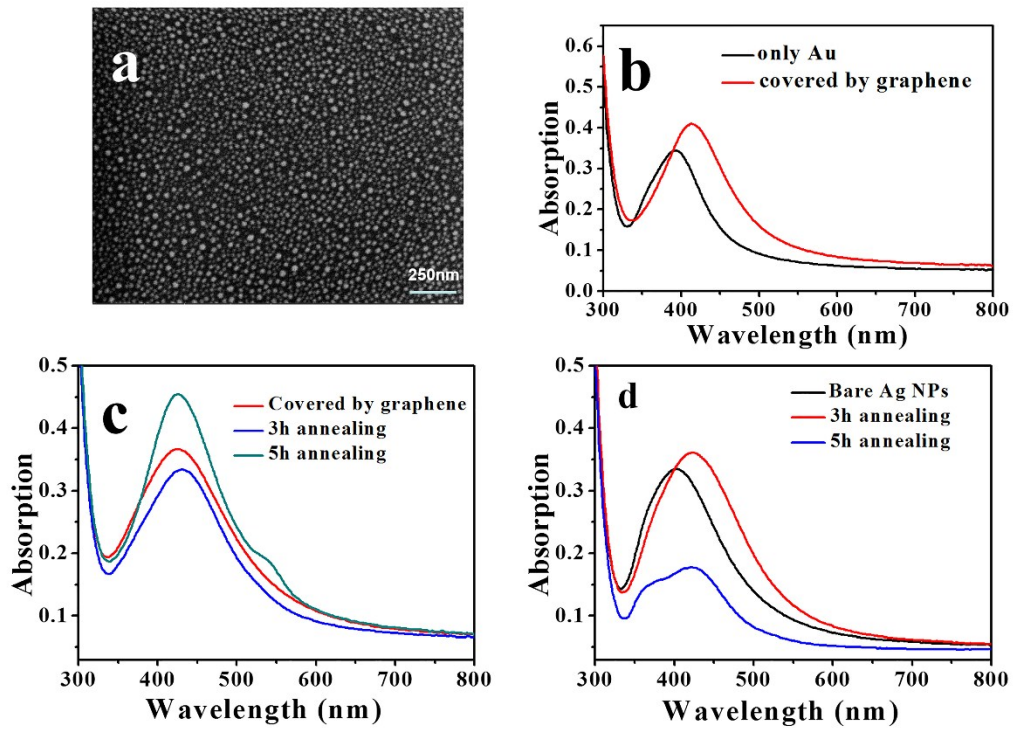


Figure S5: The absorption spectra of silver NPs covered by graphene (a) and bare silver NPs (b) before and after annealing. SEM images of silver NPs covered by graphene (c) and bare silver NPs (d) after 5h annealing in air, the scale bars are 200nm.

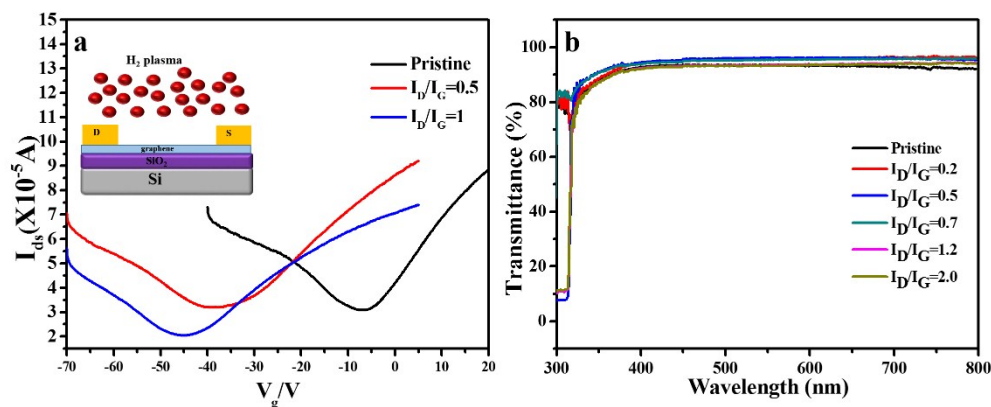


Figure S6: (a) The dependence of the transfer characteristics of graphene FET devices on the degree of hydrogenation, insert is a schematic diagram of the device being treated by hydrogen plasma; (b) The transmittance spectra of graphene with different hydrogenation degrees.