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Au-ZnO Janus Nanoparticle Exhibiting Strong Charge-Transfer-Induced SERS for Recyclable SERS-active Substrates

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Supporting Information

Synthesis of the etched Au-ZnO Janus nanoparticles

Au-ZnO nanopyramids were etched by acetic acid (pH～3) diluted with ethonal. 20 mL acetic acid solution and 20 mg Au-ZnO nanopyramids were mixed under continuous stirring at room temperature. Extracted samples at different times until the colour of the mixture changed from purple to blue.

Characterizations of the etched Au-ZnO Janus nanoparticles

Inorder to obtain the nanoflower-shaped Au-ZnO nanoparticles, we observed the etching process by transmission electron microscopy (TEM). Fig. S1 show the TEM images of etched Au@ZnO nanopyramids with different time, 3 min, 6 min, 12 min, 18 min, 24 min, and 30 min, by acetic acid. Obviously, the ZnO shell was vanished gradually with etching time. After the etching treatment of 6 minutes, ZnO nanopyramids turn into the nanoflower shape and its size reduces to ～10 nm. Two or three flower-shaped ZnO NPs still decorate at one Au core. Powder X-ray diffraction (XRD) data were collected on a D2 PHASER X-ray difffractometer (Cu Kα radiation, λ= 0.154 nm). Fig. S2 shows that the XRD pattern of etched Au–ZnO Janus nanoparticles was the same as the Au-ZnO nanopyramids. It demonstrates that no impurity has been induced in the sample after etching.

Raman spectra of PATP solid powders

We measured the Raman spectrum of PATP solid powders by a Via-Reflex spectrometer with 532 nm radiation from a solid-state laser. The predominant bands in the spectrum of PATP solid powders (Fig. S3) are located at 1593, 1176, and 1086 cm^{-1}.

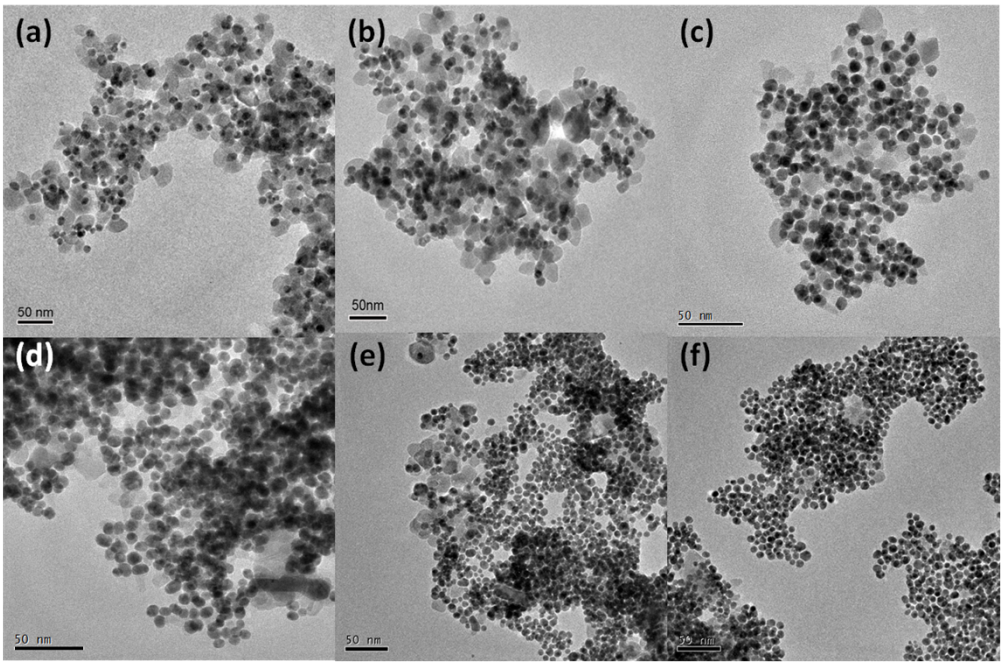

Fig. S1 TEM images of etched Au@ZnO nanopyramids with different time (a) 3 min. (b) 6 min (c) 12 min (d) 18 min (e) 24 min, and (f) 30 min, by acetic acid (pH～3).

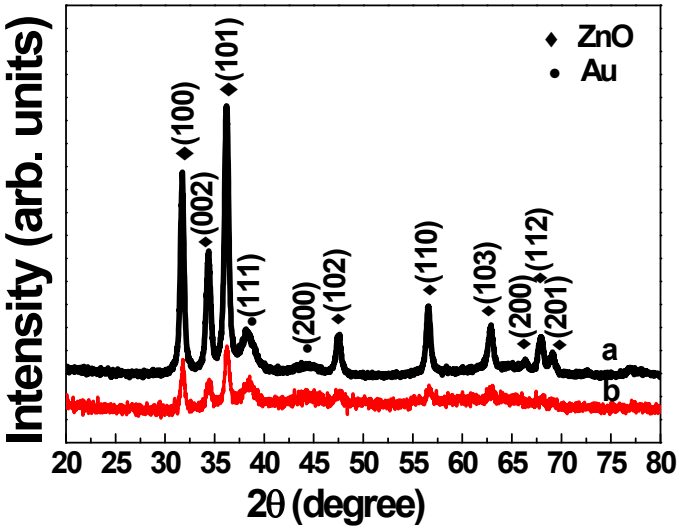

Fig. S2 XRD patterns of (a) the Au@ZnO nanopyramids, and (b) the etched Au/ZnO nanoparticles.

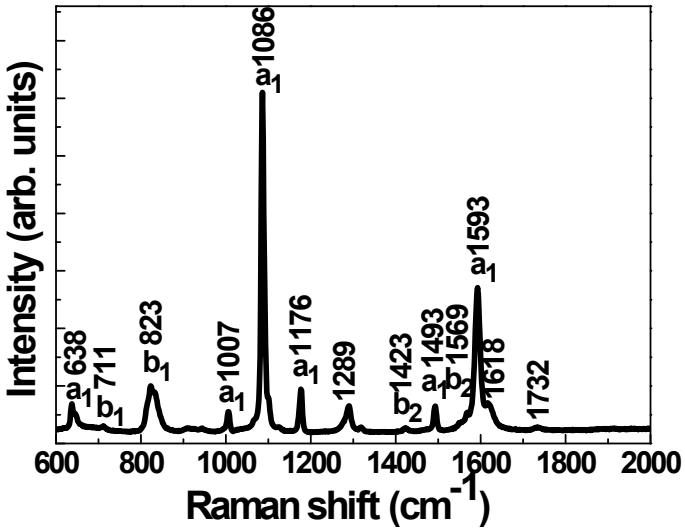

Fig. S3 Raman spectra of PATP solid powders with 532 nm laser excitation.