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Supporting Information

Au@ZnO Core-Shell Nanostructures with Plasmon-Induced Visible-Light Photocatalytic and Photoelectrochemical Properties

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SUPPORTING METHODS

Preparation of the Au Nanospheres.

Au nanospheres (NSs) were synthesized by a seed-mediated growth method reported previously. In a typically procedure, 0.25 mL of $HAuCl_4$ aqueous solution (0.01 M) was added to 9.75 mL of CTAB aqueous solution (0.1 M), then quickly injection of 0.60 mL of freshly-prepared, ice-cold $NaBH_4$ aqueous solution (0.01 M) under vigorous stirring. The mixed resultant aqueous solution was kept at room temperature for 3 h under mild stirring to the formation of the seed 1. After the gradual addition of 9.75 mL of CTAB aqueous solution, 4 mL of $HAuCl_4$ aqueous solution (0.01 M), and 15 mL ascorbic acid (0.1 M) to 190 mL of water, 0.12 mL of seed 1 was put into the growth mixed aqueous solution. The mixed aqueous solution was gently shaken and then kept at room temperature for overnight under standing to form the seed 2. In addition, the seed 2 was obtained by four times into water by centrifugation and then re-dispersion with water for further use. The seed 2 was first added into a growth aqueous solution, which is made up of 30 mL of CTAC aqueous solution (0.025 M), 0.75 mL of ascorbic acid (0.1M), and 1.5 mL of $HAuCl_4$ aqueous solution (0.01 M). Followed by the mixed aqueous solution was placed in an air-bath shaker at 45 °C for 3 h, then was centrifuged and re-dispersed in 30 mL of CTAB aqueous solution (0.02 M). Finally, 1.5 mL of $HAuCl_4$ aqueous solution (0.01 M) was added into the CTAB aqueous solution and then was placed in an air-bath shaker at 45 °C for 2 h to produce Au NSs. The synthesized Au NSs were centrifuged and re-dispersed in water before further use.

Preparation of the pure ZnO nanoparticles. The pure ZnO nanoparticles was prepared according to the same procedure as that for the Au@ZnO core-shell nanostructures, except that the Au nanospheres were not added. The as-prepared ZnO nanoparticles were then calcined under the same conditions before the photocatalytic/photoelectrochemical tests.

Preparation of the Au@SiO$_2$ Core-Shell Nanostructures. For comparison, the Au@SiO$_2$ core-shell nanostructures with the same Au-nanosphere cores as that of the Au@ZnO were also prepared for the photocatalytic test. Briefly, the Au nanospheres (2 mL, 1.2×10^{11} particles·mL^{-1}) were dispersed into a CTAB solution (10 mL, 0.006 M). A NaOH solution (0.12 mL, 0.1 M) and a tetraethoxysilane solution (0.24 mL, 10 vol% in ethanol) were sequentially added into the Au nanocrystal solutions under gentle shaking. The reactions were allowed to continue under gentle shaking at 45 ^{o}C for 6 h. The resultant Au@SiO$_2$ core-shell nanostructuress were washed by centrifugation with deionized water and collected for further use.

SUPPORTING FIGURES

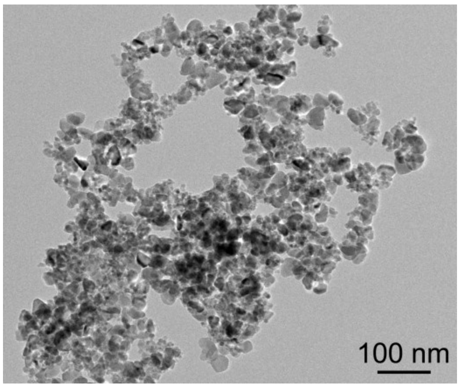

Fig. S1. TEM image of the pure ZnO nanoparticles.

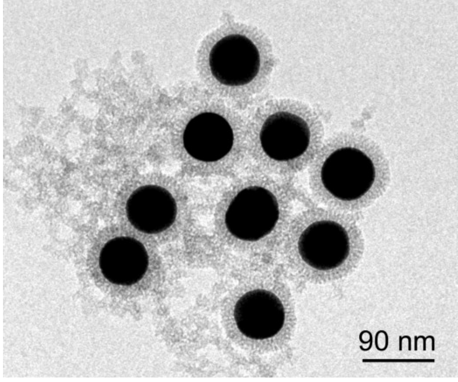

Fig. S2. TEM image of the Au@SiO_2 core-shell nanostructures.