Supporting Information

Figure S1

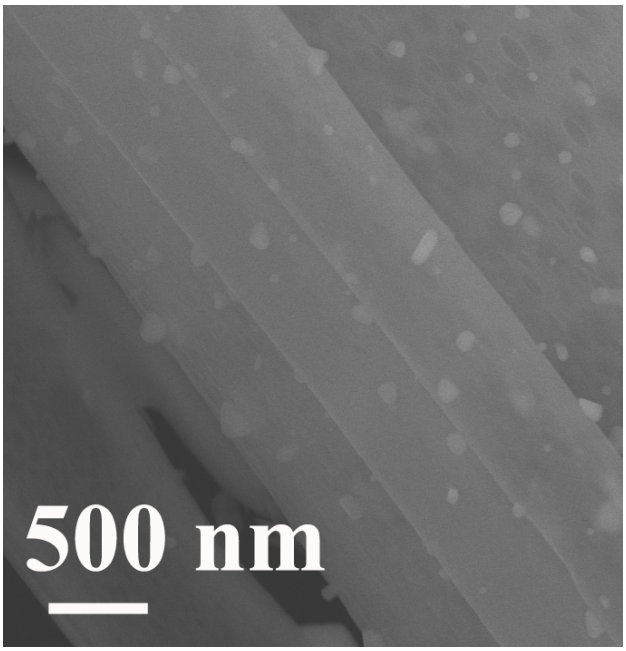

Figure S1 SEM images of Ag@TiO2@Ag nanotubes with 7.3% Ag content.

Figure S2

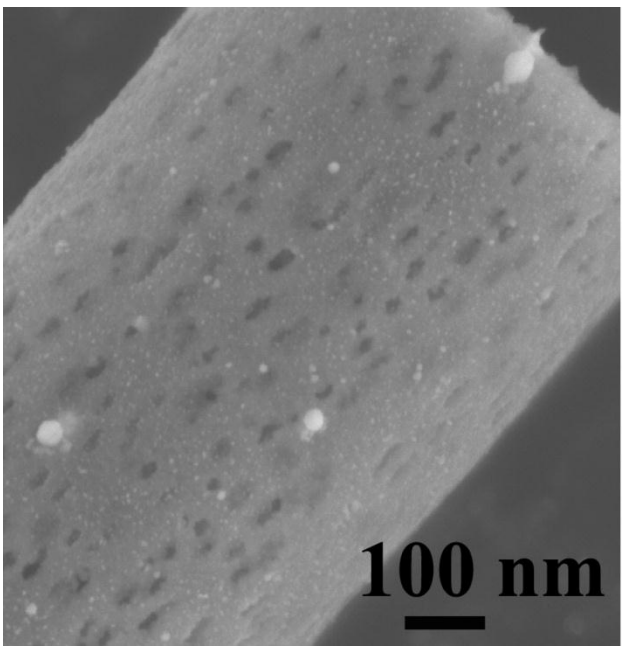

Figure S2 SEM images of Ag@TiO2@Ag nanotubes with 10.6% Ag content.

Figure S3

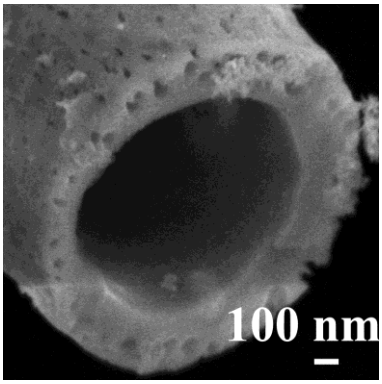

Figure S3 SEM images of Au nanoparticles depostied on both side-walls of TiO_2 nanotubes (Au@TiO_2@Au NTs).

Typical synthesis of Au@TiO_2@Au NTs process was described as below. In the first step, 0.60 g tetrabutyl titanate was dissolved in 0.80 g ethanol and 1.05 g ethanoic acid. This mixed solution was stirred for 20 min. Second, 0.2 g poly (vinyl pyrrolidone) (PVP) was dissolved in 0.6 g ethanol and stirred for 20 min. Then the two prepared solutions were mixed together and stirred for 1 h. Thus, a viscous gel of PVP/titanium acetate composite solution was obtained. Third, $HAuCl_4$ was dissolved in PVP/titanium acetate composite solution and stirred at room temperature for 20min. Fourth, 0.7 g mineral oil was added to the $HAuCl_4$/PVP/titanium acetate composite solution and stirred at room temperature for 48 h to obtain a stable and homogeneous emulsion. As for a typical electrospinning process, the spinneret had an inner diameter of 0.6 mm. Grounded aluminum strips (2 cm in width) with parallel gaps of about 1 cm were used as the collectors. A distance of 15 cm and a direct current voltage of 18 kV were maintained between the tip of the spinneret and the collector. During the electrospinning process the environmental temperature was maintained at 90℃. The temperature of the syringe was maintained under 70℃. After electrospinning, the fibers were heated from room temperature to 550 ℃ at a rate of 8℃ min^{-1}, and then held at 550℃for 2 h in air.

Figure S4

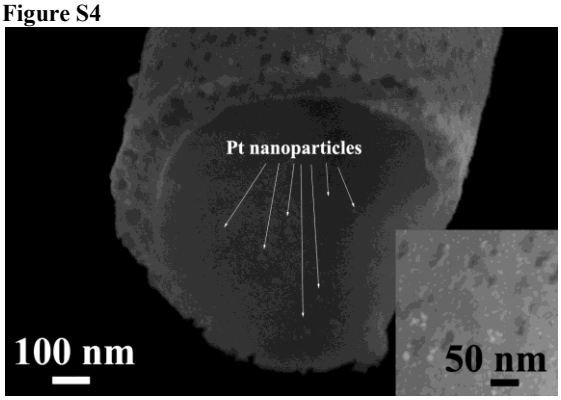

Figure S4 SEM images of Pt nanoparticles depostied on both side-walls of TiO_2 nanotubes (Pt@TiO_2@Pt NTs).

Typical synthesis of Pt@TiO_2@Pt NTs NTs process was described as below. In the first step, 0.60 g tetrabutyl titanate was dissolved in 0.80 g ethanol and 1.05 g ethanoic acid. This mixed

solution was stirred for 20 min. Second, 0.2 g poly (vinyl pyrrolidone) (PVP) was dissolved in 0.60 g ethanol and stirred for 20 min. Then the two prepared solutions were mixed together and stirred for 1 h. Thus, a viscous gel of PVP/titanium acetate composite solution was obtained. Third, $HPtCl_4$ was dissolved in PVP/titanium acetate composite solution and stirred at room temperature for 20min. Fourth, 0.70 g mineral oil was added to the $HPtCl_4$/PVP/titanium acetate composite solution and stirred at room temperature for 48 h to obtain a stable and homogeneous emulsion. As for a typical electrospinning process, the spinneret had an inner diameter of 0.6 mm. Grounded aluminum strips (2 cm in width) with parallel gaps of about 1 cm were used as the collectors. A distance of 15 cm and a direct current voltage of 18 kV were maintained between the tip of the spinneret and the collector. During the electrospinning process the environmental temperature was maintained at 90℃. The temperature of the syringe was maintained under 70℃. After electrospinning, the fibers were heated from room temperature to 600℃at a rate of 10℃ min^{-1}, and then held at 600℃for 2 h in air.

Figure S5

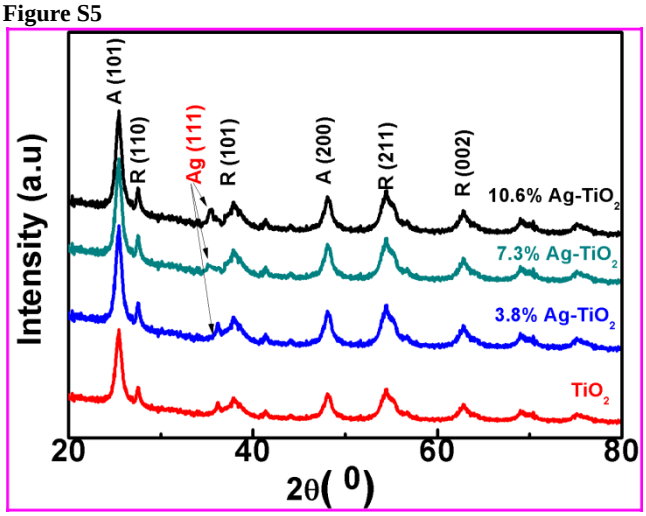

Figure S5 XRD patterns of the Ag@TiO_2@Ag NTs heterostructures with various Ag concentrations.

The TiO_2 showed mixed crystalline phases of anatase and rutile and the ratio of anatase phase to rutile phase was about 80 : 20. When Ag concentration is 3.8% almost no peaks corresponding to Ag can be detected, but with the Ag concentration increasing, the peaks at 2θ values of 38.20° can be indexed to fcc metallic Ag(111).