Electronic Supplementary Information (ESI)

Plasmonic photocatalysis properties of Au nanoparticles precipitated anatase/rutile mixed TiO_2 nanotubes

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Fabriction of the highly porous TiO_2 NTs

Highly porous TiO_2 NTs were prepared by a two-step process, as described below. In the first step, 1.2 ml tetrabutyl titanate was dissolved in 1.6 ml ethanol and 2.2 ml ethanoic acid. This mixed solution was stirred for 30 min. Second, 0.4g poly (vinyl pyrrolidone) (PVP) was dissolved in 3.6 ml ethanol and stirred for 30 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, 1.2 ml mineral oil (ISO VG46, attention: the high number mineral oil will make the solution hard to getting a homogeneous emulsion) was added to the PVP/titanium acetate composite solution and stirred at room temperature for 48 h to obtain a stable and homogeneous emulsion. As for a typical electro-spinning process, the spinneret had an inner diameter of 0.8 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, seen in Fig. S1(a). After electro-spinning, the fibers were heated from room temperature to 500 °C at a rate of 2 °C min^{-1}, and then held at 500 °C for 2 h in air, seen in Fig. S1(b).

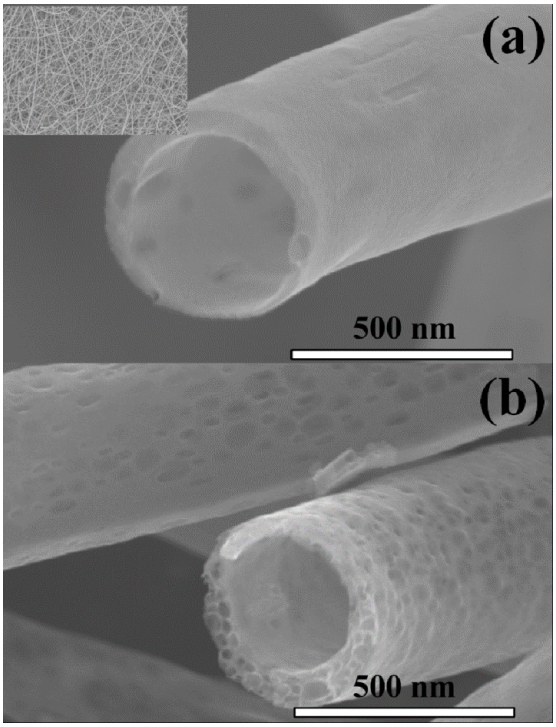

Fig. S1 (a) The SEM images of collected PVP–tetrabutyl titanate NTs under different magnification; (b) highly porous TiO_2 NTs after calcination at 500 °C for 2 h in air.

The proposed mechanism of formation of the highly porous NTs

As shown in Fig. S2, before electro-spinning, the solution was evenly spread, once the fibers were spun out from the nozzle, oil on the surface of the fibers with the ethanol and ethanoic acid evaporated. The solvent evaporation produced a region near the surface of the fiber that is enriched in PVP and tetrabutyl titanate. Thus, a core-shell made up of PVP–tetrabutyl titanate/oil (oil gathering in the inner) formed rapidly. With the remaining oil evaporating from the fibers, PVP– tetrabutyl titanate NTs formed on the collector. After calcination, the highly porous TiO_2 NTs can be obtained.

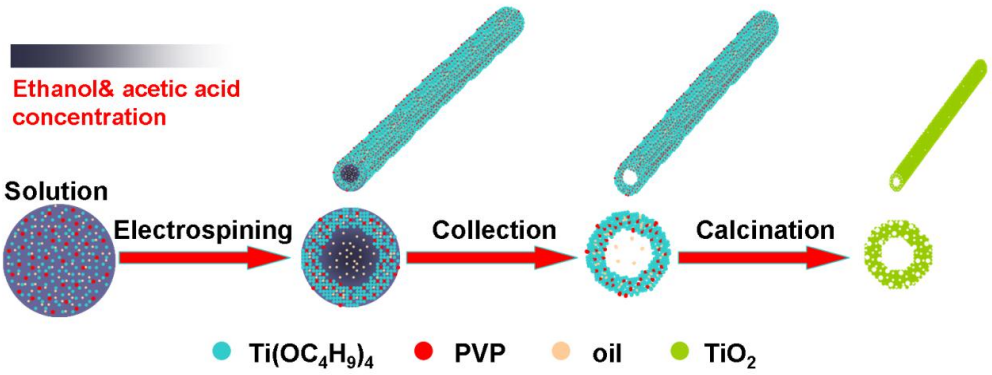

Fig. S2 The proposed mechanism of formation of the highly porous NTs.