

Supplementary Information for

Visible-light-induced photocatalysis through surface-plasmon excitation of gold on titania surfaces

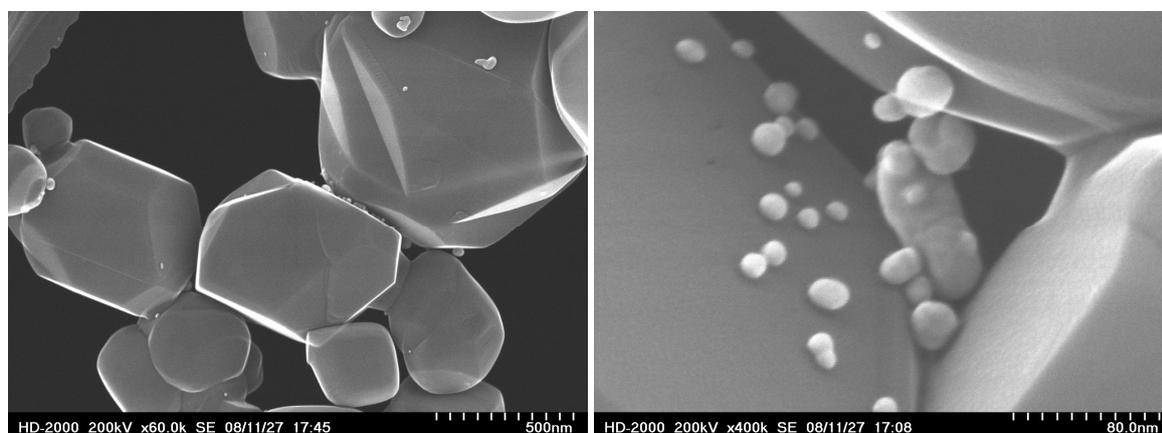
1. Preparation, characterization and activities of Au/TiO₂ and Au/SiO₂ powders prepared by impregnation/reduction method

1.1. Preparation of Au/TiO₂ and Au/SiO₂ powders

Au/TiO₂ particles were prepared by three variants of the impregnation-reduction method. In the first variant, gold nanoparticles were prepared according to the procedure reported by Andreescu *et al.*²² with a few modifications and were adsorbed on titania and silica powders of similar particle sizes (ca. 0.5 μm). A 49-mmol dm⁻³ stock solution of HAuCl₄·4H₂O used throughout the work was prepared by dissolving 1.0 g of HAuCl₄·4H₂O in a 50-mL volumetric flask. A stock solution of ascorbic acid with the same concentration of 49 mmol dm⁻³ was prepared by dissolving 0.43 g of this compound in 50 mL Milli-Q water. *Reacting solutions* of gold and ascorbic acid were prepared by diluting 8.4 mL of the *stock solutions* into two 100-mL volumetric flasks. When required, pH of the *reacting solution* of gold was adjusted with 3.6vol% HCl and 0.2 mol dm⁻³ NaOH solutions. The *reacting solution* of HAuCl₄·4H₂O was transferred into a 350-mL beaker, and *reacting solution* of ascorbic acid was rapidly added under vigorous stirring. After stirring for 2 h, the suspension of gold nanoparticles was divided into two parts (100 mL each) and mixed with silica and titania powders, separately, under vigorous stirring (1400 rpm). After mixing for 2 h, the stirring rate was reduced to 800 rpm and mixing was continued overnight. Then the obtained Au/TiO₂(SiO₂) photocatalysts were centrifuged, washed 3 times with methanol and 6 times with water, and dried overnight at 120°C. In the second variant, process steps were changed: First, Au(III) cations were adsorbed from the *reacting solution* on the oxides during overnight stirring and then reduced by addition of ascorbic acid solution. In the third variant, gold nanoparticles were prepared first by reduction with ascorbic acid with a higher ratio of Au:ascorbic acid (1:6). The aggregated larger particles of gold were destabilized during overnight stirring, followed by dissolution with aqua regia. Then Au(III) cations were adsorbed on the oxide surfaces and subjected to consecutive reduction. The influence of chirality of ascorbic acid on the activity of obtained nanoparticles was examined with L- or D-ascorbic acid as a reducing agent. As a result, 10 modified silica and 8 modified titania powders were obtained.

1.2. Characterization of Au/TiO₂ and Au/SiO₂ powders

STEM images of two samples with the highest level of activity prepared in the same method (third variant described above) are shown in Figs. S1 and S2.



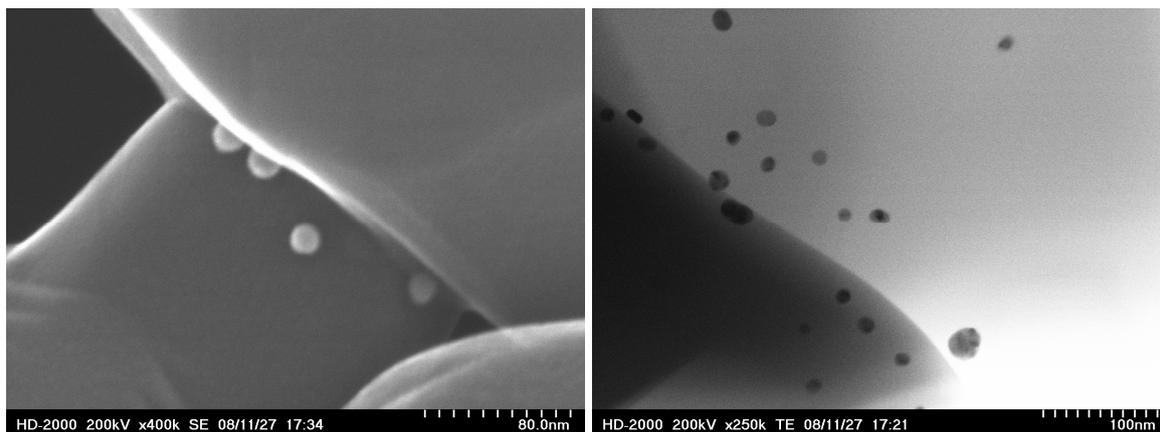


Figure S1. SE- and TE(bottom right)-STEM images of Au/TiO₂ prepared by impregnation/reduction method.

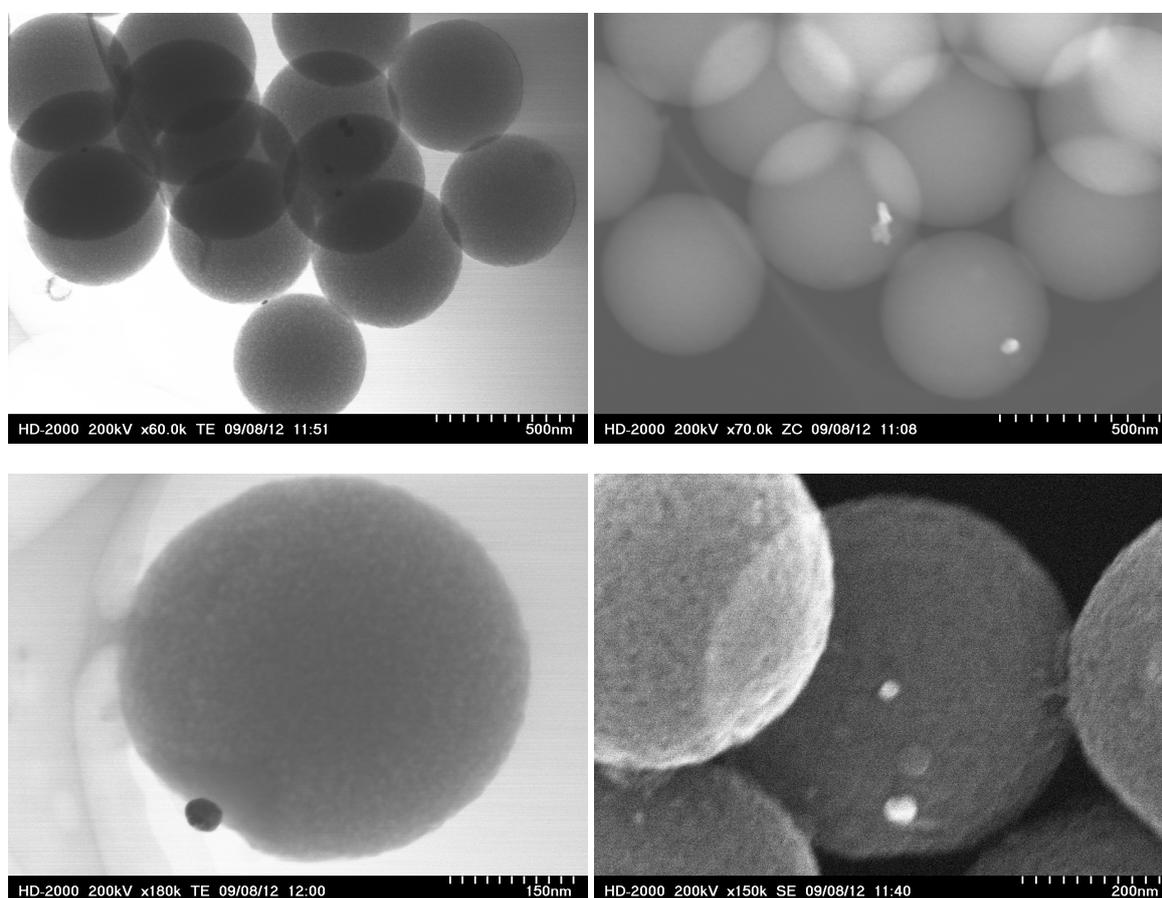


Figure S2. TE(right)-, ZC(upper right)- and SE(bottom right)-STEM images of Au/SiO₂ prepared by impregnation/reduction method.

Comparison of absorption properties of two Au/TiO₂ samples prepared by two methods (photodeposition and impregnation/reduction) is shown in Fig. S3. The reaction time courses during acetic acid decomposition for the most active Au/SiO₂ and Au/TiO₂ prepared by impregnation/reduction method are shown in Fig. S4.

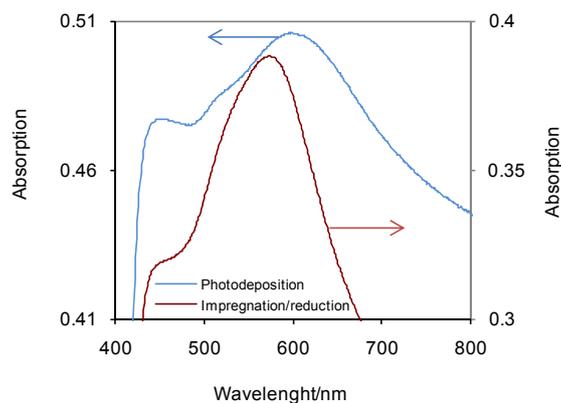


Figure S3. Comparison of absorption spectra of Au/TiO₂ (Aldrich_r) powders obtained by two methods (photodeposition and impregnation/reduction).

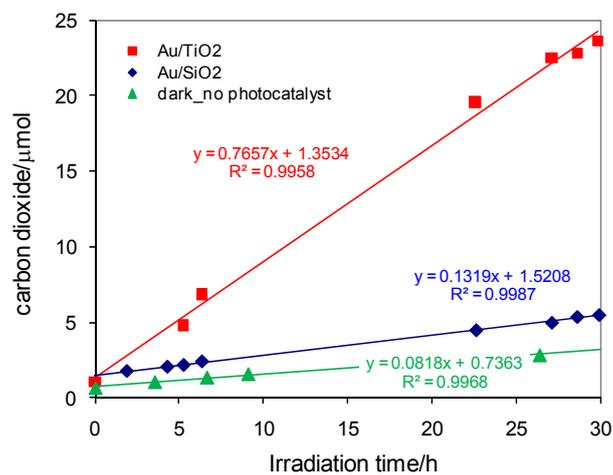


Figure S4. Acetic acid decomposition during irradiation under visible light (xenon lamp, Y44 filter) on Au/TiO₂ and Au/SiO₂ powders, and during dark reaction in the absence of photocatalyst.

2. Light emission measurements for two irradiation sources and different cut-off filters

The comparison of light emission from two irradiation sources is shown in Fig. S5, left. The light emission after application of different cut-off filters is shown on the right side of Fig. S5.

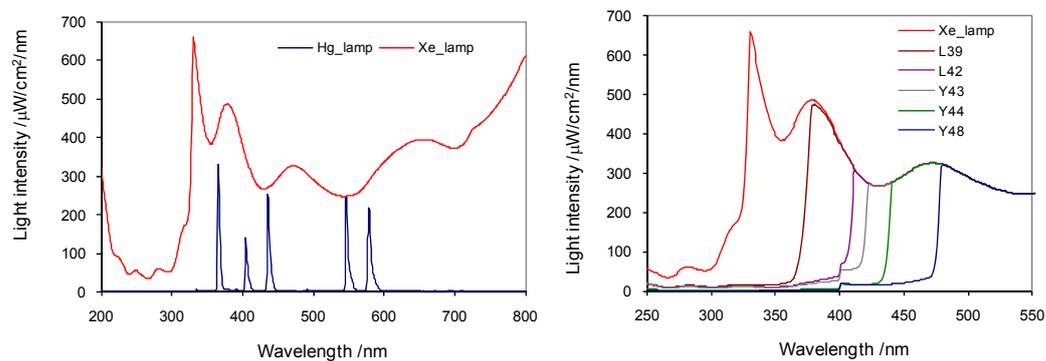


Figure S5. Light emission spectra of mercury and xenon lamps (left) and from xenon lamp after application of cut-off filters (right).

3. The activities under UV and vis irradiation during acetic acid decomposition

The increase of activity after gold photodeposition on titania powders under UV and visible light irradiation during acetic acid decomposition is shown in Fig. S6.

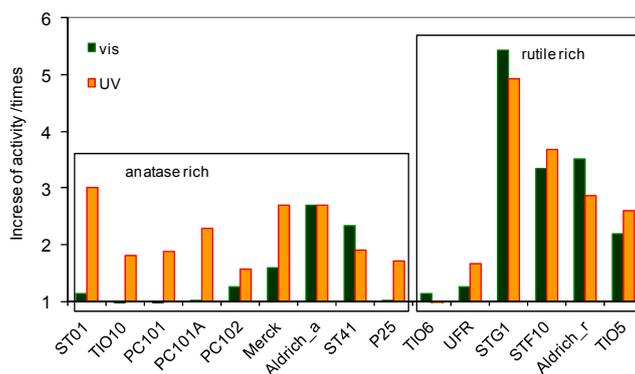


Figure S6. Increase of activity after gold deposition on titania powders under UV (mercury lamp) and vis irradiation (mercury lamp, Y48).