Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Modified hierarchical TiO_2 NTs for enhanced gas phase photocatalytic activity

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1. NMNs modified hierarchical TiO_2 NTs

The Ag nanoparticles were decorated on the TiO_2 NTs by a photocatalytic reduction method using $AgNO_3$. The TiO_2 NTs were soaked into the precursor solution (0.5×10^{-2} mol/L、1.0×10^{-2} mol/L、1.5×10^{-2} mol/L $AgNO_3$ aqueous solution) for 24 h and then were irradiated in this solution with a 300 W high pressure mercury lamp for 30 min to reduce the absorbed Ag^+ to Ag^0 by photocatalysis at the expense of water oxidation. [1] Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time was shown in fig. 1s.

The Au nanoparticles were decorated on the TiO_2 NTs by a photocatalytic reduction method using $HAuCl_4$. The TiO_2 NTs were soaked into the precursor solution (1.21×10^{-4} mol/L、2.43×10^{-4} mol/L、3.64×10^{-4} mol/L $HAuCl_4$ aqueous solution) for 24 h and then were irradiated in this solution with a 300 W high pressure mercury lamp for 30 min to reduce the absorbed Au^{3+} to Au^0 by photocatalysis at the expense of water oxidation. Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time was shown in fig. 2s.

The Pt nanoparticles were decorated on the TiO_2 NTs by a photocatalytic reduction method using $Pt(AcAc)_2$. The TiO_2 NTs were soaked into the precursor solution ($0.5\ \times10^{-3}$mol/L、1.0×10^{-3} mol/L、1.5×10^{-3} mol/L $Pt(AcAc)_2$ aqueous solution) for 24 h and then were irradiated in this solution with a 300 W high pressure mercury lamp for 30 min to reduce the absorbed Pt^{2+} to Pt^0 by photocatalysis at the expense of water oxidation. Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time was shown in fig. 3s.

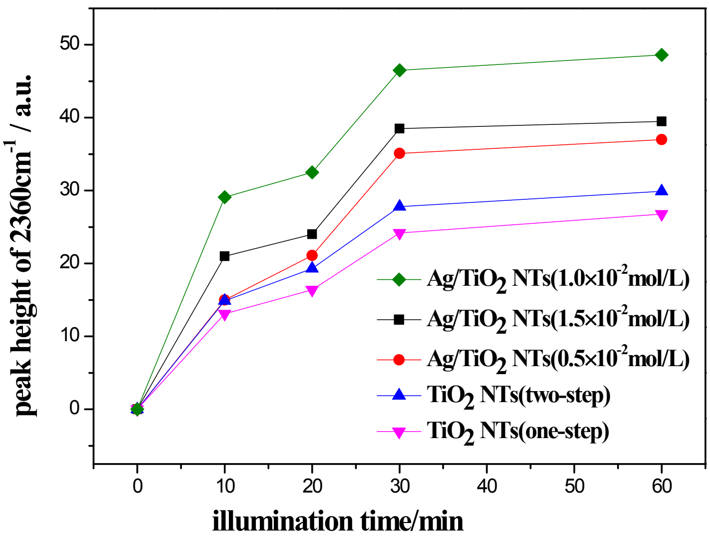

Fig. S1. Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time

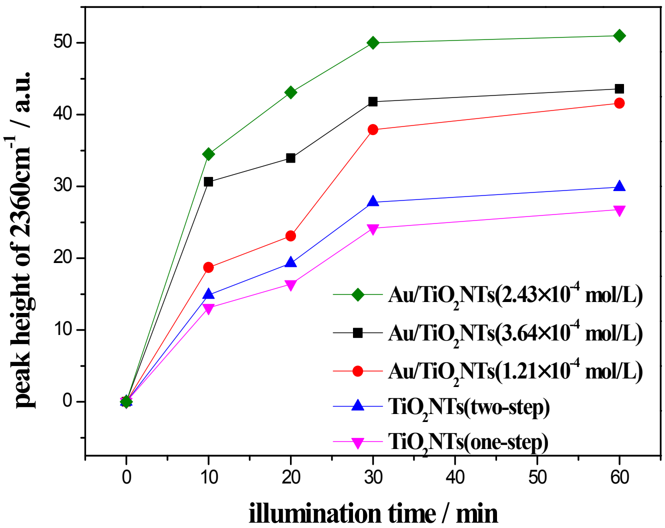

Fig. S2. Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time.

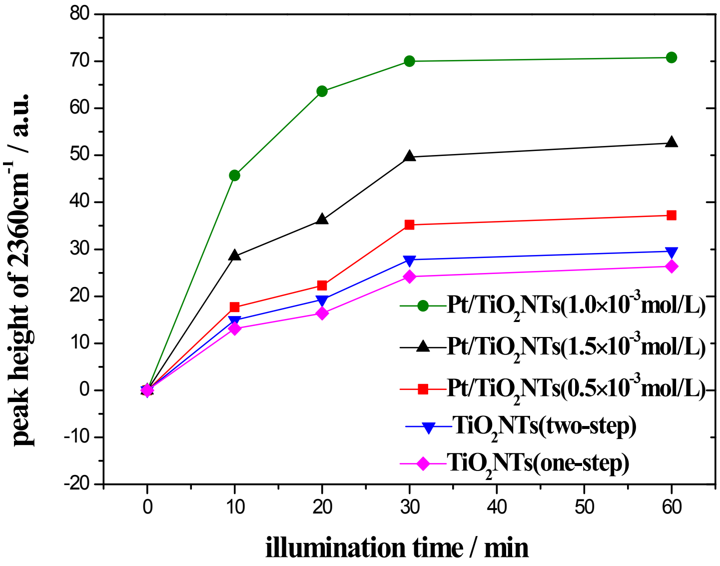

Fig. S3. Variation of the peak height of 2360 cm^{-1} corresponding to the normal vibration of CO_2 molecules derived from the FTIR transmittance spectra with the irradiation time.

Clearly, the Ag/TiO_2 NTs soaked in 1.0×10^{-2} mol/L $AgNO_3$ aqueous solution, the Au/TiO_2 NTs soaked in 2.43×10^{-4} mol/L $HAuCl_4$ aqueous solution, the Pt/TiO_2 NTs soaked in 1×10^{-3} mol/L $Pt(AcAc)_2$ aqueous solution showed the the biggest decomposition rate and highest gas phase PC activity within the range of concentration.

2. Experimental facility

Fig. S4. Experimental facility

3. Morphology of TiO_2 NTs

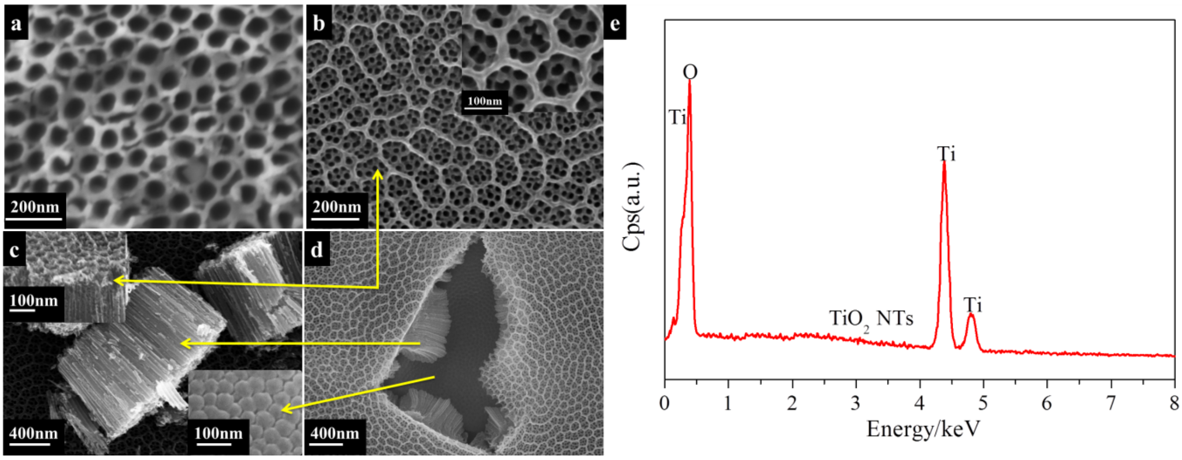

Figure S5. Morphology of TiO_2 NTs: (a) TiO_2 NTs in the one-step anodization; (b) hierarchical TiO_2 NTs in the two-step anodization;(c)(d)side view and the place of fracture of TiO_2 NTs; (e)EDS spectra of two-step TiO_2 NTs.

References

1 Z. Zhang, L. Zhang, M. N. Hedhili, H. Zhang, and P. Wang. Nano Lett. 2013, **13**, 14.