Electronic Supplementary Material (ESI) for RSC Advances.
This journal is © The Royal Society of Chemistry 2014

SUPPORTING INFORMATION

Carbon-deposited TiO_2 nanoparticle balls for high-performance visible photocatalysis

Sunbok Lee,† Yu-Il Kang,† Su-Jin Ha, and Jun Hyuk Moon*

Department of Chemical and Biomolecular Engineering, Sogang University, Seoul 121-742, South Korea.

†These authors contributed equally to this work.

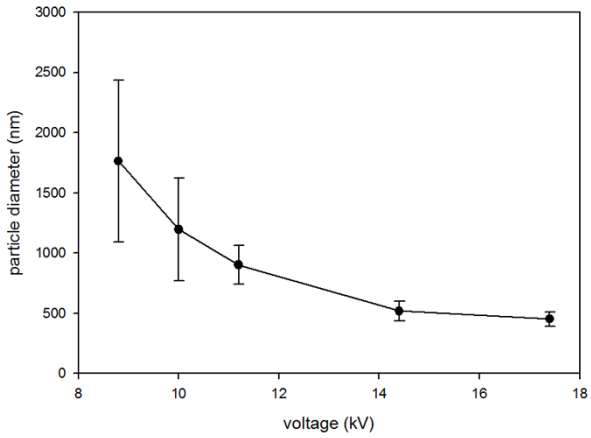

Figure S1. The diameters and size distributions of NP balls produced at various applied electric field voltages.

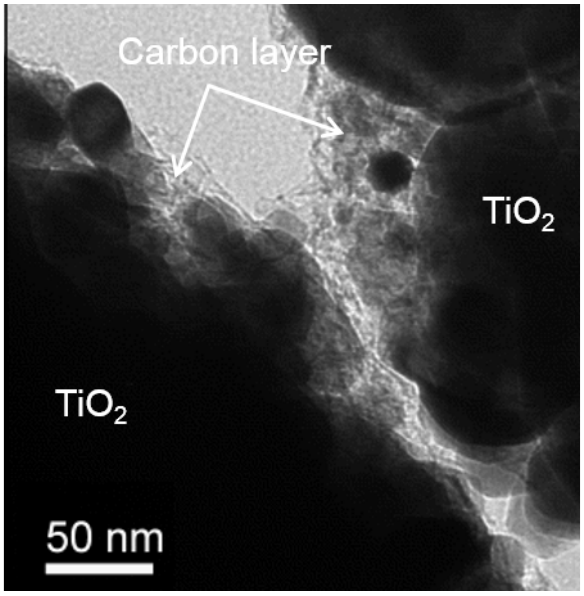

Figure S2. High resolution TEM image of carbon-coated NP balls.

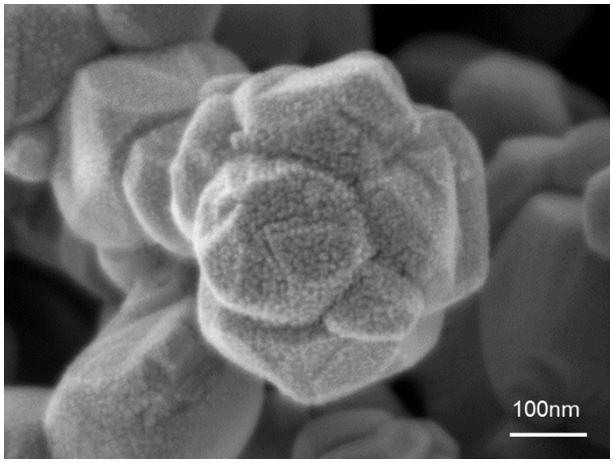

Figure S3. SEM image of bare TiO_2 NP balls heat-treated at 700°C.

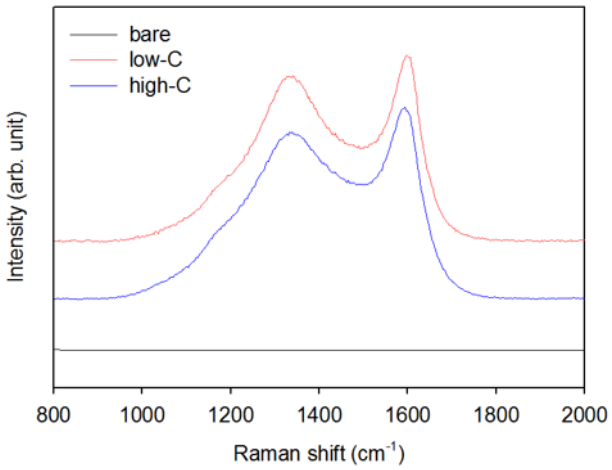

Figure S4. Raman spectra of the bare TiO2 NP balls, low-C NP balls, and high-C NP balls.

The D band corresponds to the A1g mode and is characteristic of in-plane disorder or edge defects in graphite, i.e., microcrystalline graphite, whereas the G band corresponds to the in-plane E2g vibrational mode of graphite sheets. The peak ratio of these bands can be used to qualitatively determine the graphitic crystal size. The ratio of the peak intensities of the D and G bands (I_D/I_G) inversely depends on the in-plane crystallite size Ld according to the Tuinstra-Koenig relation:

$$Ld = (2.4 \times 10^{-10})\ \lambda^4\ (I_D/I_G)^{-1}$$

where λ is the excitation wavelength. The ID/IG values of the bare, low-C, and high-C NP balls are 0.90, 0.89, and 0.87, respectively. The corresponding Ld values were 18.8 nm for the bare NP balls, 18.9 nm for the low-C NP balls, and 19.3 nm for the high-C NP balls.

Table S1. Comparative list of the decomposition rates of the C-NP balls with previous results

Ref.	Materials	Exposure light source	MB degradation quantity for 1hr (mmole hr^{-1} g^{-1})
Our result	Carbon-doped TiO_2 Composite	Xenon lamp (150W) (400~700nm)	0.025
Adv. Mater. 2012, 24, 1084–1088	Graphene/TiO_2 Composite	Xenon lamp (450W) (>420nm)	0.024
Chem. Commun., 2012, 48, 2528–2530	Nitrogen-doped TiO_2 Composite	Xenon lamp (350W) (>410nm) 15mW/cm^2	0.016
J. Mater. Chem.,2011, 21, 1049–1057	Carbon-doped TiO_2 sheet	Oriel mercury lamp (420~1000nm) 75mW/cm^2	0.0040
J. Mater. Chem.,2012, 22, 17700–17708	Molibden, Nitogen co-doped TiO_2 sheet	High pressure mercury lamp (250W) (>420nm)	0.0070
RSC Adv.,2013, 3, 18474–18481	Nitogen, Graphene co-doped TiO_2 composite	Xenon lamp (500W) (>400nm)	0.020
Angew. Chem. Int. Ed. 2013, 52, 9196 –9200	Nitrogen-doped TiO_2 fiber	Xenon lamp (>420nm)	0.063