Electronic Supplementary Material (ESI) for RSC Advances.

High Visible-Light Photochemical Activity of Titania Decorated on Single-Wall Carbon Nanotube Aerogels

Hang-Ah Park, Siyuan Liu, Paul A. Salvador, Gregory S. Rohrer and Mohammad F. Islam*

Department of Materials Science and Engineering, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, USA. E-mail: mohammad@cmu.edu

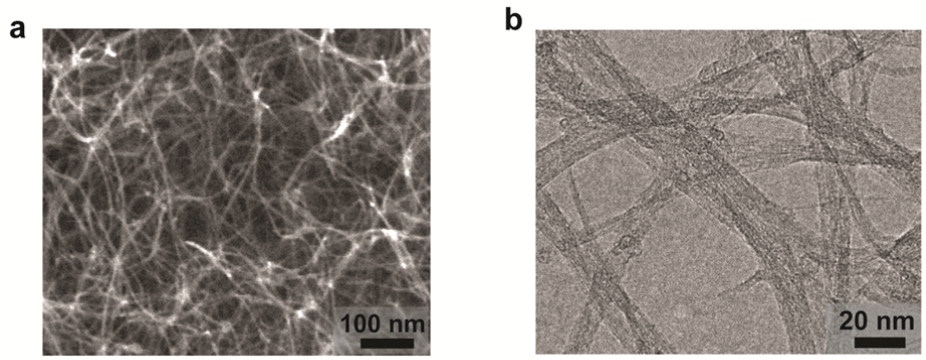

Fig. S1. a) High-resolution SEM and b) conventional TEM images of cross-sections of pristine single-wall carbon nanotube (SWCNT) aerogels.

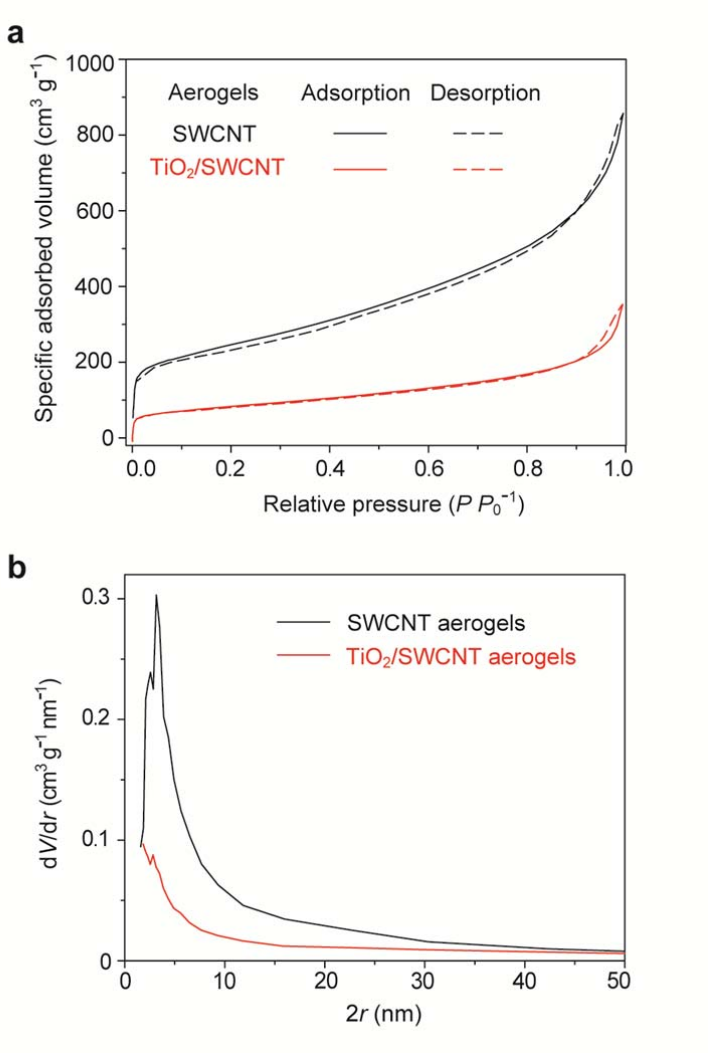

Fig. S2. a) Nitrogen adsorption–desorption isotherms of SWCNT and TiO_2/SWCNT aerogels with mass density of ≈ 9 mg mL^{-1} and ≈ 36 mg mL^{-1}, respectively. Specific adsorbed volume was calculated by dividing measured adsorbed volume by the mass of the sample and is plotted against the relative pressure, $P\ P_0^{-1}$, where P and P_0 are the equilibrium pressure and saturation pressure of nitrogen at the adsorption temperature of 77 K, respectively. b) Pore diameter distributions (dV/dr) of SWCNT aerogels and TiO_2/SWCNT aerogels as a function of pore diameter (2r). The pore characteristics within SWCNT aerogels can be tuned by changing the SWCNT concentration.[1]

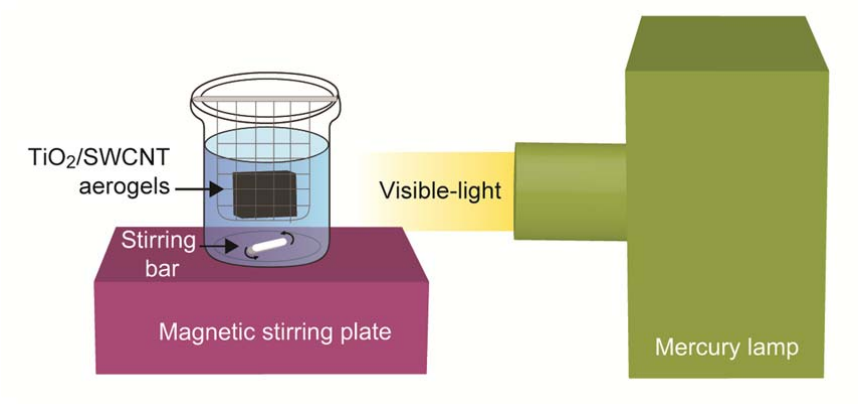

Fig. S3. Schematic illustration of photocatalytic dye degradation experimental setup.

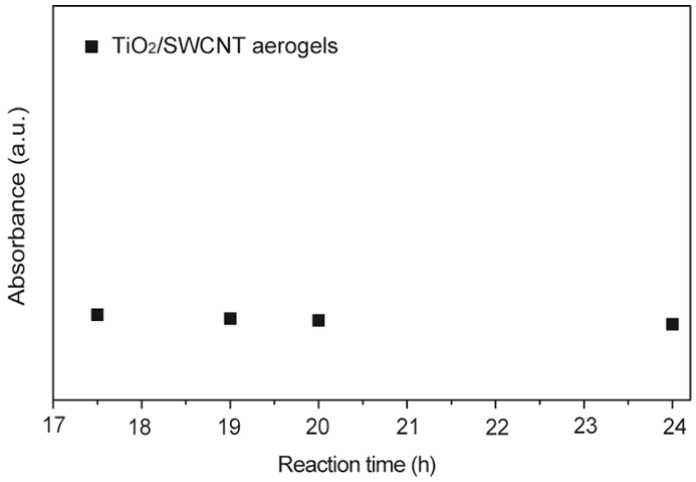

Fig. S4. Equilibration time for MB dye adsorption on TiO_2/SWCNT aerogels in the dark.

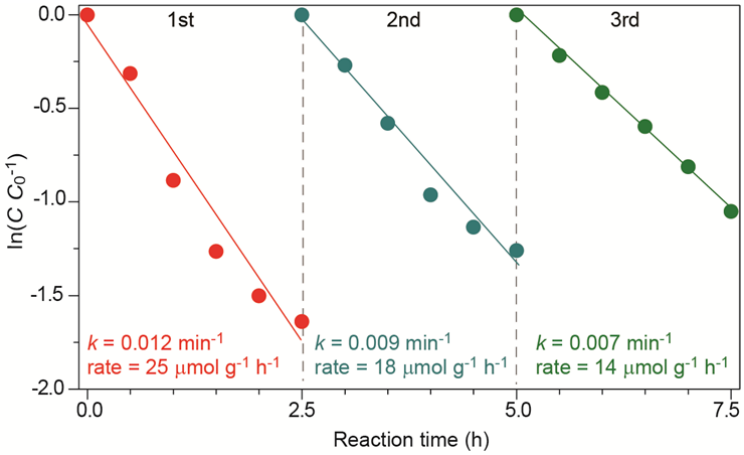

Fig. S5. Reusability of TiO_2/SWCNT aerogel composites for methylene blue dye degradation. The composites were rinsed in water after every 2.5 h of continuous use.

Table S1. Comparison of photocatalytic dye degradation performance by TiO_2 supported on carbon, graphene, or graphite.

Photocatalysts	Light source, power, spectral range	Adsorption-desorption equilibration time [h]	Dye:titania molar ratio[a]	Degradation rate[a] [μmol g^{-1} h^{-1}]	Rate constant[a] [min^{-1}]	Ref.
TiO_2/SWCNT aerogels	Hg, 300 W, visible	24	0.004	25 200[b]	0.012	This work
		24	0.032	25 (with fresh 0.02 mM dye solution)	0.0015	
TiO_2 P25/graphene	Xe, 500 W, visible	0.167	0.002	13.4	0.013	2
TiO_{2-x}/graphene	W, 500 W, visible	1	0.005	9.5	0.0045	3
TiO_2/graphene	Xe, 450 W, visible	1	0.0002	25[c]	0.034	4
TiO_2/graphene	Xe, 100 mW/cm^2, AM 1.5 solar simulator	0.5	0.003	13.7	0.019	5
TiO_2/carbon-dot	Xe, 1000 W, visible	Overnight	0.012	5.1	0.0047	6

[a] After dye adsorption to the samples had reached equilibrium in the dark.

[b] Estimated by taking the starting concentration of dyes before adsorption-desorption equilibration as C_0.

[c] Estimated by taking the starting concentration of dyes before adsorption-desorption equilibration as C_0 because the dye concentrations after equilibration are not provided. As such, the degradation rates and rate constants are likely to be significantly overestimated, particularly if supports had large surface area for dye adsorption.

References

1. K. H. Kim, Y. Oh and M. F. Islam, *Advanced Functional Materials*, 2013, **23**, 377-383.
2. H. Zhang, X. Lv, Y. Li, Y. Wang and J. Li, *ACS Nano*, 2010, **4**, 380-386.
3. M. Xing, X. Li and J. Zhang, *Scientific Reports,* 2014, **4**, 5493:1-7.
4. J. S. Lee, K. H. You and C. B. Park, *Advanced Materials*, 2012, **24**, 1084-1088.
5. M. Yang, Y. Liu, H. Wen, Z. Tang, H. Zhao,Y. Li and D. Wang, *ACS Nano*, 2013, **7**, 1504-1512.
6. G. Cui, W. Wang, M. Ma, M. Zhang, X. Xia, F. Hang, X. Shi, Y. Zhao, Y. Dong and B. Tang, *Chemical Communications,* 2013, **49**, 6415-6417.