

Supporting Information

Shape-enhanced Photocatalytic Activity of Single-crystalline Anatase TiO₂ (101) Nanobelts

Nianqiang Wu^{1,}, Jin Wang¹, De Nyago Tafen², Hong Wang², Jian-Guo Zheng³, James P. Lewis², Xiaogang Liu⁴, Stephen S. Leonard⁵, Ayyakkannu Manivannan⁶*

¹Department of Mechanical and Aerospace Engineering, WVNano Initiative, West Virginia University, Morgantown, WV 26506-6106, USA

²Department of Physics, West Virginia University, Morgantown, WV 26506, USA

³Materials Characterization Center (MC2), LEXI, California Institute for Communication and Information Technology, University of California, Irvine, CA 92697, USA

⁴Department of Chemistry, National University of Singapore, Singapore 117543

⁵National Institute for Occupational Safety and Health, Morgantown, WV 26505, USA

⁶National Energy Technology Laboratory, U.S. Department of Energy, Morgantown, WV 26507, USA

*Corresponding author: Fax: +1-(304)-293-6689, E-mail: nick.wu@mail.wvu.edu

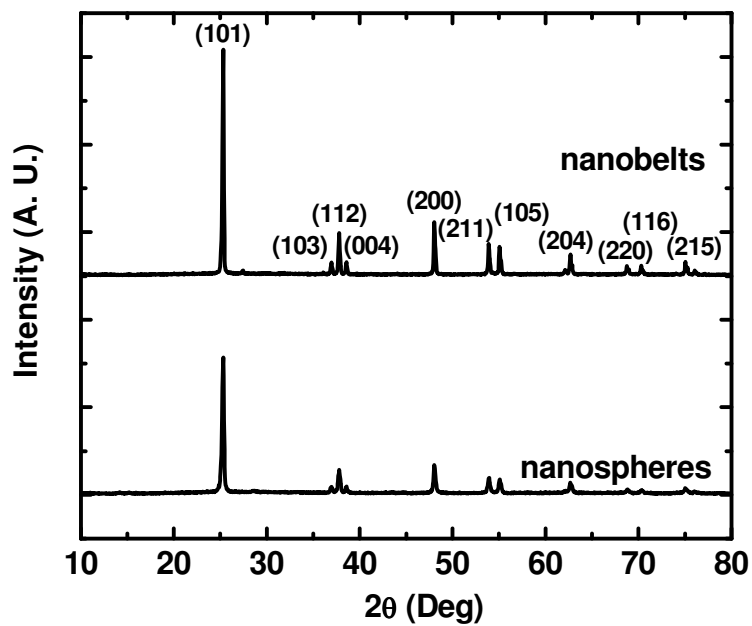


Figure S1 XRD patterns of the TiO₂ nanobelts and the TiO₂ nanospheres

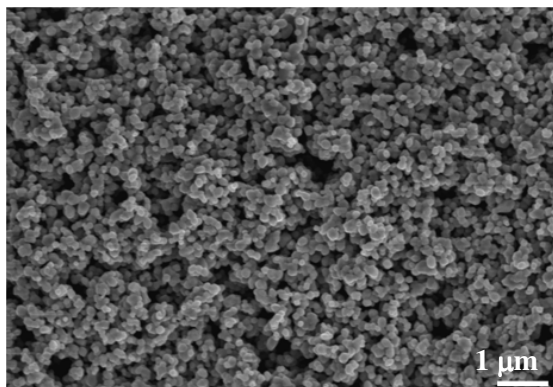


Figure S2 SEM image of the anatase TiO₂ nanospheres

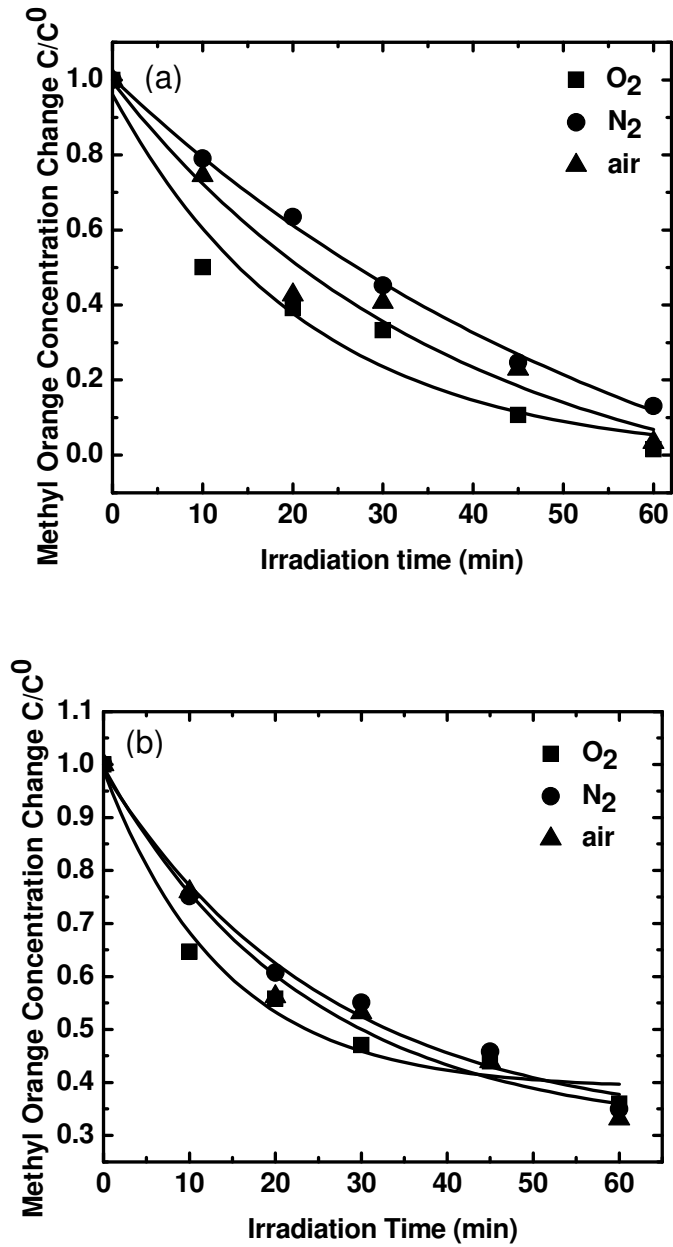


Figure S3 Degradation of methyl orange in an aqueous solution saturated with oxygen, nitrogen and air, respectively. (a) For the reaction photocatalyzed by the TiO₂ nanobelts under UVA irradiation; (b) for the reaction photocatalyzed by the nanospheres

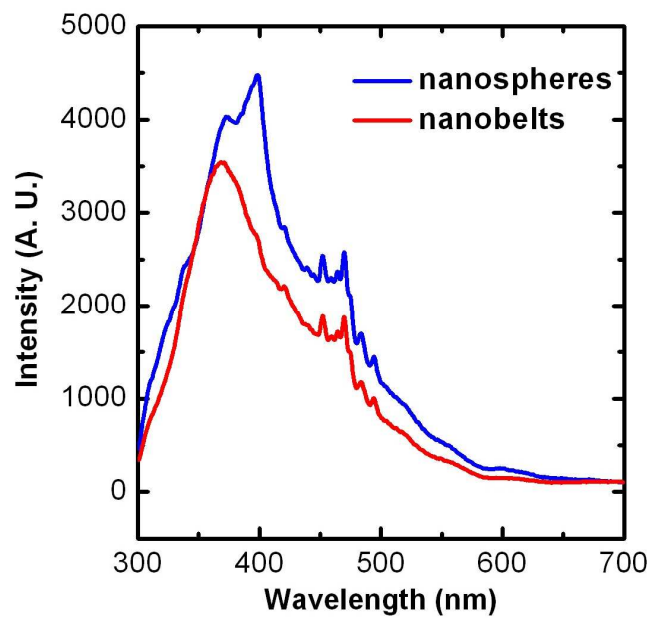


Figure S4 Photoluminescence spectra of the TiO₂ nanobelts and the nanospheres excited with the ultraviolet light with the wavelength centered at 250 nm

Method for determining the facet of two major exposed surfaces of the nanobelts

The crystallographic plane of two major exposed surfaces of the nanobelts is determined to be (101) facet. In order to identify this facet, several pairs of SAED patterns and bright-field images were recorded in different crystallographic orientations while the [010] axis remained horizontal (Fig. 1(d)). The projected widths of the nanobelt were measured from the images and the orientations of the nanobelt from TEM goniometer readings as well as the patterns. Because the [010] axis remained in the same direction during tilting, the orientation of the nanobelt can be described by α , the angle between the electron beam and the normal of the (101) plane (Fig. 1(d)). The projected widths and the α values are listed in Table 1. If the major surface is the (101) facet, the projected width (p) of a nanobelt with thickness (t) and width (w) is dependent on the α value and can be calculated by the formula,

$$P(\alpha) = w \cos(\alpha) + |t \sin(\alpha)|$$

If all pairs of p and α satisfy the formula, it is true that the major surface is the (101) plane, and the values of w and t can be determined as well. Four pairs of p and α obtained from Fig. 1(d) are summarized in Table 1. It can be seen that they satisfy the formula within the error limit of 5%. w and t are 180 nm and 10 nm, respectively. Thus it is confirmed that two major exposed surfaces of the nanobelts are terminated with the (101) facet.

Table 1 Experimental and calculated widths of one nanobelt tilted at different angles

	α	P_{exp}	P_{cal}
1	-47.4	126 nm	129 nm
2	-21.7	168 nm	171 nm
3	-2.3	180 nm	180 nm
4	2.1	180 nm	180 nm