

# Nano Photocatalytic Materials Design Toward Small Molecular Hydrocarbons Oxidation

Zhiguo Yi\*

Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou 350002, China

Corresponding Author. Email: [zhiguo@fjirsm.ac.cn](mailto:zhiguo@fjirsm.ac.cn)

Received: 11 May 2017, Accepted: 16 June 2017, Published Online: 28 October 2017

Citation Information: Zhiguo Yi, *Nano-Micro Conference*, 2017, 1, 01050 doi: 10.11605/cp.nmc2017.01050

## Abstract

The search for active catalysts that efficiently oxidize methane under ambient conditions remains a challenging task for both C1 utilization and atmospheric cleansing [1-6]. Here, we show that when the particle size of zinc oxide is reduced down to the nanoscale, it exhibits high activity for methane oxidation under simulated sunlight illumination, and nano silver decoration further enhances the photo-activity via the surface plasmon resonance. The high quantum yield of 8% at wavelengths <400 nm and over 0.1% at wavelengths ~470 nm achieved on the silver decorated zinc oxide nanostructures shows great promise for atmospheric methane oxidation. Moreover, the nano-particulate composites can efficiently photo-oxidize other small molecular hydrocarbons such as ethane, propane and ethylene, and in particular, can dehydrogenize methane to generate ethane, ethylene and so on. On the basis of the experimental results, a two-step photocatalytic reaction process is suggested to account for the methane photo-oxidation.

## References

- [1] Xuxing Chen; Yunpeng Li; Xiaoyang Pan; David Cortie; Xintang Huang; Zhiguo Yi, Photocatalytic oxidation of methane over silver decorated zinc oxide nanocatalysts. *Nature Communications*. 7, 12273 (2016). doi:10.1038/ncomms12273
- [2] Xiaoyang Pan; Xuxing Chen; Zhiguo Yi, Photocatalytic oxidation of methane over SrCO<sub>3</sub> decorated SrTiO<sub>3</sub> nanocatalysts via a synergistic effect. *Physical Chemistry Chemical Physics*. 18, 31400-31409 (2016). doi:10.1039/C6CP04604E
- [3] Yunpeng Li; Yuanzhu Cai; Xuxing Chen; Xiaoyang Pan; Mingxue Yang; Zhiguo Yi, Photocatalytic oxidation of small molecule hydrocarbons over Pt/TiO<sub>2</sub> nanocatalysts. *RSC Advances*. 6, 2760-2767 (2016). doi:10.1039/C5RA22459D
- [4] Peiqing Long; Yaohong Zhang; Xuxing Chen; Zhiguo Yi, Fabrication of Y<sub>x</sub>Bi<sub>1-x</sub>VO<sub>4</sub> solid solutions for efficient C<sub>2</sub>H<sub>4</sub> photodegradation. *Journal of Materials Chemistry A*. 3, 4163-4169 (2015). doi:10.1039/C4TA05872K
- [5] Dan Wang; Xiaoyang Pan; Guangtao Wang; Zhiguo Yi, Improved propane photooxidation activities upon nano Cu<sub>2</sub>O/TiO<sub>2</sub> heterojunction semiconductors at room temperature. *RSC Advances*. 5, 22038-22043 (2015). doi:10.1039/C4RA15215H
- [6] Xuxing Chen; Xintang Huang; Zhiguo Yi, Enhanced Ethylene Photodegradation Performance of g-C<sub>3</sub>N<sub>4</sub>-Ag<sub>3</sub>PO<sub>4</sub> Composites with Direct Z-Scheme Configuration. *Chemistry - A European Journal*. 20, 17590-17596 (2014). doi:10.1002/chem.201404284

## Open Access

This article is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

© The Author(s) 2017