



# Chinese Journal of Catalysis

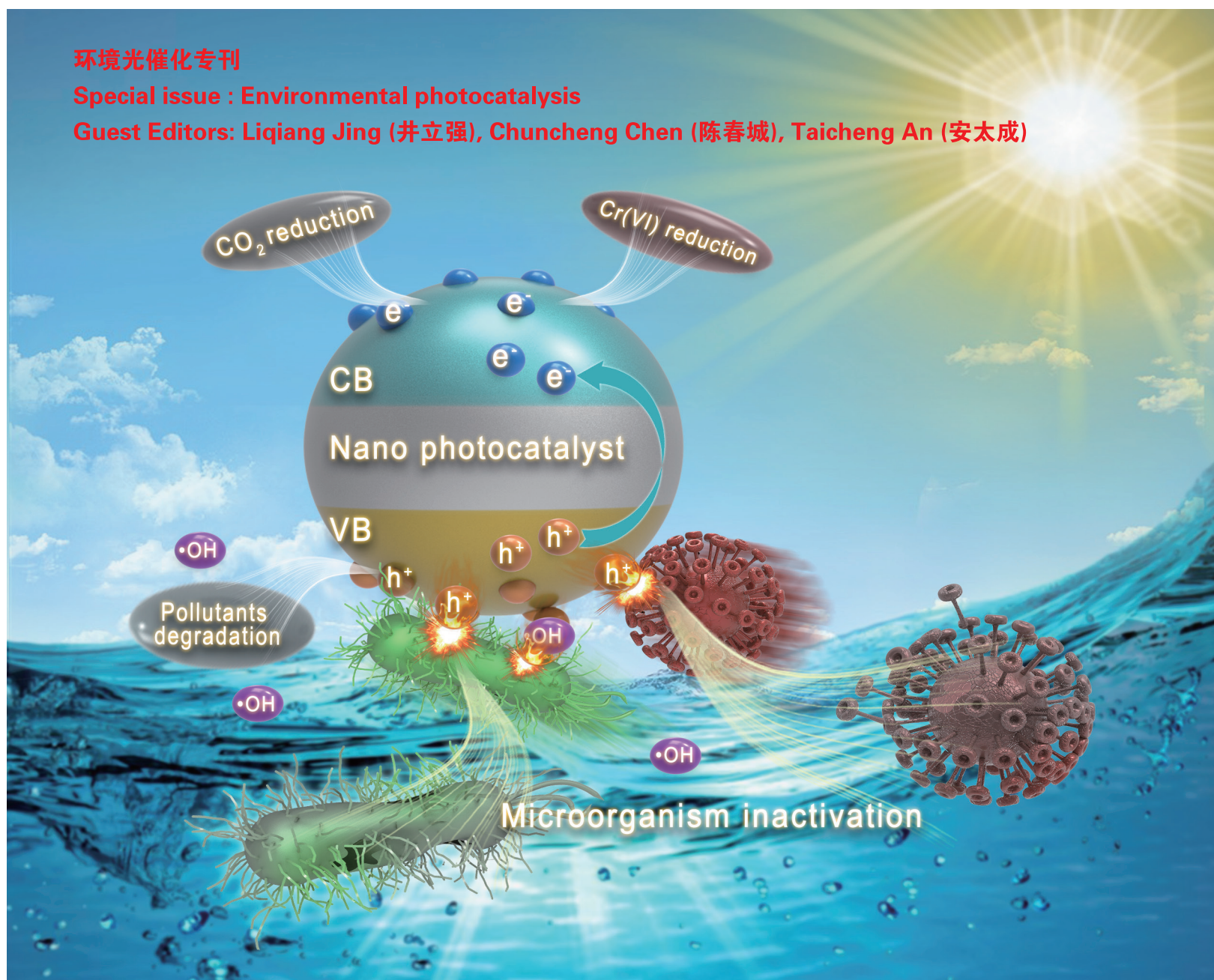
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环境光催化专刊

Special issue : Environmental photocatalysis

Guest Editors: Liqiang Jing (井立强), Chuncheng Chen (陈春城), Taicheng An (安太成)



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## Special issue: Environmental photocatalysis

Guest Editors: Liqiang Jing, Chun Cheng Chen, Taicheng An

## Chinese Journal of Catalysis

### Graphical Contents

### Editorial

*Chin. J. Catal.*, 2020, 41: 1439 doi: 10.1016/S1872-2067(20)63645-2

#### Preface to special issue: Environmental photocatalysis

Liqiang Jing, Chun Cheng Chen, Taicheng An

Heilongjiang University; Institute of Chemistry, Chinese Academy of Sciences; Guangdong University of Technology



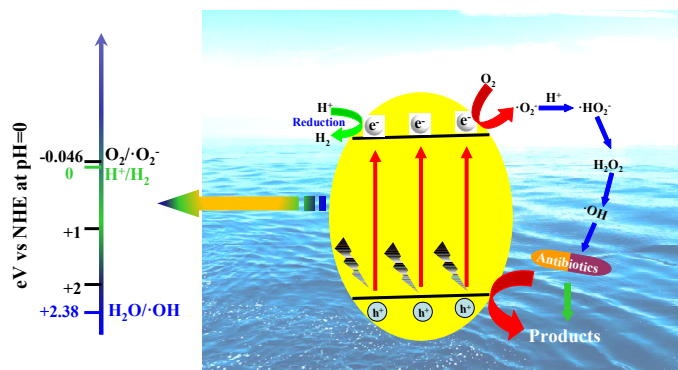
### Reviews

*Chin. J. Catal.*, 2020, 41: 1440–1450 doi: S1872-2067(19)63448-0

#### A review on photocatalysis in antibiotic wastewater: Pollutant degradation and hydrogen production

Zhidong Wei, Junying Liu, Wenfeng Shangguan \*

Shanghai Jiao Tong University



This mini-review concluded the recent development of photocatalysis in antibiotic wastewater, including degradation and regarded it as a kind of energy for producing hydrogen. Furthermore, some challenges and perspectives were also proposed.

*Chin. J. Catal.*, 2020, 41: 1451–1467 doi: 10.1016/S1872-2067(20)63594-X

### Effects of fluorine on photocatalysis

Xiaofang Li, Xiaofeng Wu, Shengwei Liu, Yuhan Li, Jiajie Fan, Kangle Lv\*

*South-Central University for Nationalities, China;*

*Wuhan University of Science and Technology, China;*

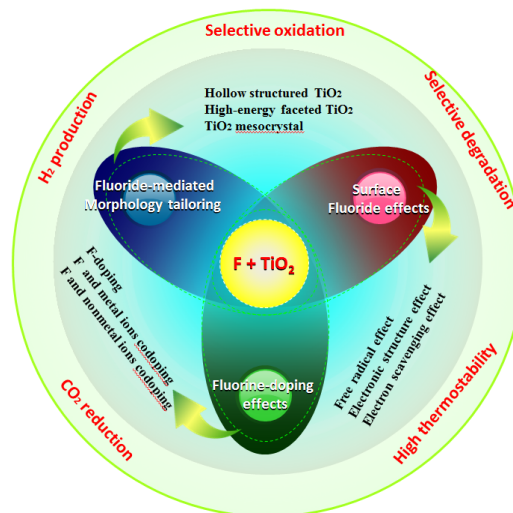
*Sun Yat-sen University, China;*

*Chongqing Technology and Business University, China;*

*Zhengzhou University, China;*

*Eindhoven University of Technology, The Netherlands*

The recent progress of fluorine effects in semiconductor photocatalysis is reviewed, including surface fluoride modification effect, fluorine doping effect and fluorine-induced morphology tailoring effect. The applications of fluorine effects in semiconductor photocatalysis are also summarized.



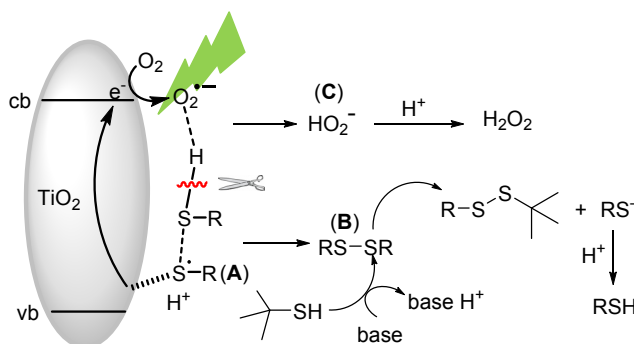
## Communications

*Chin. J. Catal.*, 2020, 41: 1468–1473 doi: 10.1016/S1872-2067(20)63640-3

### Visible-light photocatalytic selective aerobic oxidation of thiols to disulfides on anatase TiO<sub>2</sub>

Hui Xu, Ji-Long Shi, Shaoshuai Lyu, Xianjun Lang\*

*Wuhan University; Nankai University*



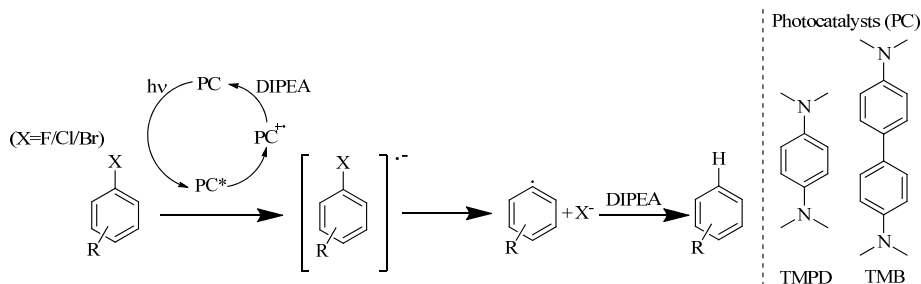
Surface complex formed between thiols and TiO<sub>2</sub> gives rise to visible-light photocatalytic activity, leading to excellent reaction activity, substrate scope, and functional group tolerance under 520 nm LED irradiation.

*Chin. J. Catal.*, 2020, 41: 1474–1479 doi: 10.1016/S1872-2067(20)63582-3

### Light-driven activation of carbon-halogen bonds by readily available amines for photocatalytic hydrodehalogenation

Di Meng, Qian Zhu, Yan Wei, Shengli Zhen, Ran Duan, Chuncheng Chen, Wenjing Song\*, Jincai Zhao

*Institute of Chemistry, Chinese Academy of Sciences; University of Chinese Academy of Sciences*



Photocatalytic system based on readily available amine sensitizers offers efficient hydrogenation of a variety of aromatic halides.

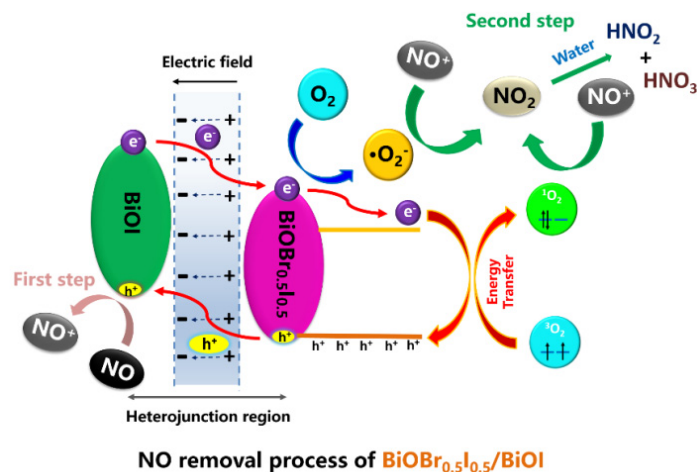


## Articles

*Chin. J. Catal.*, 2020, 41: 1480–1487 doi: 10.1016/S1872-2067(20)63607-5

### Molecular oxygen activation enhancement by $\text{BiOBr}_{0.5}\text{I}_{0.5}/\text{BiOI}$ utilizing the synergistic effect of solid solution and heterojunctions for photocatalytic NO removal

Mingpu Kou, Yu Deng, Rumeng Zhang, Li Wang, Po Keung Wong, Fengyun Su\*, Liqun Ye\*  
Nanyang Normal University; China Three Gorges University; The Chinese University of Hong Kong



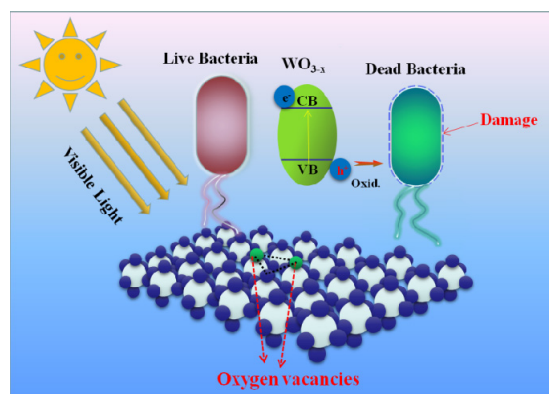
The synergistic effect of solid solution and heterojunction was used to enhance the ability of  $\text{BiOBr}_{0.5}\text{I}_{0.5}/\text{BiOI}$  to removal NO under visible light.

*Chin. J. Catal.*, 2020, 41: 1488–1497 doi: S1872-2067(19)63409-1

### Microwave-assisted synthesis of defective tungsten trioxide for photocatalytic bacterial inactivation: Role of the oxygen vacancy

Wenquan Gu, Wanjun Wang\*, Guiying Li, Haojing Xie, Po Keung Wong, Taicheng An  
Guangdong University of Technology; The Chinese University of Hong Kong

Bacterial inactivation occurs via a direct  $\text{h}^+$  oxidation pathway, in which oxygen vacancy not only promotes the interfacial charge separation but also tunes the band structure to increase the  $\text{h}^+$  oxidation power.

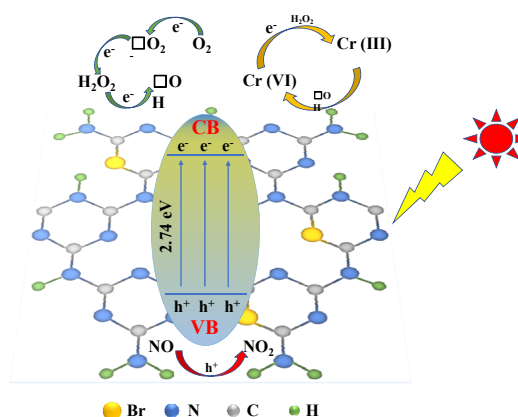


*Chin. J. Catal.*, 2020, 41: 1498–1510 doi: S1872-2067(19)63435-2

### Br-doping of g- $\text{C}_3\text{N}_4$ towards enhanced photocatalytic performance in $\text{Cr(VI)}$ reduction

Mian Wang, Yubin Zeng\*, Guohui Dong\*, Chuanyi Wang\*  
Wuhan University; Shaanxi University of Science and Technology

Br-doped g- $\text{C}_3\text{N}_4$  exhibits improved photocatalytic activity for  $\text{Cr(VI)}$  reduction under visible light irradiation. The Br element was intercalated into g- $\text{C}_3\text{N}_4$  to form C-Br bonds, and photogenerated  $\text{e}^-$ ,  $\cdot\text{OH}$ , and  $\text{H}_2\text{O}_2$  play important roles in  $\text{Cr(VI)}$  reduction.





*Chin. J. Catal.*, 2020, 41: 1511–1521 doi: S1872-2067(19)63525-4

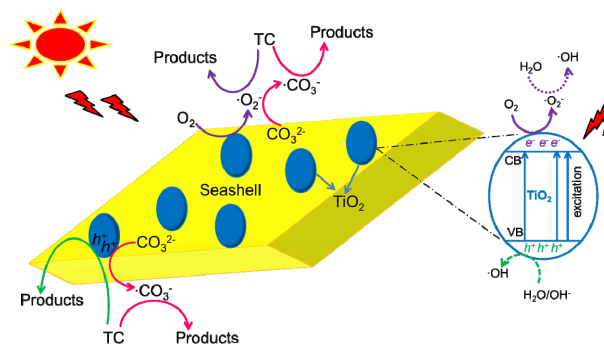
### Significant role of carbonate radicals in tetracycline hydrochloride degradation based on solar light-driven $\text{TiO}_2$ -seashell composites: Removal and transformation pathways

Jiaqi Wang, Qingrong Qian, Qinghua Chen, Xin-Ping Liu, Yongjin Luo, Hun Xue\*, Zhaohui Li\*

Fujian Normal University;

Fuqing Branch of Fujian Normal University; Fuzhou University

Novel  $\text{TiO}_2$ -seashell composites were successfully fabricated via a sol-gel method and benefited from the activity of  $\cdot\text{CO}_3^{\cdot-}$  radicals generated under solar light irradiation. The  $\text{TiO}_2$ -seashell composite exhibited enhanced performance in the photodegradation of tetracycline hydrochloride.

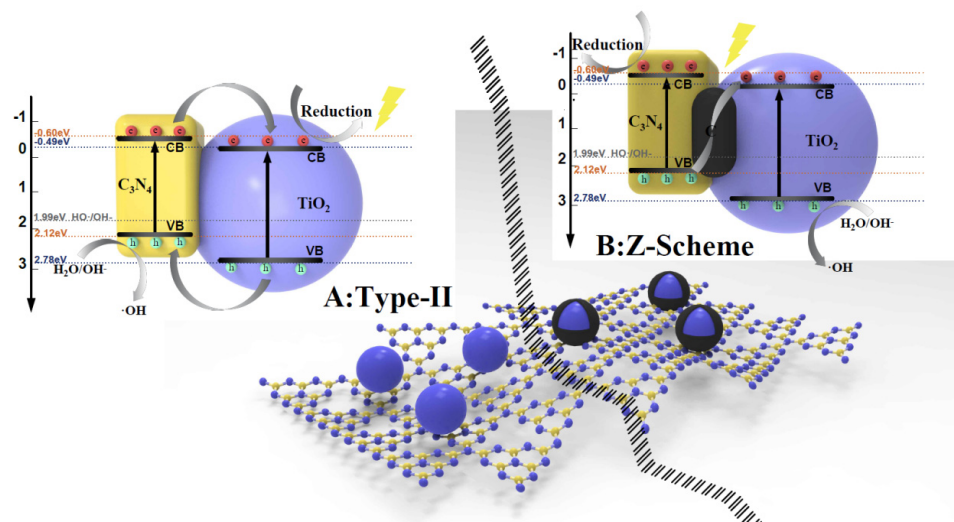


*Chin. J. Catal.*, 2020, 41: 1522–1534 doi: S1872-2067(19)63495-9

### Experimental method to explore the adaptation degree of type-II and all-solid-state Z-scheme heterojunction structures in the same degradation system

Zheao Huang, Shuo Zhao, Ying Yu\*

Central China Normal University



The all-solid-state Z-scheme semiconductor  $\text{TiO}_2$ - $\text{C}_3\text{N}_4$  and type-II heterojunction semiconductor photocatalyst  $\text{TiO}_2$ - $\text{C}_3\text{N}_4$  were fabricated for comparison. Different photocatalysis mechanisms for the two photocatalysts were determined experimentally, which shed light on the design of a highly efficient photocatalyst for different degradation systems.

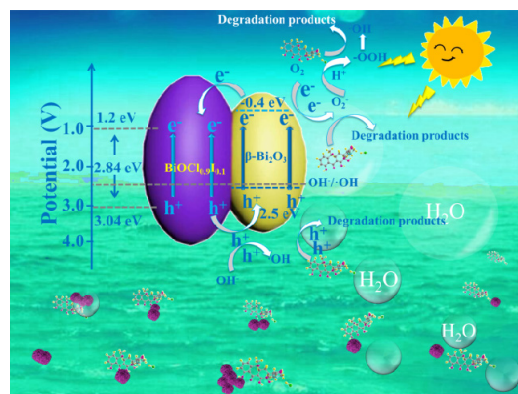
*Chin. J. Catal.*, 2020, 41: 1535–1543 doi: S1872-2067(19)63486-8

### Preparation of $\text{BiOCl}_{0.9}\text{I}_{0.1}/\beta\text{-Bi}_2\text{O}_3$ composite for degradation of tetracycline hydrochloride under simulated sunlight

Xiong Ma, Kaiyi Chen, Bin Niu, Yan Li, Lei Wang, Jingwei Huang, Houde She, Qizhao Wang\*

Chang'an University; Northwest Normal University

$\beta\text{-Bi}_2\text{O}_3$  and element-doped  $\text{BiOCl}_{0.9}\text{I}_{0.1}$  were combined to construct a  $\text{BiOCl}_{0.9}\text{I}_{0.1}/\beta\text{-Bi}_2\text{O}_3$  composite catalyst; compared with those of the pure  $\beta\text{-Bi}_2\text{O}_3$ ,  $\text{BiOCl}_{0.9}\text{I}_{0.1}$  catalysts, the efficiency of the composite catalyst toward tetracycline hydrochloride degradation was significantly enhanced under simulated sunlight.

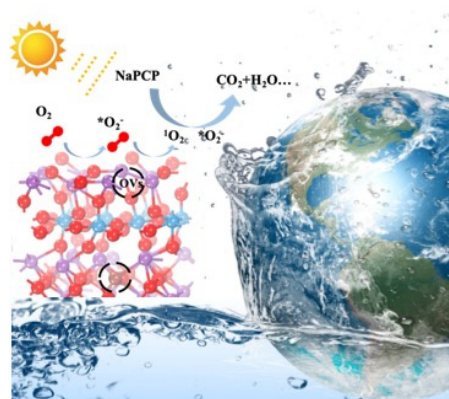


*Chin. J. Catal.*, 2020, 41: 1544–1553 doi: S1872-2067(19)63506-0

### Iodine-doping-assisted tunable introduction of oxygen vacancies on bismuth tungstate photocatalysts for highly efficient molecular oxygen activation and pentachlorophenol mineralization

Shengyao Wang, Zhongliang Xiong, Nan Yang, Xing Ding \*, Hao Chen \*  
Huazhong Agricultural University, China

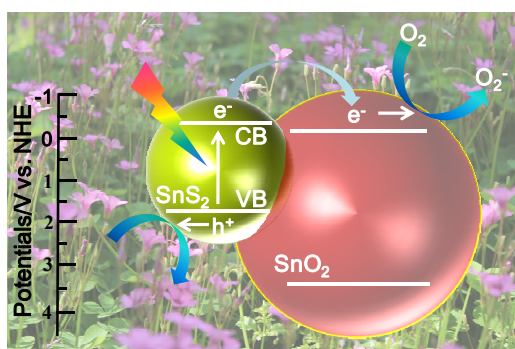
By adjusting the iodine dopants in  $\text{Bi}_2\text{WO}_6$ , a high density of oxygen vacancies was introduced through homogeneous iodine doping, which remarkably enhanced the molecular oxygen activation and pentachlorophenol mineralization under visible light irradiation.



*Chin. J. Catal.*, 2020, 41: 1554–1563 doi: S1872-2067(19)63498-4

### In-situ fabrication $\text{SnO}_2/\text{SnS}_2$ heterostructure for boosting the photocatalytic degradation of pollutants

Ying Liu, Donglai Pan, Mingwen Xiong \*, Ying Tao, Xiaofeng Chen, Dieqing Zhang, Yu Huang, Guisheng Li \*  
Shanghai Normal University; Bengbu University; Institute of Earth Environment, CAS

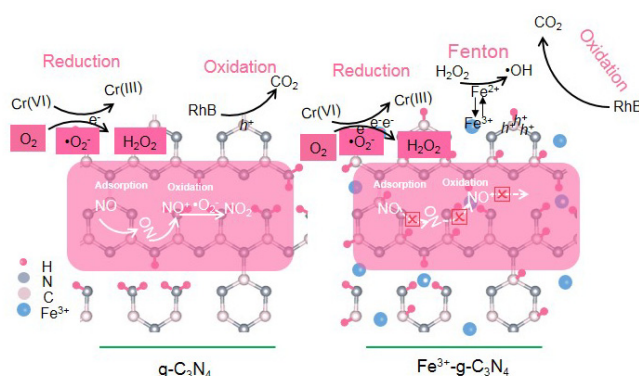


An *in-situ* fabrication  $\text{SnO}_2/\text{SnS}_2$  photocatalyst was obtained with a tight-contact heterostructure. Owing to the rapid carrier transportation ability and heterostructure, the as-prepared samples displayed optimal photocatalytic performance for organic pollutant degradation. Moreover, EIS Bode plots indicated the longest carrier lifetime for such prepared  $\text{SnO}_2/\text{SnS}_2$  heterostructure photocatalysts.

*Chin. J. Catal.*, 2020, 41: 1564–1572 doi: S1872-2067(19)63518-7

### The photocatalytic performance and active sites of $\text{g-C}_3\text{N}_4$ effected by the coordination doping of $\text{Fe(III)}$

Guimei Liu, Guohui Dong \*, Yubin Zeng \*, Chuanyi Wang \*  
Wuhan University; Shaanxi University of Science and Technology

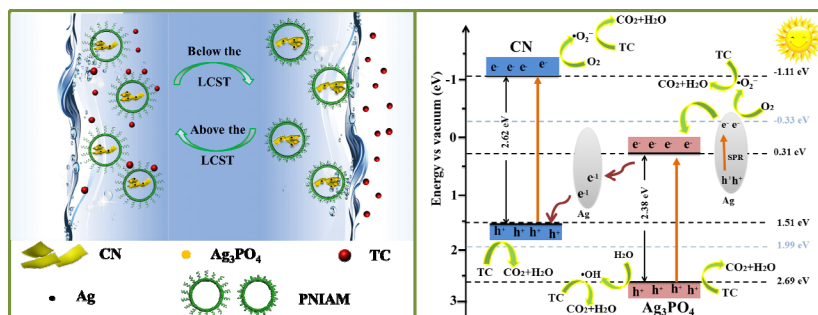


The coordination doping of  $\text{Fe(III)}$  could enhance the photo-redox activity of  $\text{g-C}_3\text{N}_4$ , but the active site of  $\text{NO}$  removal was passivated by  $\text{Fe(III)}$ .

*Chin. J. Catal.*, 2020, 41: 1573–1588 doi: 10.1016/S1872-2067(20)63554-9

### Thermo-responsive functionalized PNIPAM@Ag/Ag<sub>3</sub>PO<sub>4</sub>/CN-heterostructure photocatalyst with switchable photocatalytic activity

Linlin Sun, Yaju Zhou, Xin Li, Jinze Li, Dong Shen, Shikang Yin, Huiqin Wang, Pengwei Huo \*, Yongsheng Yan  
Jiangsu University

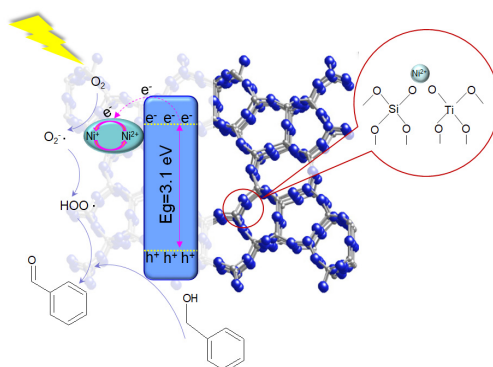


The PNIPAM@Ag/Ag<sub>3</sub>PO<sub>4</sub>/CN photocatalyst exhibits a response to the degradation process under ambient temperature. The Z-scheme heterostructure and plasma resonance effect of the Ag nanoparticles achieve effective separation of the electrons and holes under visible-light irradiation.

*Chin. J. Catal.*, 2020, 41: 1589–1602 doi: 10.1016/S1872-2067(20)63555-0

### Synthesis of Ni<sup>2+</sup> cation modified TS-1 molecular sieve nanosheets as effective photocatalysts for alcohol oxidation and pollutant degradation

Imran Khan, Xiaoyu Chu, Yanduo Liu, Salman Khan, Linlu Bai \*, Liqiang Jing \*  
Heilongjiang University; Harbin University of Science and Technology; Dalian University of Technology



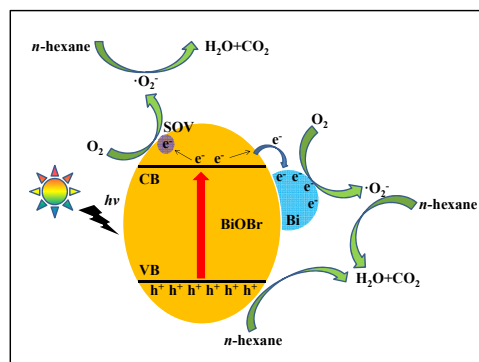
This work demonstrates that Ni<sup>2+</sup>-modified TS-1 molecular sieve nanosheets are an effective photocatalysts for selective aerobic alcohol oxidation and pollutant degradation. Their excellent photoactivity is attributed mainly to their greatly improved charge separation and the introduction of Ni<sup>2+</sup> catalytic sites for activating O<sub>2</sub> as the oxidant. This work opens the way to a class of highly selective, robust, and low-cost titanasilicate molecular sieve-based photocatalysts with industrial potential for selective oxidative transformations and pollutant degradation.

*Chin. J. Catal.*, 2020, 41: 1603–1612 doi: 10.1016/S1872-2067(19)63496-0

### In-situ decoration of metallic Bi on BiOBr with exposed (110) facets and surface oxygen vacancy for enhanced solar light photocatalytic degradation of gaseous *n*-hexane

Qingqing Yu, Jiangyao Chen \*, Yanxu Li, Meicheng Wen, Hongli Liu,  
Guiying Li, Taicheng An  
Guangdong University of Technology;  
Synergy Innovation Institute of GDUT

Bi/BiOBr composite displayed an excellent solar light photocatalytic degradation activity toward gaseous *n*-hexane owing to improved charge separation and strong formation of active species at the exposed (110) facets and surface oxygen vacancy obtained on BiOBr after doping with Bi.



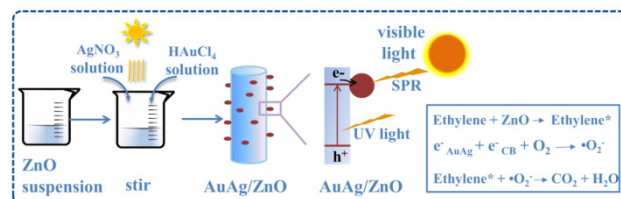


*Chin. J. Catal.*, 2020, 41: 1613–1621 doi: S1872-2067(19)63473-X

### ZnO nanorod decorated by Au-Ag alloy with greatly increased activity for photocatalytic ethylene oxidation

Huishan Zhai, Xiaolei Liu, Zeyan Wang, Yuanyuan Liu, Zhaoke Zheng, Xiaoyan Qin, Xiaoyang Zhang, Peng Wang\*, Baibiao Huang\*  
Shandong University

Au-Ag alloy NPs were loaded on ZnO by photo-deposition procedure with high photocatalytic activity and stability, which can be ascribed to efficient visible light absorption by AuAg alloy NPs and synergistic effects of LSPR excitation.

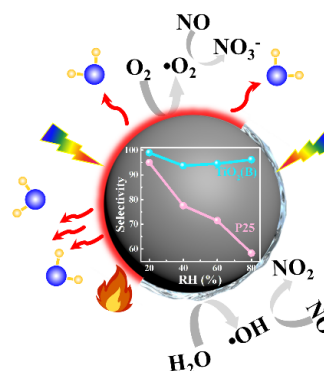


*Chin. J. Catal.*, 2020, 41: 1622–1632 doi: S1872-2067(19)63508-4

### High-humidity tolerance of porous TiO<sub>2</sub>(B) microspheres in photothermal catalytic removal of NO<sub>x</sub>

He Ma, Changhua Wang\*, Songmei Li, Xintong Zhang#, Yichun Liu  
Northeast Normal University

The photothermal catalytic activity of TiO<sub>2</sub>(B) is superior to its photocatalytic activity at elevated temperatures. Moreover, the photothermal catalytic activity of TiO<sub>2</sub>(B) is higher than that of P25. The superior activity of TiO<sub>2</sub>(B) becomes more evident at high RH levels.

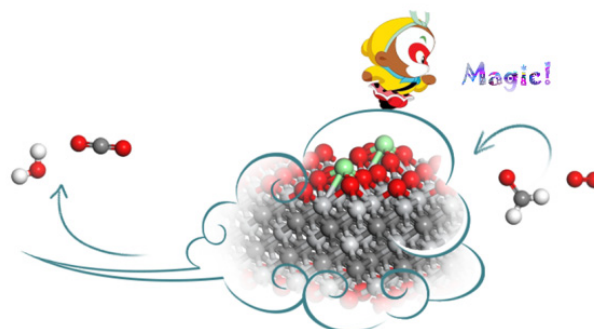


*Chin. J. Catal.*, 2020, 41: 1633–1644 doi: 10.1016/S1872-2067(20)63571-9

### Density functional theory calculations on single atomic catalysis: Ti-decorated Ti<sub>3</sub>C<sub>2</sub>O<sub>2</sub> monolayer (MXene) for HCHO oxidation

Junhui Zhou, Guanlan Liu, Quanguo Jiang, Weina Zhao, Zhimin Ao\*, Taicheng An  
Guangdong University of Technology; Hohai University

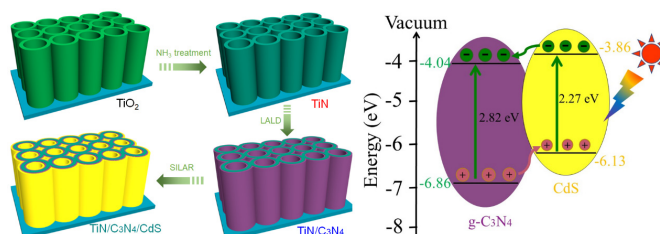
Formaldehyde, a common indoor air pollutant, which can be magically oxidized to H<sub>2</sub>O and CO<sub>2</sub> molecules on a single atomic catalyst (SAC), Ti-decorated Ti<sub>3</sub>C<sub>2</sub>O<sub>2</sub> (MXene) monolayer, at low temperature based on density functional theory study.



*Chin. J. Catal.*, 2020, 41: 1645–1653 doi: S1872-2067(19)63512-6

### Facile synthesis and photoelectrochemical properties of novel TiN/C<sub>3</sub>N<sub>4</sub>/CdS nanotube core/shell arrays

Changzhi Ai, Li Tong, Zhipeng Wang, Xidong Zhang, Guizhen Wang, Shengjue Deng, Jin Li\*, Shiwei Lin\*  
Hainan University; Zhejiang University



A novel TiN/C<sub>3</sub>N<sub>4</sub>/CdS nanotube arrays core/shell structure was successfully synthesized by liquid atomic layer deposition and successive ionic layer adsorption reaction methods and shows the excellent photoelectrocatalytic performance due to the increased light absorption and effective separation of electron-hole pairs.

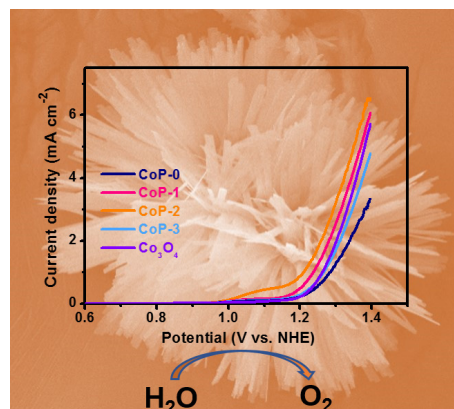
*Chin. J. Catal.*, 2020, 41: 1654–1662 doi: S1872-2067(19)63513-8

### Hierarchical cobalt phenylphosphonate nanothorn flowers for enhanced electrocatalytic water oxidation at neutral pH

Mei-Rong Liu, Yang-Peng Lin, Kai Wang, Shumei Chen \*, Fei Wang, Tianhua Zhou \*

Fuzhou University; Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences; Sichuan Normal University

The 3D hierarchical cobalt phenylphosphonate nanothorn flower by a facile hydrothermal synthesis shows an excellent water oxidation performance at neutral pH.

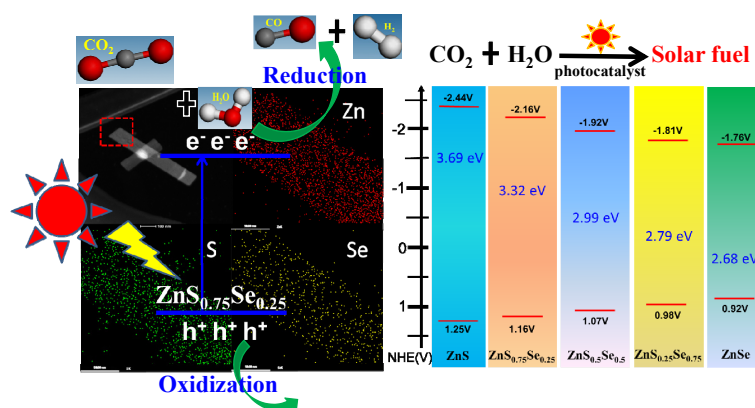


*Chin. J. Catal.*, 2020, 41: 1663–1673 doi: 10.1016/S1872-2067(20)63537-9

### Composition-tunable ZnS<sub>1-x</sub>Se<sub>x</sub> nanobelt solid solutions for efficient solar-fuel production

Pan Li, Sajjad Hussain, Lu Li, Lingju Guo, Tao He \*

CAS Center for Excellence in Nanoscience, National Center for Nanoscience and Technology; University of Chinese Academy of Sciences



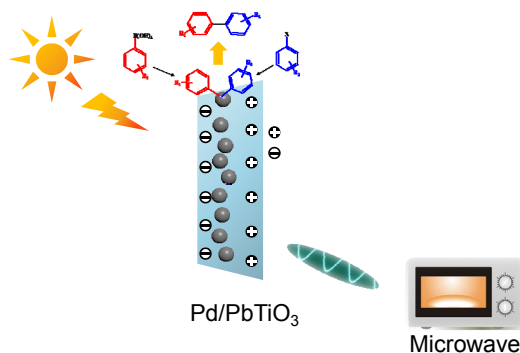
Composition-tunable ZnS<sub>1-x</sub>Se<sub>x</sub> nanobelt solid solutions are prepared by solvothermal method, which can exhibit enhanced photocatalytic activity for solar-fuel production, mainly dependent on the balance between effective light harvesting and adequate alignment of energy levels.

*Chin. J. Catal.*, 2020, 41: 1674–1681 doi: 10.1016/S1872-2067(20)63581-1

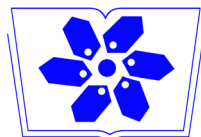
### Pyroelectricity effect on photoactivating palladium nanoparticles in PbTiO<sub>3</sub> for Suzuki coupling reaction

Jieya Wen, Lili Ling, Yao Chen, Zhenfeng Bian \*

Shanghai Normal University; Shanghai University of Electric Power



The pyroelectric effect of PbTiO<sub>3</sub> crystal promotes organic reaction and enhances reactivity under the action of microwave field and ultraviolet light. The effect of microwave on the catalyst was studied by performing the model Suzuki coupling reaction with bromobenzene.



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## 环境光催化专刊

客座主编：井立强，陈春城，安太成

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