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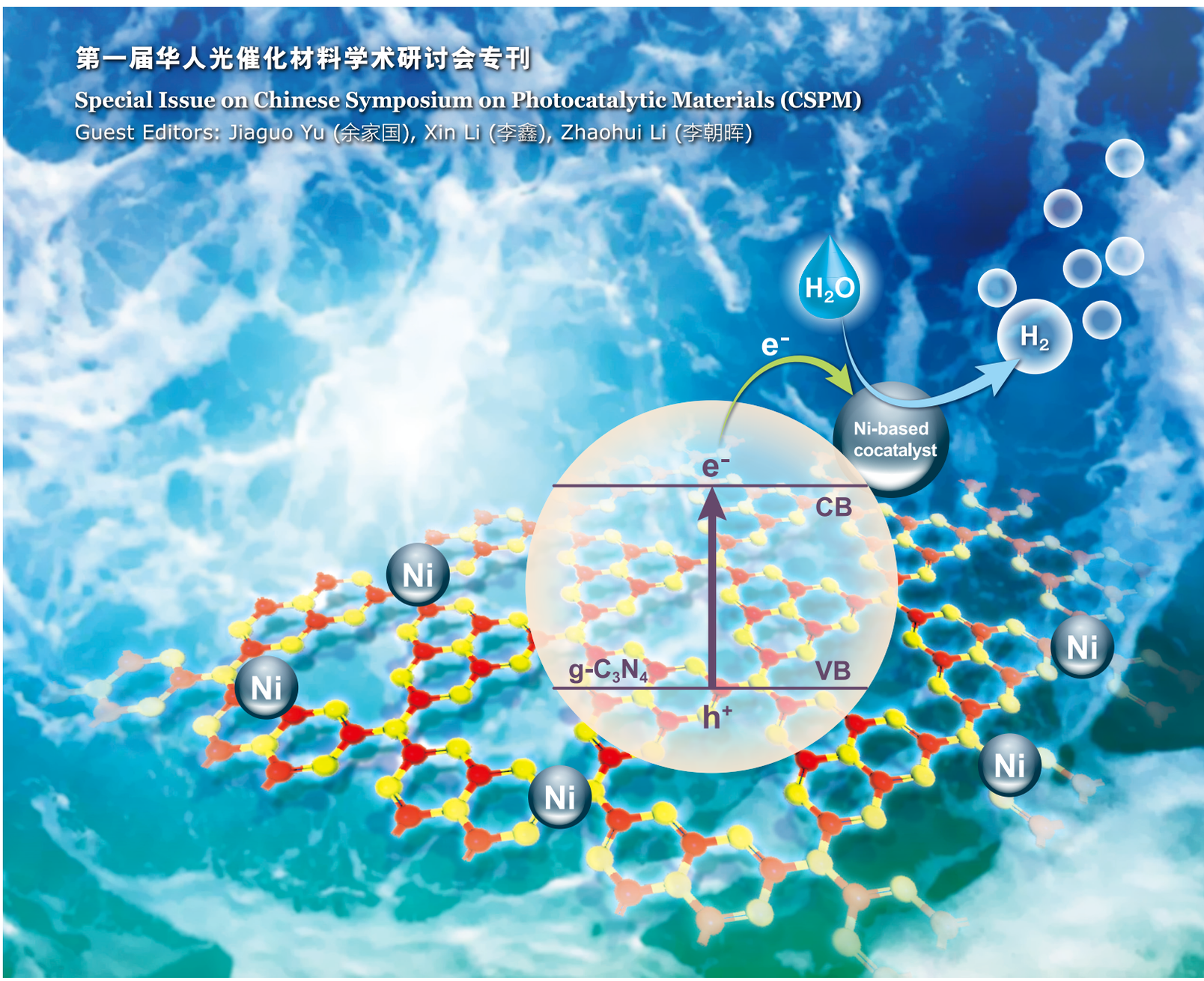
第一届华人光催化材料学术研讨会专刊

Special Issue on Chinese Symposium on Photocatalytic Materials (CSPM)

Guest Editors: Jiaguo Yu (余家国), Xin Li (李鑫), Zhaohui Li (李朝晖)



催化学报 CHINESE JOURNAL OF CATALYSIS March 2019 Vol. 40 No. 3 pages 239–476

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In This Issue

Cover: Li and coworkers comprehensively reviewed the advances in the promising and appealing low-cost Ni-based H_2-generation cocatalysts. Specific emphasis was placed on the fundamentals, design principle, roles, challenges and mechanism insights. Especially, four kinds of modification strategies based on increased light harvesting, enhanced charge separation, strengthened interface interaction, improved electrocatalytic activity were discussed. Read more about the article behind the cover on pages 240–288.

封面: 李鑫等综述了Ni基助催化剂的光催产氢研究进展. 系统地总结了Ni基助催化剂的本质、设计规则、作用、挑战以及机理研究, 尤其是从增加光捕获、载流子分离、界面相互作用及电催化活性四个方面对提高产氢助催化剂活性的改性策略进行了详细的总结. 见本期第240–288页.

About the Journal

Chinese Journal of Catalysis is an international journal published monthly by Chinese Chemical Society, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, and Elsevier. The journal publishes original, rigorous, and scholarly contributions in the fields of heterogeneous and homogeneous catalysis in English or in both English and Chinese. The scope of the journal includes:

- New trends in catalysis for applications in energy production, environmental protection, and production of new materials, petroleum chemicals, and fine chemicals;
- Scientific foundation for the preparation and activation of catalysts of commercial interest or their representative models;
- Spectroscopic methods for structural characterization, especially methods for in situ characterization;
- New theoretical methods of potential practical interest and impact in the science and applications of catalysis and catalytic reaction;
- Relationship between homogeneous and heterogeneous catalysis;
- Theoretical studies on the structure and reactivity of catalysts.
- The journal also accepts contributions dealing with photo-catalysis, bio-catalysis, and surface science and chemical kinetics issues related to catalysis.

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- ***Communications*** rapidly report studies with significant innovation and major academic value. They are limited to four Journal pages. After publication, their full-text papers can also be submitted to this or other journals.
- ***Articles*** are original full-text reports on innovative, systematic and completed research on catalysis.
- ***Highlights*** describe and comment on very important new results in the original research of a third person with a view to highlight their significance. The results should be presented clearly and concisely without the comprehensive details required for an original article.
- ***Perspectives*** are short reviews of recent developments in an established or developing topical field. The authors should offer a critical assessment of the trend of the field, rather than a summary of literatures.
- ***Viewpoints*** describe the results of original research in general in some area, with a view to highlighting the progress, analyzing the major problems, and commenting the possible research target and direction in the future.

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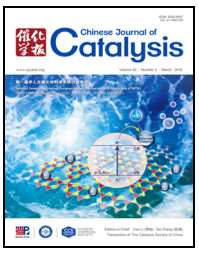

Special Issue on Chinese Symposium on Photocatalytic Materials (CSPM)

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Chinese Journal of Catalysis

Graphical Contents

Editorial

Chin. J. Catal., 2019, 40: 239 doi: S1872-2067(19)63308-5

Preface to Special Issue on Chinese Symposium on Photocatalytic Materials (CSPM)

Jiaguo Yu, Xin Li, Zhaohui Li

Wuhan University of Technology; South China Agricultural University; Fuzhou University

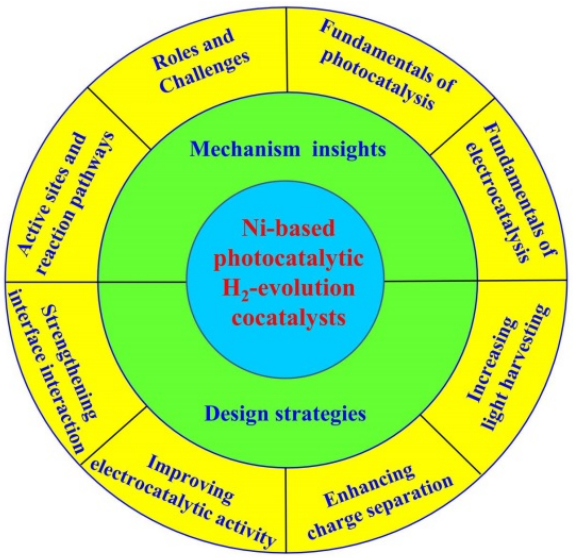
Reviews

Chin. J. Catal., 2019, 40: 240–288 doi: S1872-2067(19)63294-8

Ni-based photocatalytic H_2-production cocatalysts

Rongchen Shen, Jun xie, Quanjun Xiang *, Xiaobo Chen *, Jizhou Jiang, Xin Li *

South China Agricultural University, China;
University of Electronic Science and Technology of China, China;
University of Missouri – Kansas City, USA;
Wuhan Institute of Technology, China

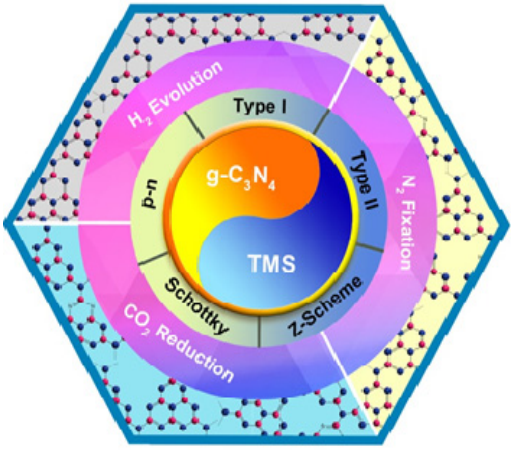


The fundamentals of photocatalysis and electrocatalysis, roles and challenges, active sites and reaction pathways, and different design strategies are summarized to offer a conceptual basis for designing and developing highly efficient Ni-based photocatalytic H_2-evolution cocatalysts.

Chin. J. Catal., 2019, 40: 289–319 doi: S1872-2067(19)63293-6

Interfacial engineering of graphitic carbon nitride (g-C_3N_4)-based metal sulfide heterojunction photocatalysts for energy conversion: A review

Yijie Ren, Deqian Zeng *, Wee-Jun Ong *
Xiamen University Malaysia, Malaysia;
Guangxi University, China;
Xiamen University, China



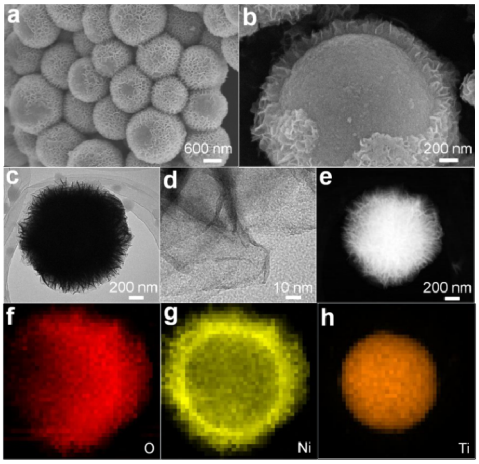
This review presents recent developments of g-C_3N_4-based metal sulfide heterojunction photocatalysts for the energy conversion. The state-of-the-art advancement of this emerging g-C_3N_4 field from the aspects of fabrication and charge separation will be elucidated.

Communication

Chin. J. Catal., 2019, 40: 320–325 doi: 10.1016/S1872-2067(18)63169-9

3D flower-like heterostructured TiO_2@Ni$(OH)_2$ microspheres for solar photocatalytic hydrogen production

Wei Zhang, Hongwen Zhang, Jianzhong Xu *, Huaqiang Zhuang *, Jinlin Long *
Hebei University;
Fuzhou University;
Quanzhou Normal University



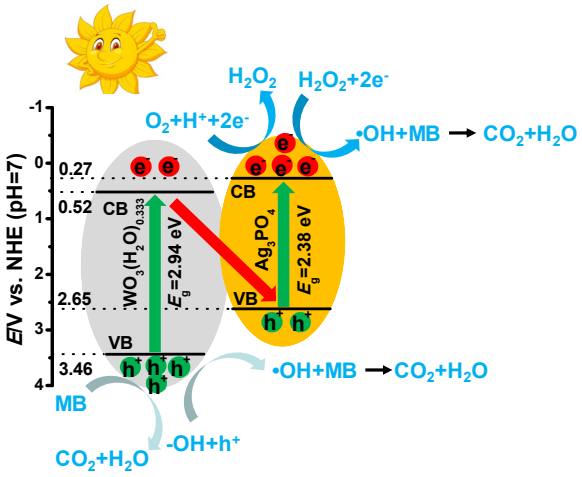
We report a solvothermal approach combined with an oil-bath-based chemical synthesis to prepare a 3D flower-like TiO_2@Ni$(OH)_2$ core-shell heterostructure, which results in a six-fold enhancement in the hydrogen production rate.

Articles

Chin. J. Catal., 2019, 40: 326–334 doi: 10.1016/S1872-2067(18)63165-1

Preparation of Z-scheme $WO_3(H_2O)_{0.333}$/Ag_3PO_4 composites with enhanced photocatalytic activity and durability

Zhen Li, Xia Wang, Jinfeng Zhang *, Changhao Liang, Luhua Lu, Kai Dai *
Huaibei Normal University; Institute of Solid State Physics, Chinese Academy of Sciences; Botou Vocational College; University of Geosciences

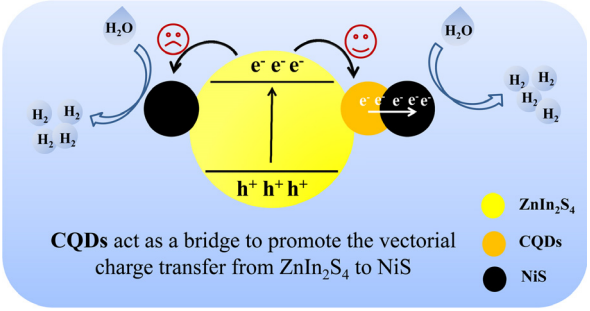


A Z-scheme $WO_3(H_2O)_{0.333}$/Ag_3PO_4 composite with enhanced photocatalytic activity and durability is successfully constructed. Under visible light irradiation, electron-hole pairs are generated on the surfaces of Ag_3PO_4 and $WO_3(H_2O)_{0.333}$. The photo-induced electrons of $WO_3(H_2O)_{0.333}$ are transferred to the CB interface of Ag_3PO_4. Under the action of holes, –OH reacts with h^+ to produce ·OH, and ·OH reacts with contaminants to form CO_2 and H_2O. Meantime, a great deal of H^+ and O_2 react with electrons to generate H_2O_2 at the conduction band interface of Ag_3PO_4. After that, H_2O_2 reacts with electrons to generate ·OH, and ·OH reacts with MB to form CO_2 and H_2O.

Chin. J. Catal., 2019, 40: 335–342 doi: 10.1016/S1872-2067(18)63159-6

Rational design of ternary NiS/CQDs/$ZnIn_2S_4$ nanocomposites as efficient noble-metal-free photocatalyst for hydrogen evolution under visible light

Bingqing Wang, Yao Ding, Zirong Deng, Zhaohui Li *
Fuzhou University



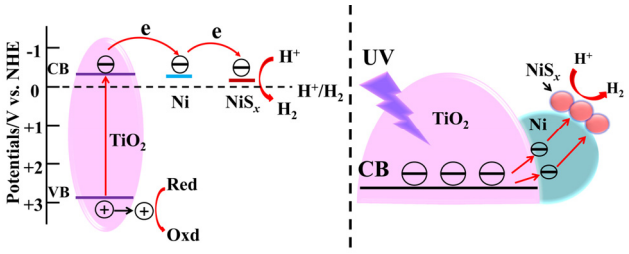
CQDs act as a bridge to promote the charge transfer from $ZnIn_2S_4$ to NiS in the ternary NiS/CQDs/$ZnIn_2S_4$ nanocomposite.

Chin. J. Catal., 2019, 40: 343–351 doi: 10.1016/S1872-2067(18)63157-2

Ni nanoparticles as electron-transfer mediators and NiS_x as interfacial active sites for coordinative enhancement of H_2-evolution performance of TiO_2

Ping Wang, Shunqiu Xu, Feng Chen, Huogen Yu *
Wuhan University of Technology

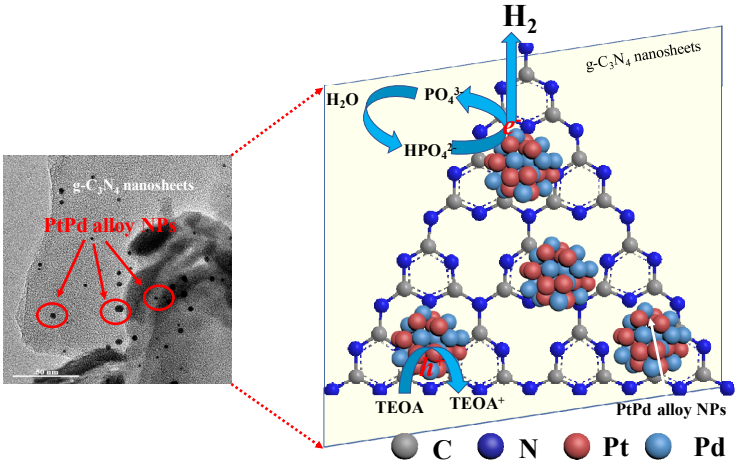
The TiO_2/Ni-NiS_x photocatalyst exhibited enhanced H_2-evolution performance due to the excellent synergistic effect of Ni nanoparticles as electron-transfer mediators and NiS_x as interfacial active sites to promote H_2 evolution.



Chin. J. Catal., 2019, 40: 352–361 doi: 10.1016/S1872-2067(18)63180-8

Novel PtPd alloy nanoparticle-decorated g-C_3N_4 nanosheets with enhanced photocatalytic activity for H_2 evolution under visible light irradiation

Nan Xiao, Songsong Li, Shuang Liu, Boran Xu, Yandong Li, Yangqin Gao, Lei Ge *, Guiwu Lu
China University of Petroleum Beijing

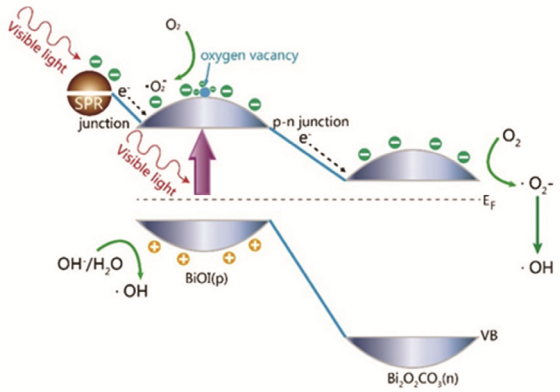


PtPd/g-C_3N_4 photocatalysts were used as a photosensitizer and coupled with PtPd alloy nanoparticles for photocatalytic H_2 production under visible light. The H_2 production rate was ~800 times higher than with pure g-C_3N_4. This enhancement is probably due to a semiconductor/co-catalyst interface interaction between the PtPd alloy nanoparticles and the g-C_3N_4 nanosheets that increases the charge transfer process efficiency.

Chin. J. Catal., 2019, 40: 362–370 doi: 10.1016/S1872-2067(18)63187-0

A Bi/BiOI/$(BiO)_2CO_3$ heterostructure for enhanced photocatalytic NO removal under visible light

Yanjuan Sun *, Jiazhen Liao, Fan Dong, Sujuan Wu, Lidong Sun *
Chongqing University; Chongqing Technology and Business University; University of Electronic Science and Technology of China

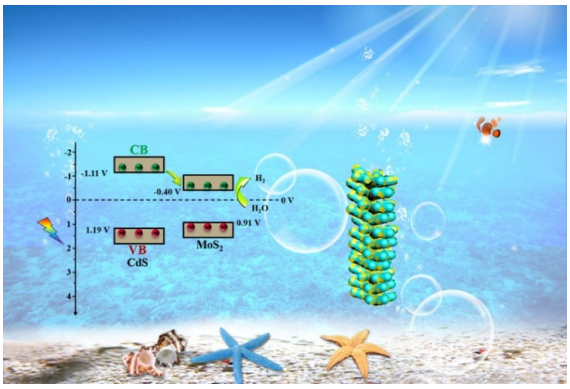


Photoexcited electrons spontaneously migrate through the heterojunction from Bi to OV-BiOI and then to $(BiO)_2CO_3$ under the driving force of the energy difference between the dual heterojunction. The holes remain in the VB of BiOI, and the electrons on the CB of $(BiO)_2CO_3$ react with O_2 to produce $\bullet O_2^-$ radicals. The residual holes in the VB of OV-BiOI react with the OH^- to produce •OH radicals.

Chin. J. Catal., 2019, 40: 371–379 doi: 10.1016/S1872-2067(18)63178-X

One-pot hydrothermal synthesis of willow branch-shaped MoS_2/CdS heterojunctions for photocatalytic H_2 production under visible light irradiation

Zhen-Wei Zhang, Qiu-Hao Li, Xiu-Qing Qiao *, Dongfang Hou, Dong-Sheng Li *
China Three Gorges University

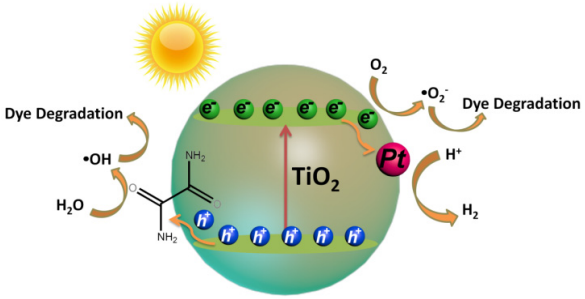


Novel willow branch-shaped MoS_2/CdS heterojunctions synthesized via a one-pot hydrothermal method show excellent photocatalytic H_2 evolution activity.

Chin. J. Catal., 2019, 40: 380–389 doi: 10.1016/S1872-2067(18)63166-3

Accelerating photocatalytic hydrogen evolution and pollutant degradation by coupling organic co-catalysts with TiO_2

Jun Shen, Rui Wang, Qinqin Liu *, Xiaofei Yang, Hua Tang, Jin Yang
Suzhou Vocational Health College; Jiangsu University; Nanjing Forestry University

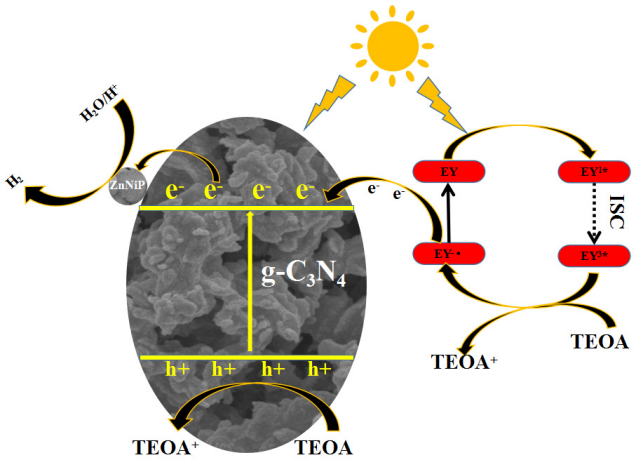


An organic molecule, oxamide, is utilized as a co-catalyst to enhance the photocatalytic H_2 evolution and dye-degradation performance of TiO_2 nanosheets. Oxamide, which has a unique π-conjugated structure, can provide hole-transfer sites and thus greatly promote the separation and transfer of photo-generated electron-hole pairs in TiO_2.

Chin. J. Catal., 2019, 40: 390–402 doi: 10.1016/S1872-2067(18)63173-0

Controllable design of Zn-Ni-P on g-C_3N_4 for efficient photocatalytic hydrogen production

Yanbing Li, Zhiliang Jin *, Lijun Zhang, Kai Fan
North Minzu University

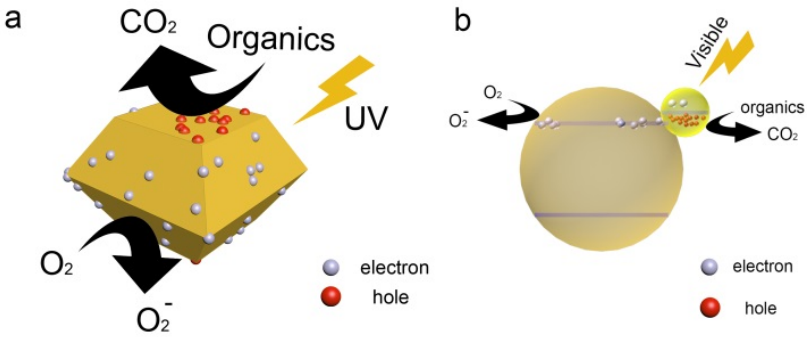


The existence of Zn-Ni-P was the main reason for the efficient electronic separation and transmission observed in Zn-Ni-P@g-C_3N_4, which could accelerate the rapid transfer of electrons and the depletion of holes through the sacrificial reagent TEOA. Thus, the recombination of the photoelectrons and photoholes was inhibited, and the photocatalytic activity was enhanced.

Chin. J. Catal., 2019, 40: 403–412 doi: 10.1016/S1872-2067(18)63174-2

Effects of crystallinity, {001}/{101} ratio, and Au decoration on the photocatalytic activity of anatase TiO_2 crystals

Jiangyan Wang, Baoshun Liu *, Kazuya Nakata
Wuhan University of Technology, China; Tokyo University of Science, Japan

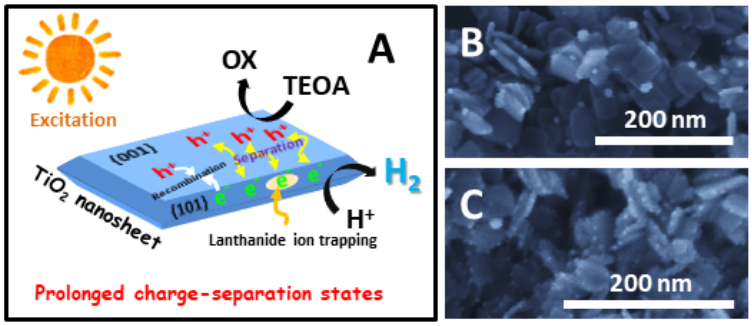


The photocatalytic activity of anatase TiO_2 materials prepared by calcination of $TiOF_2$ can be substantially improved by increasing their crystallinities and {001}/{101} ratios; moreover, Au decoration can effectively enhance the visible light-induced photocatalytic activity.

Chin. J. Catal., 2019, 40: 413–423 doi: 10.1016/S1872-2067(18)63182-1

Prolonging charge-separation states by doping lanthanide-ions into {001}/{101} facets-coexposed TiO_2 nanosheets for enhancing pho-tocatalytic H_2 evolution

Yongan Zhu, Zhenyi Zhang *, Na Lu, Ruinian Hua *, Bin Dong *
Dalian Nationalities University

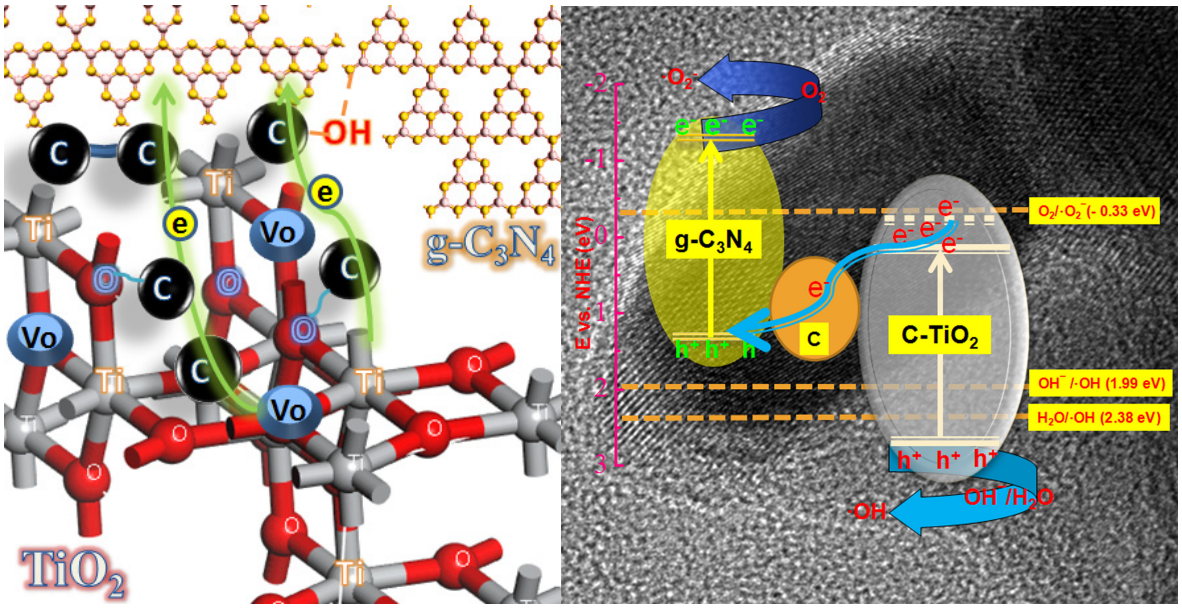


The lanthanide ions were selectively doped into the {101} facets of the TiO_2 nanosheets with coexposed {001}/{101} facets by using a one-step solvothermal method. These samples exhibited a remarkable enhancement of photocatalytic activity for H_2 evolution due to the prolonged charge-separation states, as evidenced by the kinetics analyses.

Chin. J. Catal., 2019, 40: 424–433 doi: 10.1016/S1872-2067(18)63183-3

Defect-assisted surface modification enhances the visible light photocatalytic performance of g-C_3N_4@C-TiO_2 direct Z-scheme heterojunctions

Xibao Li *, Jie Xiong, Ying Xu, Zhijun Feng, Juntong Huang *
Nanchang Hangkong University;
Hunan University of Science and Technology

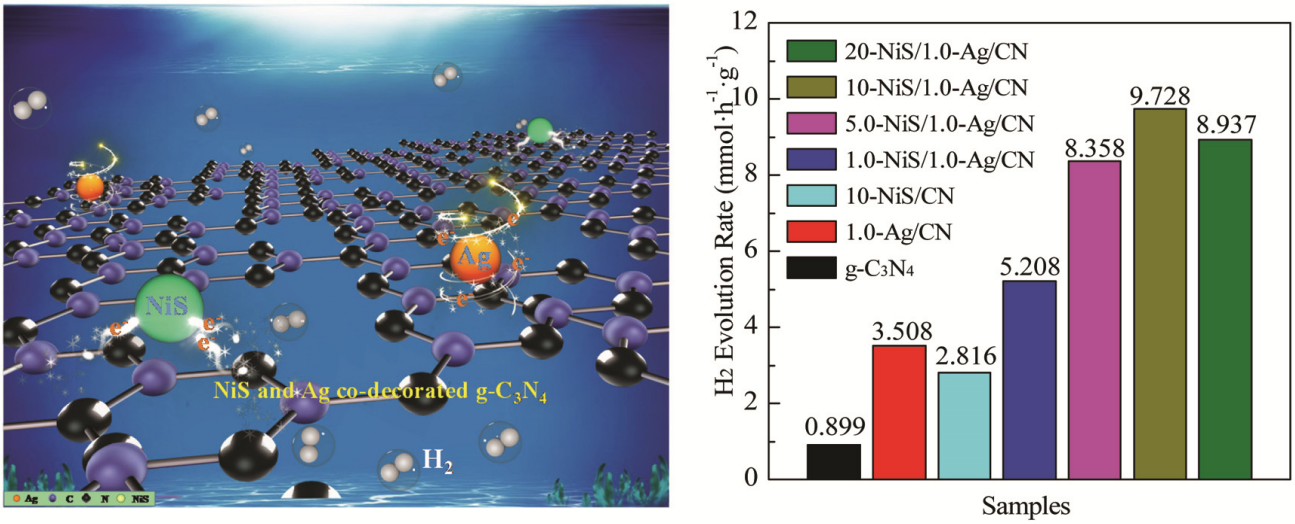


Novel g-C_3N_4@C-TiO_2 heterojunction exhibiting a direct Z-scheme photocatalytic mechanism. Appropriate amounts of carbon doping introduced new non-local impurity levels into the catalyst, which more efficiently transferred photogenerated electrons, enhancing the photocatalytic activity.

Chin. J. Catal., 2019, 40: 434–445 doi: 10.1016/S1872-2067(18)63189-4

Enhanced photocatalytic H_2 production over dual-cocatalyst-modified g-C_3N_4 heterojunctions

Zong Li, Yongning Ma, Xiaoyun Hu, Enzhou Liu *, Jun Fan *
Northwest University

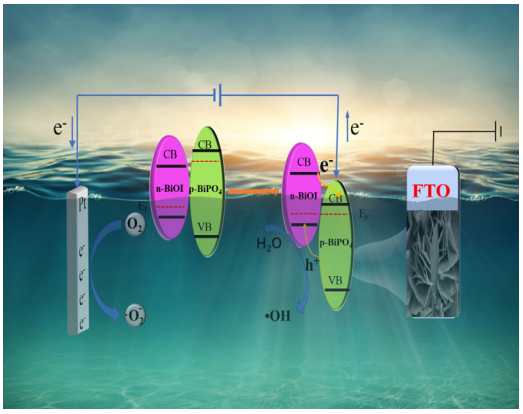


g-C_3N_4 co-decorated with Ag nanoparticles and NiS co-catalysts exhibits enhanced migration and separation of photoexcited charge carriers and, thus, improved photocatalytic H_2 generation owing to Ag and NiS serving as electron acceptors, surface-active sites, and H_2-evolution co-catalysts.

Chin. J. Catal., 2019, 40: 446–457 doi: 10.1016/S1872-2067(18)63186-9

Preparation of a p-n heterojunction 2D BiOI nanosheet/1DBiPO$_4$ nanorod composite electrode for enhanced visible light photoelectrocatalysis

Sen Liu, Mengyu Zhao, Zetian He, Yi Zhong, Hao Ding, Daimei Chen *
China University of Geosciences

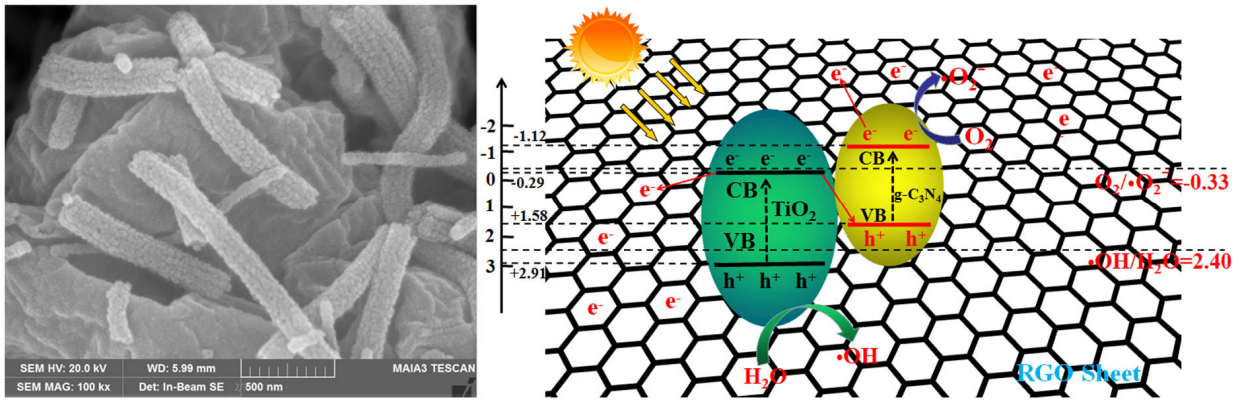


The p-n heterojunction structure promotes the separation and migration of photogenerated charges leading to enhanced photoelectrocatalytic efficiency in the BiOI/BiPO$_4$/FTO electrode.

Chin. J. Catal., 2019, 40: 458–469 doi: 10.1016/S1872-2067(18)63181-X

Direct electrospinning method for the construction of Z-scheme TiO$_2$/g-C$_3$N$_4$/RGO ternary heterojunction photocatalysts with remarkably ameliorated photocatalytic performance

Liming Hu, Juntao Yan *, Chunlei Wang, Bo Chai, Jianfen Li *
Wuhan Polytechnic University



Z-scheme TiO$_2$/g-C$_3$N$_4$/RGO ternary heterojunction photocatalysts are constructed successfully via a direct electrospinning method coupled with annealing, and it exhibits the best photodegradation efficiency of 99.1% within 60 min among the photocatalysts achieved. Moreover, the Z-scheme mechanism is proposed to elucidate the remarkably enhanced photocatalytic performance.

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Simultaneous hydrogen and peroxide production by photocatalytic water splitting

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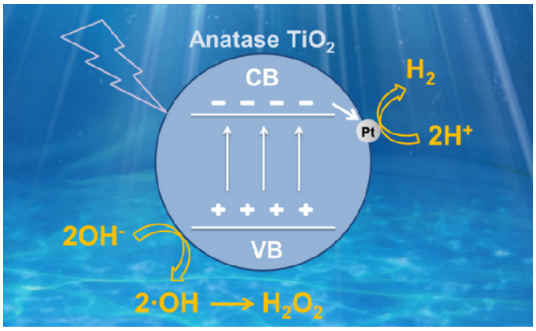

Photocatalytic water splitting into hydrogen and peroxide, two value-added chemicals, is achieved over a Pt/TiO$_2$(anatase) photocatalyst, avoiding separation problems.

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