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纪念辛勤研究员专刊

Special Issue in Memory of Professor Qin Xin

Guest Editors: Feng-Shou Xiao (肖丰收), Wenzhen Li (李文震)



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Special Issue in Memory of Professor Qin Xin

Guest Editors: Feng-Shou Xiao, Wenzhen Li

Chinese Journal of Catalysis

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Chin. J. Catal., 2021, 42: 2089–2090 doi: 10.1016/S1872-2067(21)63906-2

Preface to Special Issue in Memory of Professor Qin Xin

Feng-Shou Xiao, Wenzhen Li

Zhejiang University, China; Iowa State University, USA



Highlight

Chin. J. Catal., 2021, 42: 2091–2093 doi: 10.1016/S1872-2067(21)63914-1

Direct and selective methanation of biomass via oxygen vacancy-mediated catalysis

Ye Wang

Xiamen University



An “oxygen vacancy-mediated catalysis” was developed for the direct methanation of biomass with 82%–99% CH₄ yield from a wide range of biomass feedstock under 200 °C.

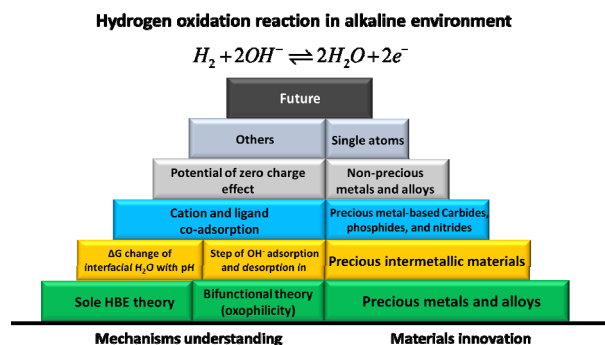
Reviews

Chin. J. Catal., 2021, 42: 2094–2104 doi: 10.1016/S1872-2067(21)64088-3

Electrocatalysts development for hydrogen oxidation reaction in alkaline media: From mechanism understanding to materials design

Yang Qiu, Xiaohong Xie, Wenzhen Li*, Yuyan Shao*
Pacific Northwest National Laboratory, USA;
Iowa State University, USA; DOE's Ames Laboratory, USA

Orders of magnitude slower HOR kinetics in base attracts great attention in cost-effective and highly active electrocatalyst development. This review focuses on recent progress of HOR mechanism understanding and materials innovation in alkaline environment.

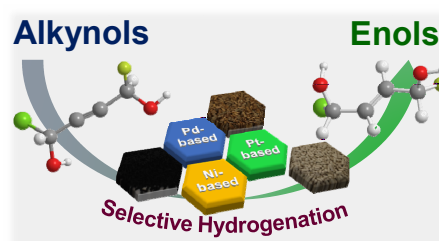


Chin. J. Catal., 2021, 42: 2105–2121 doi: 10.1016/S1872-2067(20)63773-1

Highly selective catalysts for the hydrogenation of alkynols: A review

Xiao Chen, Chuang Shi, Changhai Liang*
Dalian University of Technology

This review presents the progress in the design of highly selective catalysts for the hydrogenation of alkynols, summarizing and discussing the characteristics of these catalysts, particularly active structure, reaction mechanism, and stability.

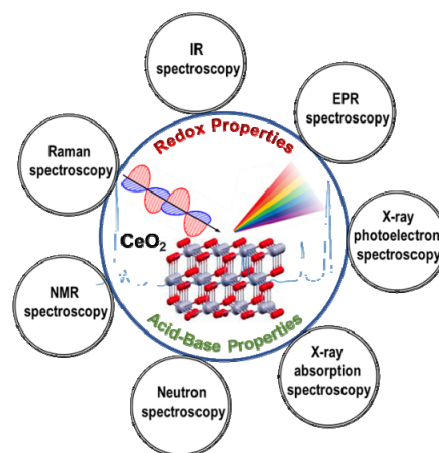


Chin. J. Catal., 2021, 42: 2122–2140 doi: 10.1016/S1872-2067(21)63806-8

In situ spectroscopic insights into the redox and acid-base properties of ceria catalysts

Xiang Wang, Meijun Li, Zili Wu*
Oak Ridge National Laboratory, USA

This work overviewed the advances in spectroscopic characterization of the redox and acid-base properties of ceria as a function of pretreatment, morphology, and size of ceria nanoparticles via direct spectroscopy approach and its combination with various probe molecules.

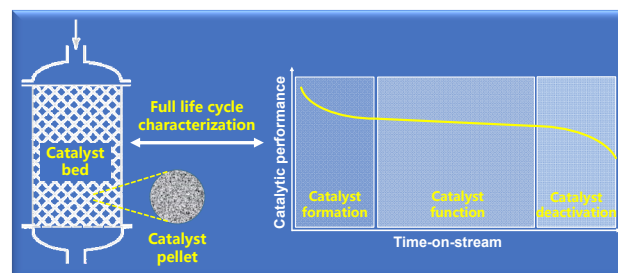


Chin. J. Catal., 2021, 42: 2141–2148 doi: 10.1016/S1872-2067(20)63786-X

Full life cycle characterization strategies for spatiotemporal evolution of heterogeneous catalysts

Renyang Zheng, Zaiku Xie*
China Petroleum & Chemical Corporation;
SINOPEC Shanghai Research Institute of Petrochemical Technology

In-situ characterization of a working catalyst and simultaneous measurement of its catalytic performance should contribute to theory-based science. Full life cycle characterization strategies for real world heterogeneous catalytic reactions, from catalyst formation and function, to deactivation, are summarized.

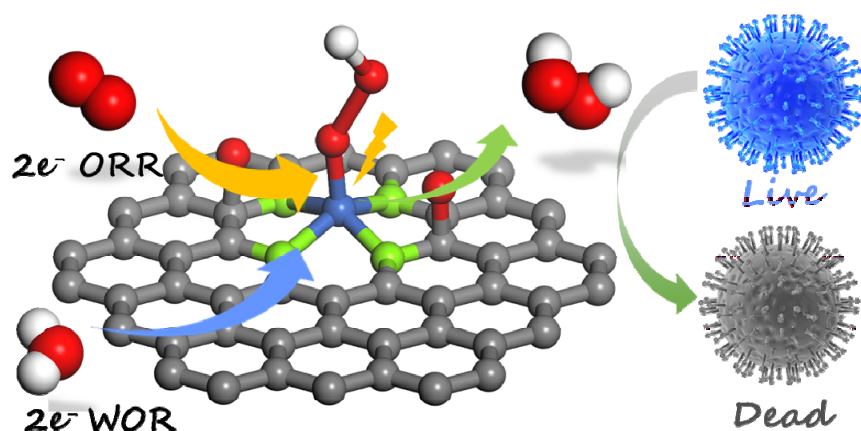


Chin. J. Catal., 2021, 42: 2149–2163 doi: 10.1016/S1872-2067(20)63781-0

Electrocatalytic H₂O₂ generation for disinfection

Yachao Zeng, Gang Wu *

University at Buffalo, The State University of New York, USA



Electrocatalytic H₂O₂ Generation boosts Disinfection

Electrochemical H₂O₂ generation by using renewable electricity emerged as a promising alternative route for on-site H₂O₂ production. In this review, the fundamental principles and implementations of electrochemical H₂O₂ generation for disinfection have been summarized.

Articles

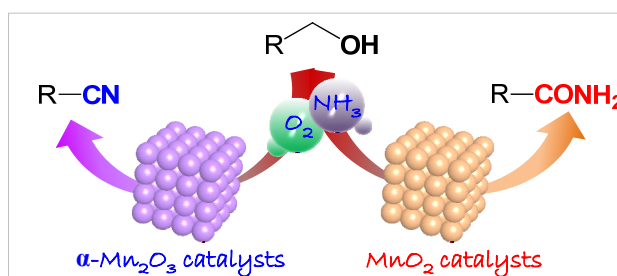
Chin. J. Catal., 2021, 42: 2164–2172 doi: 10.1016/S1872-2067(21)63803-2

Product selectivity controlled by manganese oxide crystals in catalytic ammoxidation

Hai Wang, Qingsong Luo, Liang Wang *, Yu Hui, Yucai Qin, Lijuan Song, Feng-Shou Xiao *

Zhejiang University; Liaoning Shihua University

The product selectivity in alcohol ammoxidation could be effectively controlled by tuning manganese oxide crystals, where nitriles are dominant products over α -Mn₂O₃-based catalysts, and MnO₂-based catalysts are favourable for nitrile hydration to form amides.



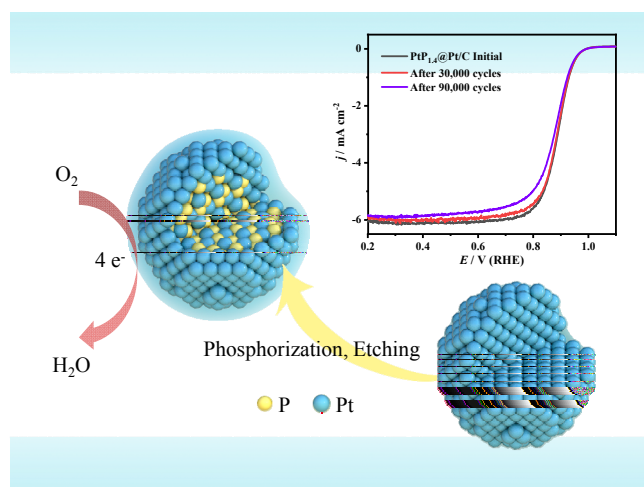
Chin. J. Catal., 2021, 42: 2173–2180 doi: 10.1016/S1872-2067(21)63901-3

High activity and durability of carbon-supported core-shell PtP_x@Pt/C catalyst for oxygen reduction reaction

Wei-Ze Li, Bang-An Lu, Lin Gan, Na Tian *, Peng-Yang Zhang, Wei Yan, Wei-Xin Chen, You-Hu Chen, Zhi-You Zhou, Shi-Gang Sun *

Xiamen University; Tsinghua University

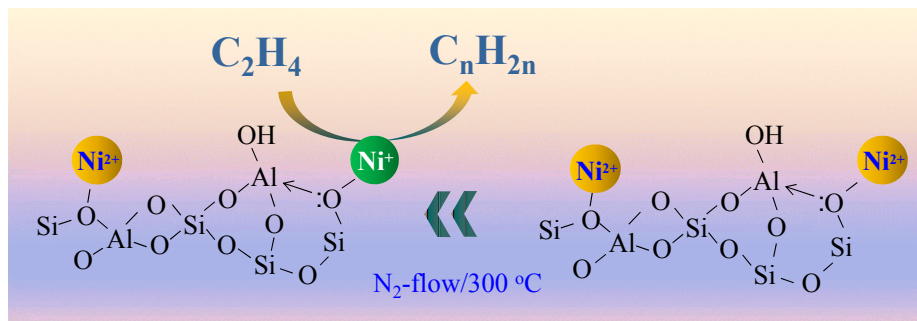
Owing to the core-shell nanostructure, electronic structure effect, and resistance to Pt nanoparticle aggregation, the carbon-supported core-shell PtP_{1.4}@Pt/C catalyst exhibited superior durability and enhanced ORR activity compared with the commercial Pt/C catalyst.



Chin. J. Catal., 2021, 42: 2181–2188 doi: 10.1016/S1872-2067(21)63827-5

Identification of the structure of Ni active sites for ethylene oligomerization on an amorphous silica-alumina supported nickel catalyst

Jinghua Xu, Ruifeng Wang, Yaru Zhang, Lin Li, Wenjun Yan, Junying Wang, Guodong Liu, Xiong Su*, Yanqiang Huang*, Tao Zhang
*Dalian Institute of Chemical Physics, Chinese Academy of Sciences; University of Chinese Academy of Sciences;
 Institute of Coal Chemistry, Chinese Academy of Sciences*



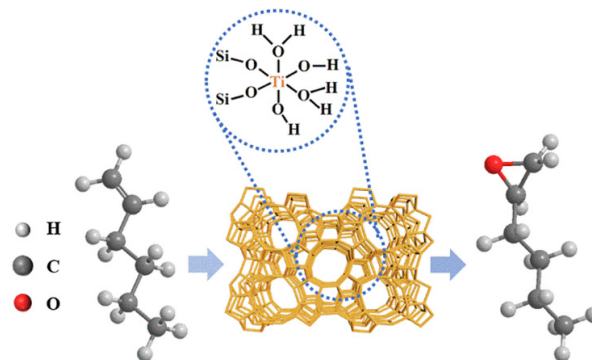
Ni⁺ species on acidic silanols with a weaker interaction with the amorphous silica-alumina support, which was reduced facilely from Ni²⁺ precursor, has been found highly efficient for catalyzing ethylene oligomerization to produce liquid fuels.

Chin. J. Catal., 2021, 42: 2189–2196 doi: 10.1016/S1872-2067(21)63882-2

Amino acid-assisted synthesis of TS-1 zeolites containing highly catalytically active TiO₆ species

Yuyao Wang, Li Li, Risheng Bai, Shiqin Gao, Zhaochi Feng,
 Qiang Zhang*, Jihong Yu*
*Jilin University;
 Dalian Institute of Chemical Physics, Chinese Academy of Sciences*

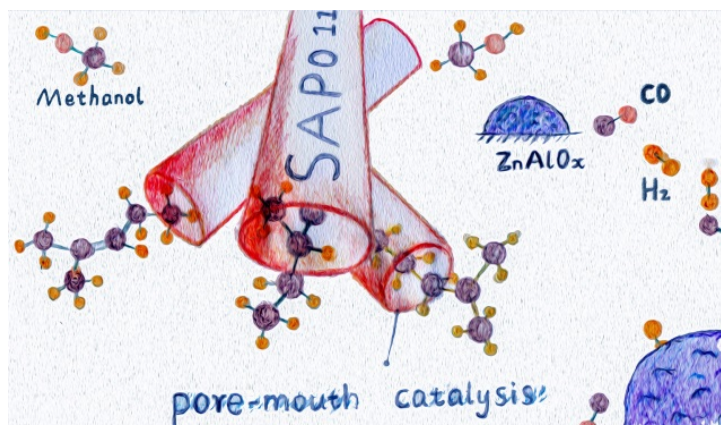
Anatase-free TS-1 zeolites containing TiO₄ and TiO₆ species were produced by a L-lysine-assisted two-step crystallization, affording a superior 1-hexene conversion and epoxide selectivity performance for alkene epoxidation owing to the coexistence of TiO₄ and TiO₆ species.



Chin. J. Catal., 2021, 42: 2197–2205 doi: 10.1016/S1872-2067(20)63770-6

Pore-mouth catalysis boosting the formation of iso-paraffins from syngas over bifunctional catalysts

Mengheng Wang, Yaoyao Han, Suhan Liu, Zhiming Liu, Dongli An, Zhiqiang Zhang, Kang Cheng*, Qinghong Zhang, Ye Wang*
Xiamen University



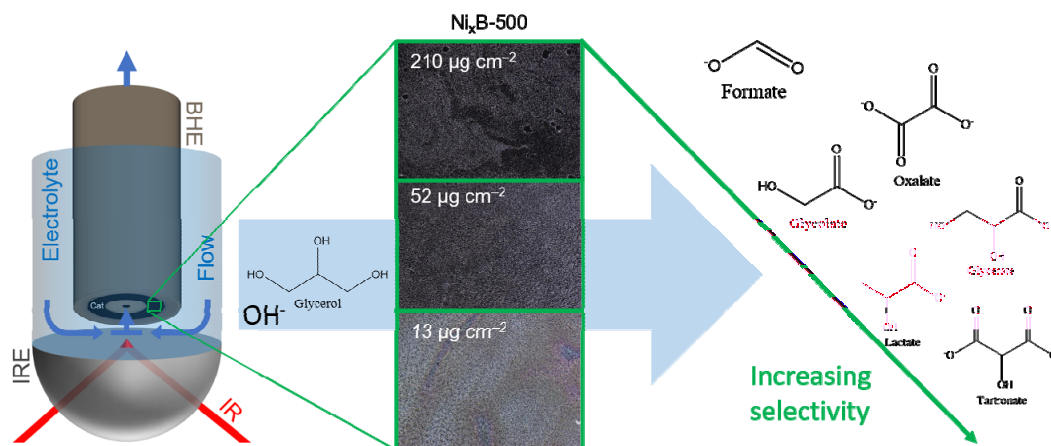
The formation of iso-paraffins over the bifunctional ZnAlO_x/SAPO-11 catalyst follows a pore-mouth catalysis mechanism, which means the isomerization of linear hydrocarbons can only take place near the pore mouth region of zeolite channels.

Chin. J. Catal., 2021, 42: 2206–2215 doi: 10.1016/S1872-2067(20)63766-4

Optimizing the nickel boride layer thickness in a spectroelectrochemical ATR-FTIR thin-film flow cell applied in glycerol oxidation

Steffen Cychy, Sebastian Lechler, Zijian Huang, Michael Braun, Ann Cathrin Brix, Peter Blümmler, Corina Andronesco, Friederike Schmid, Wolfgang Schuhmann, Martin Muhler *

Ruhr University Bochum, Germany; University of Duisburg-Essen, Germany; Johannes Gutenberg-University Mainz, Germany



Drop-casted catalyst loadings influence the observed selectivities of the glycerol oxidation reaction under spectroelectrochemical thin-film conditions. Lower loadings resulting in more even and thinner catalyst films yield less formate and more C₂ and C₃ oxygenates over Ni_xB.

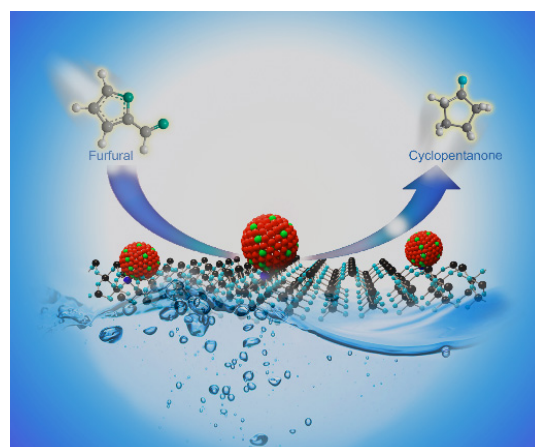
Chin. J. Catal., 2021, 42: 2216–2224 doi: 10.1016/S1872-2067(21)63842-1

Selective tandem hydrogenation and rearrangement of furfural to cyclopentanone over CuNi Bimetallic catalyst in water

Shujing Zhang, Hong Ma *, Yuxia Sun, Xin Liu, Meiyun Zhang, Yang Luo, Jin Gao, Jie Xu *

Dalian Institute of Chemical Physics, Chinese Academy of Sciences; University of Chinese Academy of Sciences

Tandem hydrogenation rearrangement of furfural with Cu-Ni/Al-MCM-41 provided an attractive solution for manufacturing cyclopentanone from renewable biomass resources. It afforded a 99.0% conversion and 97.7% selectivity for cyclopentanone in a near-neutral aqueous solution.



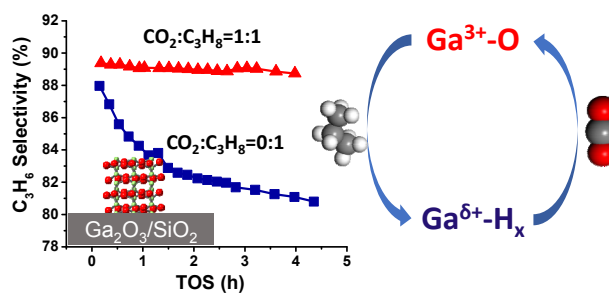
Chin. J. Catal., 2021, 42: 2225–2233 doi: 10.1016/S1872-2067(21)63900-1

Promoting propane dehydrogenation with CO₂ over Ga₂O₃/SiO₂ by eliminating Ga-hydrides

Yi Liu, Guanghui Zhang *, Jianyang Wang, Jie Zhu, Xinbao Zhang, Jeffrey T. Miller, Chunshan Song *, Xinwen Guo *

Dalian University of Technology, China; Purdue University, USA; The Chinese University of Hong Kong, China

As a soft oxidant, CO₂ is introduced into propane dehydrogenation to accelerate the transformation of Ga^{δ+}-H_x species to Ga³⁺-O pairs to re-generate the active sites for C-H bond activation of propane, thus improving the catalytic performance.

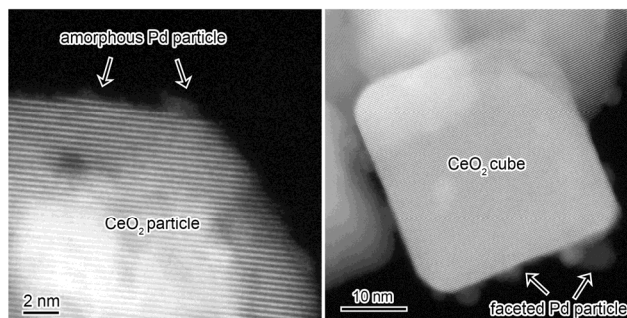


Chin. J. Catal., 2021, 42: 2234–2241 doi: 10.1016/S1872-2067(20)63725-1

Shape impact of nanostructured ceria on the dispersion of Pd species

Chunyan Dong, Yan Zhou *, Na Ta, Wenlu Liu, Mingrun Li,
Wenjie Shen *
Dalian Institute of Chemical Physics, Chinese Academy of Sciences;
University of Chinese Academy of Sciences

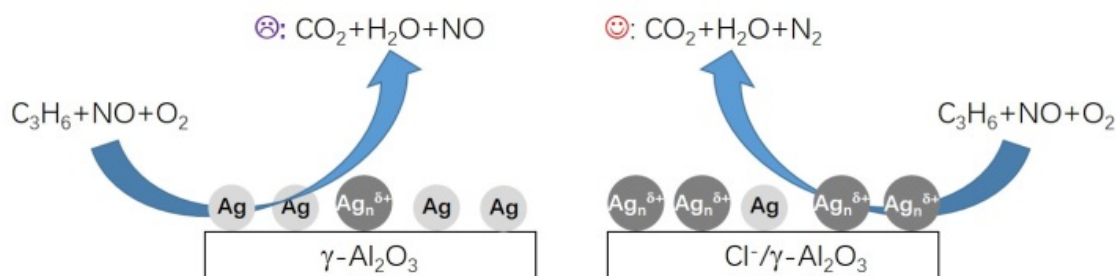
Faceted Pd particles averaged at 2.9 nm on cubic ceria, was highly active for CH₄ combustion; while amorphous Pd species of less than 2 nm, presented on spherical ceria, was more active for CO oxidation.



Chin. J. Catal., 2021, 42: 2242–2253 doi: 10.1016/S1872-2067(21)63904-9

Effect of the modification of alumina supports with chloride on the structure and catalytic performance of Ag/Al₂O₃ catalysts for the selective catalytic reduction of NO_x with propene and H₂/propene

Jia Wang, Rui You *, Kun Qian, Yang Pan, Jiuzhong Yang, Weixin Huang *
University of Science and Technology of China; Dalian National Laboratory for Clean Energy

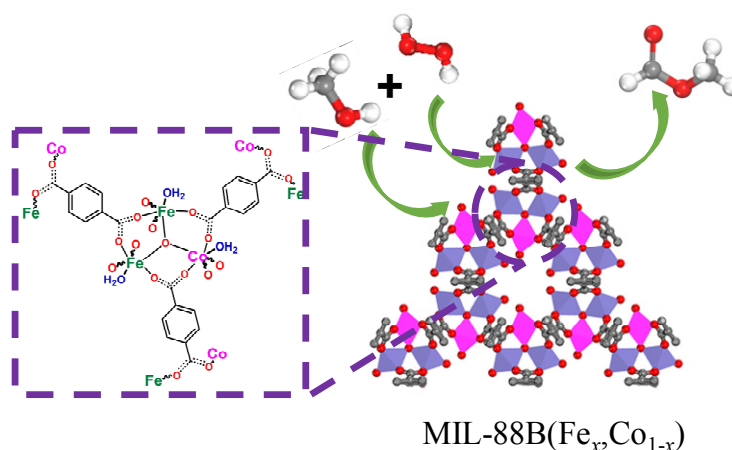


Chloride modification of alumina-supported Ag/Al₂O₃ catalysts stabilizes Ag_n^{δ+} clusters that are beneficial for the selective catalytic reduction of NO_x with propene and hydrogen-assisted selective catalytic reduction NO with propene.

Chin. J. Catal., 2021, 42: 2254–2264 doi: 10.1016/S1872-2067(20)63749-4

Preparation of MIL-88B(Fe_xCo_{1-x}) catalysts and their application in one-step liquid-phase methanol oxidation to methyl formate using H₂O₂

Jianfang Liu, Zhenzhen Ran, Qiyan Cao, Shengfu Ji *
Beijing University of Chemical Technology

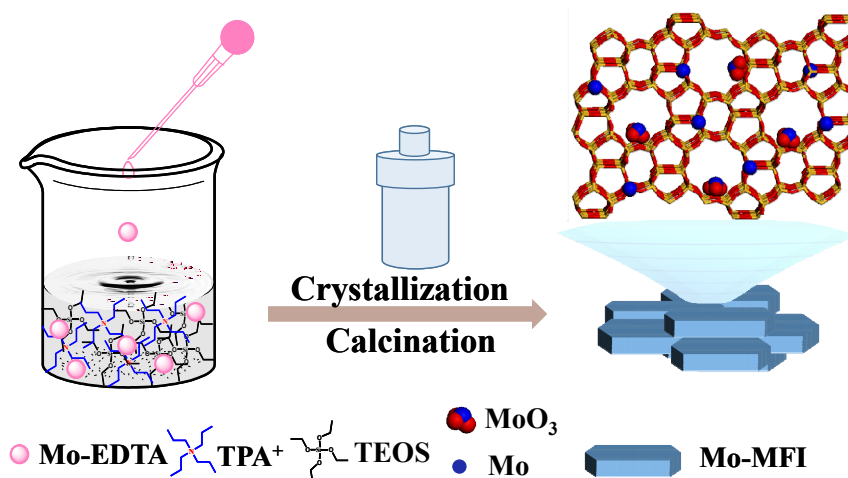


Bifunctional MIL-88B(Fe_xCo_{1-x}) catalysts were prepared. The catalytic one-step oxidation of methanol to methyl formate using H₂O₂ as oxidant and its preliminary mechanism were studied. The selectivity toward methyl formate was enhanced due to the synergistic effects between Fe and Co.

Chin. J. Catal., 2021, 42: 2265–2274 doi: 10.1016/S1872-2067(21)63826-3

Direct hydrothermal synthesis of Mo-containing MFI zeolites using Mo-EDTA complex and their catalytic application in cyclohexene epoxidation

Haoyang Zhang, Lifan Xu, Xinyu Chang, Songsong Miao, Yuting Sun, Mingjun Jia *
Jilin University



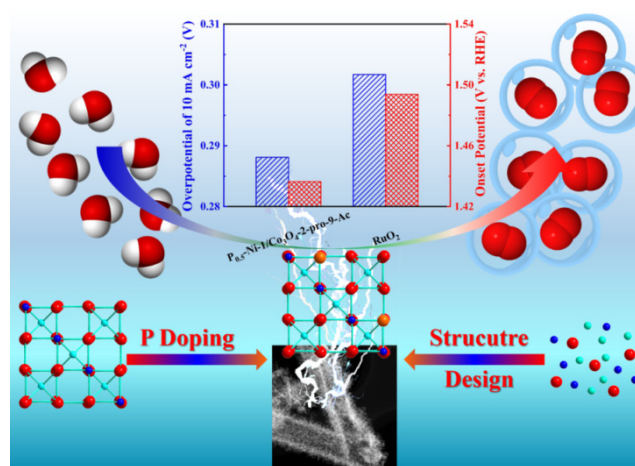
Mo-MFI zeolites with relatively high framework Mo species were hydrothermally synthesized by using Mo-EDTA as molybdenum source, and exhibited exceptional catalytic activity, selectivity and recyclability for cyclohexene epoxidation with H₂O₂ as oxidant.

Chin. J. Catal., 2021, 42: 2275–2286 doi: 10.1016/S1872-2067(21)63902-5

Template-free synthesis of Co₃O₄ microtubes for enhanced oxygen evolution reaction

Jiani Hu, Xiaofeng Zhang, Juan Xiao, Ruchun Li, Yi Wang,
Shuqin Song *
Sun Yat-sen University

A highly effective microtubular Co₃O₄ catalyst for the oxygen evolution half-reaction of water electrolysis was synthesized using structural design and P doping utilizing a template-free method; the prepared catalyst outperformed the state-of-the-art RuO₂ electrocatalyst.

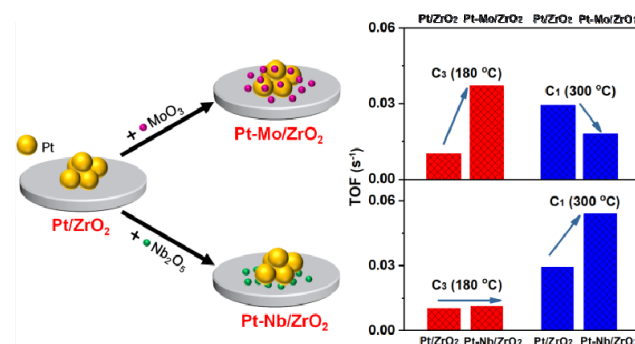


Chin. J. Catal., 2021, 42: 2287–2295 doi: 10.1016/S1872-2067(20)63771-8

Different roles of MoO₃ and Nb₂O₅ promotion in short-chain alkane combustion over Pt/ZrO₂ catalysts

Bingheng Cen, Cen Tang, Jiqing Lu, Jian Chen *, Mengfei Luo *
Zhejiang Normal University

Different roles of MoO₃ and Nb₂O₅ promotion in short-chain alkane combustion over Pt/ZrO₂ catalysts are revealed. MoO₃ is favorable for the activation of C–C bonds, whereas Nb₂O₅ is more beneficial for the activation of C–H bonds.

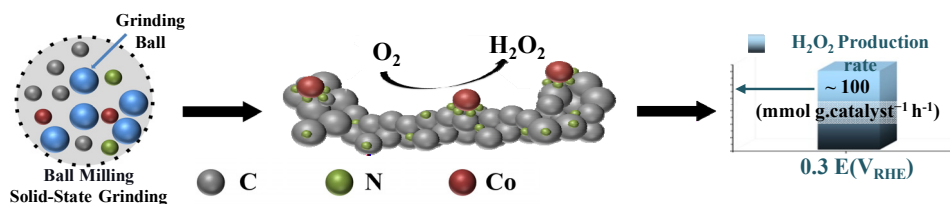


Chin. J. Catal., 2021, 42: 2296–2305 doi: 10.1016/S1872-2067(21)63804-4

Electrocatalytic generation of hydrogen peroxide on cobalt nanoparticles embedded in nitrogen-doped carbon

Basil Sabri Rawah, Wenzhen Li*

Iowa State University, USA; University of Jeddah, Saudi Arabia



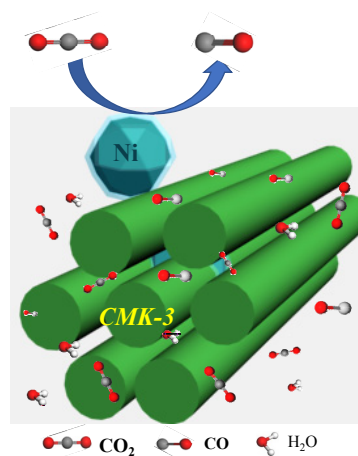
A straightforward milling technique was used to develop the cobalt nitrogen-doped carbon electrocatalyst consisting of a number of Co-N_x moieties that selectively converted oxygen to hydrogen peroxide at a rate of 100 mmol g_{cat}⁻¹ h⁻¹.

Chin. J. Catal., 2021, 42: 2306–2312 doi: 10.1016/S1872-2067(21)63903-7

Surface regulated Ni nanoparticles on N-doped mesoporous carbon as an efficient electrocatalyst for CO₂ reduction

Min Wang, Qi Xie, Huimin Chen, Guangbo Liu, Xuejing Cui, Luhua Jiang*

Qingdao University of Science and Technology



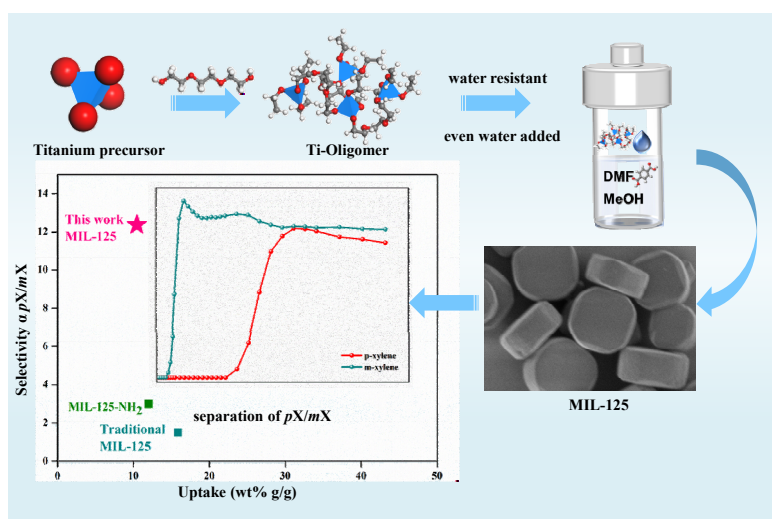
A N,O co-regulated Ni nanoparticles on N-doped CMK-3 presents high activity and selectivity for CO₂ electroreduction to CO and the N,O co-regulated Ni acts as the active center.

Chin. J. Catal., 2021, 42: 2313–2321 doi: 10.1016/S1872-2067(21)63905-0

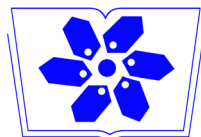
Synthesis of high-crystallinity MIL-125 with outstanding xylene isomer separation performance

Liping Yang, Jiacheng Xing, Danhua Yuan, Lin Li, Yunpeng Xu*, Zhongmin Liu*

Dalian Institute of Chemical Physics, Chinese Academy of Sciences; University of Chinese Academy of Sciences



We propose an effective method towards high-crystallinity MIL-125 using water-resistant Ti-oligomers as precursors. The selectivities of these MIL-125 materials in mesitylene are superior to those of most previously reported *para*-selective adsorbents.



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