

CO Oxidation by Gold Immobilized on Praseodymium-based Oxides under Rich CO₂ Atmosphere

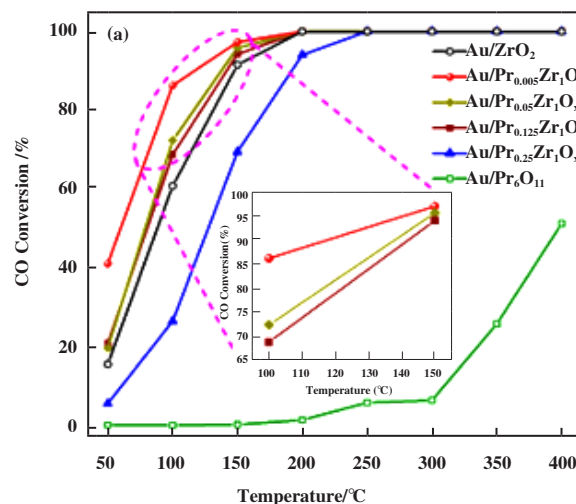
ZHANG Qing-yi, ZHAO Wei-xuan, CHENG Ya-nan,
SU Hui-juan, SUN Xun, ZHAO Li-jun, SUN Li-bo, QI Cai-xia

J. Mol. Catal. (China) **2023**, 37(2): 109–117

In this work a series of Pr_xZr_{1-x}O₃ with different praseodymium to zirconium molar ratios were prepared by hydrothermal method. The activity data shows that doping with appropriate amount of Pr element increases the reaction conversion rate. The Au/Pr_{0.005}ZrO_x catalyst shows the best conversion rate in a CO₂-rich atmosphere, which is twice as high as Au/ZrO_x at 50 °C. In addition, stability tests have shown that the catalysts in this series are not affected by high CO₂ concentrations.

A combination of X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), nitrogen physisorption analysis, scanning electron microscopy (SEM) and transmission electron microscopy

(TEM) characterization revealed that the gold nanoparticles on the prepared catalysts were well dispersed and the change in the valence state of the active species Au and the component content of the oxygen species during the reaction was the key factor causing the difference in catalyst activity.



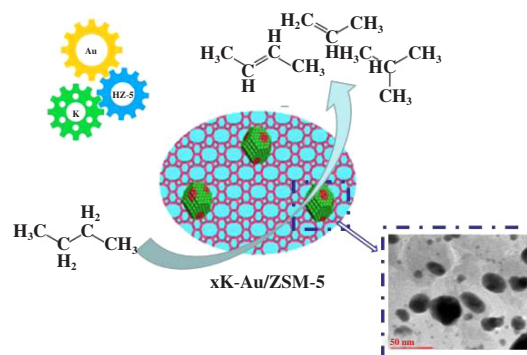
Effect of K⁺ Modified Au/ZSM-5 Zeolite Catalyst on Cracking Performance of *n*-Butane

LIAO Zheng-kun, Dilinuer.Ail, FANG Ya-ping, MIAO Cong-hui,
Aisha·Nulahong

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Low-carbon hydrocarbon catalytic cracking is one of the important reactions in the petrochemical industry, and hydrocarbon catalytic cracking has attracted the attention of researchers at home and abroad as a new way of olefin production. In this paper, Au and K metals were introduced into HZSM-5 catalysts by negative pressure deposition precipitation, and the

effects of catalysts on the cracking performance of *n*-butane were investigated. The results show that the introduction of Au metal improves the conversion rate of *n*-butane and the selectivity of isobutane and propylene.



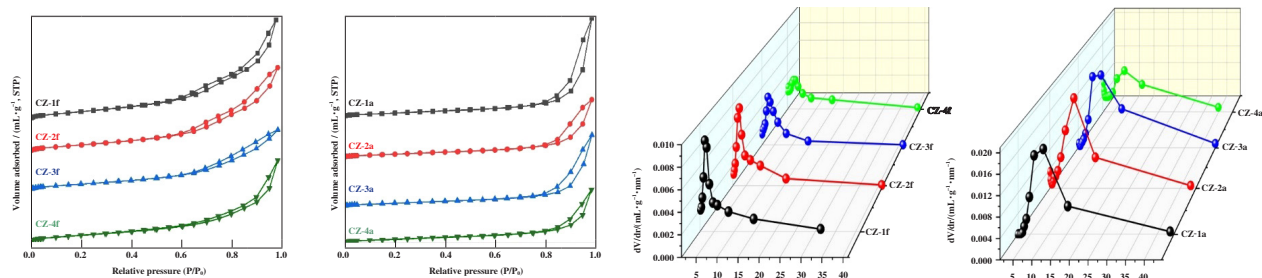
Effect of Stepwise Precipitation Method on the Thermal Stability of CeO₂-ZrO₂-Y₂O₃-La₂O₃ Materials

XIONG Fen, WANG Xi-cheng, HUANG Shuo, LI Ming-huan,
GAO Xiang-da

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It has been recognized that the performance of supported catalyst is closely related to the nature of support in heterogeneous catalysis. The excellent CeO₂-ZrO₂-Y₂O₃-La₂O₃ (CZ) materials with superior specific surface area, redox property and thermal stability are prerequisites as the supports for active Pd-only three-way

catalyst. In this work, a modified step precipitation method with different content of crystal seeds has been designed to fabricate these excellent CZ materials. By N₂-adsorption-desorption, H₂-TPR, XPS, XRD, SEM characterization, it has been verified that comparing with conventional precipitation method, the CZ-4 prepared by modified step precipitation method with 10% (mass fraction) crystal seed exhibited the highest specific surface area and hydrogen consumption. And consequently, the resulting CZ-4 supported Pd-only three-way catalyst displayed the best activity for CO, HC and NO conversion. These results are attractive. And we do believe this work will be a valuable resource for the advanced catalyst synthesis and environmental catalysis fields.



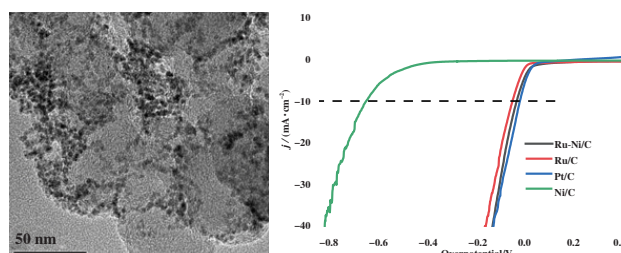
Hydrogen Evolution Research of Ru-Ni/C Catalyst in Alkaline Medium

CHEN Yan, YANG Tian-xuan, LI Jiang, WU Mei-xia, SHANG Jian-peng, GUO Yong, LI Zuo-peng

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The bimetallic supported Ru Ni/C catalyst was synthesized by deposition precipitation method. The morphology and structure of the catalyst were characterized by TEM, XRD, and the

performance of HER was tested by CV, LSV, EIS, etc. The results showed that Ru-Ni/C catalyst exhibited excellent electrocatalytic activity and stability for HER.



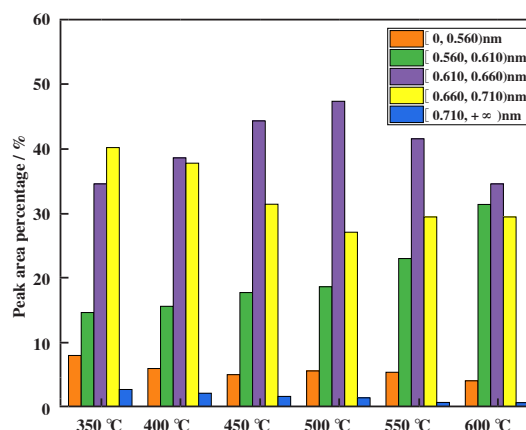
Characterization of the Composition and Molecular Size Distribution of Lignin Pyrolysis Bio-oil

ZHONG Wen-rui, LIU Hui-li, LIU Huan, HU Jian-hang

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We report the composition and molecular size distribution characteristics of lignin pyrolysis bio-oil. The direct difference between the pore size of the catalyst and the molecular size of the bio-oil will cause the shape selectivity of the molecular sieve catalyst. The pore size of the molecular sieve catalyst can be obtained by crystal structure analysis, while the molecular size of the bio-oil is difficult to obtain. The composition and content of lignin pyrolysis bio-oil were analyzed by Pyrolysis-Gas Chromatography/Mass Spectrometry (Py-GC/MS). The kinetic diameters of each constituent of the bio-oil were calculated using the group contribution method combined with the kinetic diameter

calculation model. The molecular size distribution characteristics of lignin pyrolysis bio-oil were analyzed. In this study, the main distribution ranges of the kinetic diameters of the main products of lignin pyrolysis bio-oil were determined, which provided a basis for the selection of catalysts in the catalytic pyrolysis of lignin for the preparation of high-quality aromatic fuels.



SalenMn(III) Catalyze Intramolecular Asymmetric Haloamination Reactions of Unactivated Olefin

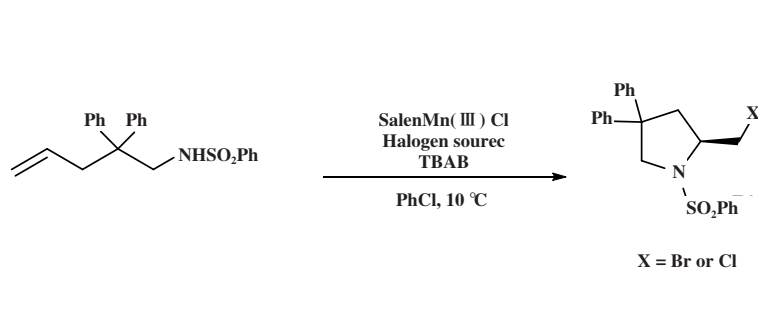
DONG Qi, LI Hai-meng, SHANG Hui-jian

J. Mol. Catal. (China) **2023**, 37(2): 164–173

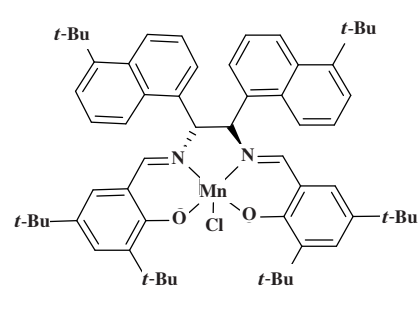
Nitrogen heterocycle is the composition and structure of

many natural products and essential substances for the human body, which is widely used in the field of medicine and chemical industry. In this paper, an intramolecular bromination of unactivated olefins catalyzed by SalenMn(III)Cl was developed. React with substrates with different substituents to explore the scope and general applicability of the reaction. A series of chiral bromopyrrolidine products were synthesized. In addition, the

reaction can also be applied to the synthesis of chlorinated products. This catalyst is easy to synthesize, and uses a small amount to obtain good results. The reaction can be carried out



under mild conditions. Reaction constructs chirality through spatial repulsion of ligand and substrate.



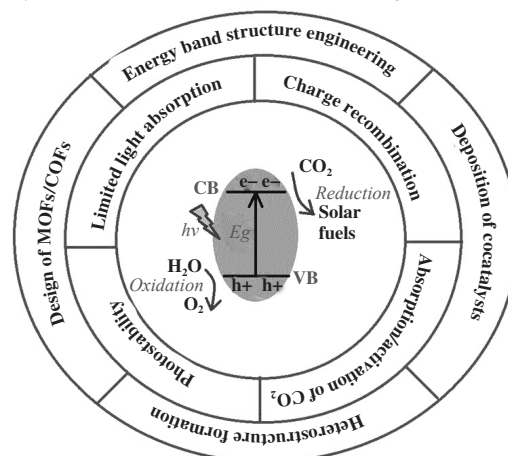
Recent Advances of Photocatalytic CO₂ Overall Reduction

YE Zhen, LUO Hao-lin, JIANG Zhi, SHANGGUAN Wen-feng

J. Mol. Catal. (China) **2023**, 37(2): 174–186

Carbon dioxide can be reduced into value-added compounds through photocatalytic reactions in which photocatalysts play an important role. Although great advances have been made in improving photocatalysts for CO₂ reduction, there are still tremendous obstacles in realizing artificial photosynthesis. The challenges can be concluded as four aspects: limited light absorption, charge recombination, absorption and activation of CO₂, poor photostability. Using water as electron donors rather than sacrificial agents, can realize photocatalytic CO₂ reduction accompanied by $\Delta G > 0$, which is therefore regarded as an ultimate goal of artificial

Photosynthesis. However, this attempt makes the challenges above even harder to solve. The main strategies can be listed as follows: Energy band structure engineering, deposition of cocatalysts, heterostructure formation and design of MOFs/COFs.



Recent Progress on the Electrocatalysts for Urea Electrolysis Reactions

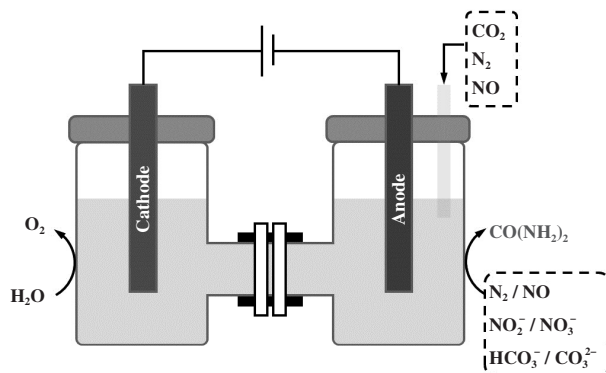
YAN Wei, LI Yuan

J. Mol. Catal. (China) **2023**, 37(2): 187–201

Urea, made of carbon, hydrogen, oxygen, nitrogen and other elements, is one of the simplest small organic molecules, which can be used in nitrogen fertilizer production, and is also a very important industrial chemical. Industrial urea synthesis is to produce ammonium carbamate from ammonia (NH₃) and carbon dioxide (CO₂) under high temperature and pressure, and then dehydrate to form urea molecule, that requires high energy consumption and a large amount of ammonia.

Electrocatalytic C – N coupling to synthesize urea can convert carbon dioxide (CO₂) and different nitrogen sources into urea under ambient condition, which not only avoids the energy-extensive consumption and high pollution but also achieves high-efficient utilization of inert gas molecules. The urea electrolysis plays a vital role in improving the efficiency of urea electrolysis and is of great significance for rapid realization of ‘carbon neutrality’ strategy. This review focuses on the urea electrolysis and combines the very recent research advances, aiming to first introduce different electrocatalysts, their catalytic mechanism, and performance improvement strategies, and then summarize the reaction mechanisms of urea synthesis via electrocatalytic C – N coupling. In addition, the

main problems in this field are fully analyzed and the future research direction of electrocatalytic urea synthesis is also forecasted.



Research Progress in Application of Au Supported Catalysts in Hydrogen Production by Water Gas Shift Reaction

LI Zhi, ZHU Xiao-mei, YANG Yu-tong, SUN Shao-hua, SUN Bing

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The development of hydrogen energy as a clean energy source appeared critical. The water gas shift reaction has been widely used in hydrogen production, and the catalyst used in water gas shift reaction has become an important research hotspot. In recent years, Au supported catalysts have been developed from traditional catalysts with higher low-temperature catalytic activity

and better stability. In order to improve the catalytic activity of catalysts, Au supported catalysts were designed and applied in the low temperature water gas shift reaction. The relevant literatures of Au supported catalysts applied in water gas shift reaction were reviewed, the factors affecting the catalytic activity of Au supported catalysts were discussed, and the active mechanism of Au supported catalysts in water gas shift reaction was analyzed. The catalytic activity of Au supported catalysts is affected by the kind of support, preparation method, and preparation parameters. The preparation parameters include the content of Au, calcination conditions and alkali metal additives. The active mechanism of Au supported catalysts catalyzing the water gas shift reaction is mainly the formate mechanism and redox mechanism. Above provides necessary reference information for researchers.

