

Green Synthesis of Zeolites and Rational Preparation of Zeolite-Based Catalysts

Prof. Feng-Shou Xiao

(College of Chemical Engineering, Zhejiang University, China)

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Industrial production of zeolites is usually performed under hydrothermal conditions in the presence of organic templates, which is typically energy-consumptive and environmentally unfriendly. We found that the major role of the organic templates is to direct the formation of zeolite nuclei, and water can be regarded as a “catalyst” for the zeolite crystallization. According to these understandings, it is developed sustainable routes for synthesis of zeolites such as organotemplate-free and solvent-free synthesis. In addition, supported metal species as catalysts suffer from deactivation resulting from metal sintering and coke deposition at high reaction temperatures. In contrast, zeolite catalysts are shape-selective and very stable, but shortage of metal active sites. We developed an efficient and general strategy for the preparation of metal species fixed within zeolite crystals, achieved a series of heterogeneous catalysts combined the advantages of both zeolite crystals (high stability of rigid zeolite framework and zeolite shape selectivity) and metal species (high activity).

Prof. Feng-Shou Xiao received his B.S. and M.S. degrees in the Department of Chemistry, Jilin University, China. From there he moved to Dalian Institute of Chemical Physics, China for Ph. D. research, then to the Catalysis Research Center, Hokkaido University, Japan, where he was involved in collaborative research between Dalian Institute of Chemical Physics & Jilin University, China with Hokkaido University, Japan. He was a Ph.D. student in Dalian for one year and in Sapporo for two years. In 1990, he was awarded his Ph.D. degree at Jilin University. After postdoctoral work at the University of California at Davis, USA, he joined the faculty at Jilin University in 1994, where he became a full professor in 1996 and distinguished professor in 2003. Since the end of 2009, Dr. Xiao as a distinguished professor has moved to Department of Chemistry, Zhejiang University. Currently, he is an associate editor of Industrial & Engineering Chemistry Research, also serving as secretary of the Asia-Pacific Association of Catalysis Societies. His research is mainly focused on zeolites, porous materials, and catalysis. He has more than 500 peer-reviewed papers with over 25 000 citations, H-index of 82, 130 granted patents, and over 50 plenary and keynote lectures at international conferences.

Selected Publications:

1. Zhu Jin, Liang Wang, Erik Zuidema, Kartick Mondal, Ming Zhang, Jian Zhang, Chengtao Wang, Xiangju Meng, Hengquan Yang, Carl Mesters, Feng-Shou Xiao, Hydrophobic Zeolite Modification for in situ Peroxide Formation in Methane Oxidation to Methanol, *Science*, 367 (2020) 193–197.
2. Hang Zhou, Xianfeng Yi, Yu Hui, Liang Wang, Wei Chen, Yucai Qin, Ming Wang, Jiabi Ma, Xuefeng Chu, Yeqing Wang, Xin Hong, Zifeng Chen, Xiangju Meng*, Hai Wang, Qiuyan Zhu, Lijuan Song, Anmin Zheng, Feng-Shou Xiao, Isolated boron in zeolite for oxidative dehydrogenation of propane, *Science*, 372 (2021) 76–80.
3. Wei Fang, Chengtao Wang, Zhiqiang Liu, Liang Wang, Lu Liu, Hangjie Li, Shaodan Xu, Anmin Zheng, Xuedi Qin, Lujie Liu, Feng-Shou Xiao, Physical mixing of a catalyst and a hydrophobic polymer promotes CO hydrogenation through dehydration, *Science*, 377 (2022) 406–410.
4. Jian Zhang, Liang Wang, Bingsen Zhang, Haishuang Zhao, Ute Kolb, Yihan Zhu, Lingmei Liu, Yu Han, Guoxiong Wang, Chengtao Wang, Dang Sheng Su, Bruce C. Gates, Feng-Shou Xiao, Sinter-resistant metal nanoparticle catalysts achieved by immobilization within zeolite crystals via seed-directed growth, *Nature Catalysis*, 1 (2018) 540–546.
5. Hai Wang, Liang Wang, Dong Lin, Xiang Feng, Yiming Niu, Bingsen Zhang & Feng-Shou Xiao, Strong metal-support interactions on gold nanoparticle catalysts achieved through Le Chatelier’s principle, *Nature Catalysis*, 4 (2021) 418–424.

問合せ先: 福岡淳 教授(fukuoka@cat.hokudai.ac.jp•011-706-9140)

共催: 触媒科学計測共同研究拠点, 学際統合物質科学研究機構