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Education:

2009~2014, Ph.D., Energy and Mineral Engineering, The Pennsylvania State University, University Park, PA, USA

2002~2004, M.S., Materials Science and Engineering, National Taiwan University

1998~2002, B.S., Chemical Engineering, National Taiwan University

Experience:

2017~present, Assistant Professor, Materials Science and Engineering, National Chiao Tung University

2015~2017, Assistant Professor, Materials Science and Engineering, Feng Chia University

2014~2015, Postdoctoral Scholar, Energy Institute, The Pennsylvania State University, University Park, PA, USA

Research Areas:

Microporous Materials and Catalysis
Metal-Organic Frameworks (MOFs) and Porous Coordinated Polymers (PCPs)
Hydrogen Storage
Hydride Hydrogen Generation
Gas Separation

Selected Publications:

1. Liao, C. -W.; Tseng, P. -S.; Chang, B. K.; and *Wang, C. -Y. “Facilitated hydrogen release kinetics from amine borane functionalization on gate-opening metal-organic framework” Surf. Coat. Tech. 2018, 350, 12-19.
2. Chung, J. -Y.; Liao, C. -W.; Chang, Y. -W.; Chang, B. K.; Wang, H.; Li, J.; and *Wang, C. -Y. “Influence of Metal–Organic Framework Porosity on Hydrogen Generation from Nanoconfined Ammonia Borane,” J. Phys. Chem. C. 2017, 121, 27369-27378.
3. Chen, T. Y.; Zhang, Y.; Hsu, L. C.; Hu, A.; Zhuang, Y.; Fan, C. M.; Wang, C. Y.; Chung, T. Y.; Tsao, C. S.; and Chuang, H. Y. “Crystal Shape Controlled H2 Storage rate in Nanoporous Carbon Composite with Ultra-fine Pt Nanoparticle,” Scientific Reports. 2017, 7, 42438.
4. Wang, C. -Y.; Wang, L.; Belnick, A.; Wang, H.; Li, J.; and Lueking, A. D. “Oxygen-Selective Adsorption in RPM3-Zn Metal Organic Framework,” Chemical Engineering Science. 2017, 165, 122-130.
5. Wang, C. Y.; Gray, J. L.; Gong, Q.; Zhao, Y.; Li, J.; Klontzas, E.; Psofogiannakis, G.; Froudakis, G.; and Lueking, A. D. "Hydrogen Storage with Spectroscopic Identification of Chemisorption Sites in Cu-TDPAT via Spillover from a Pt/activated carbon catalyst," J. Phys. Chem. C. 2014, 118, 26750–26763.
6. Wang, C. Y.; Gong, Q.; Zhao, Y.; Li, J.; and Lueking, A. D. "Stability and Hydrogen Adsorption of Metal-Organic Frameworks Prepared via Different Catalyst Doping Methods," J. Catal. 2014, 318, 128-142.

Applications of Metal-Organic Frameworks in Hydrogen Storage

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Metal-organic frameworks (MOFs), high surface area materials with adjustable structure and surface chemistry, are becoming promising candidates for gas adsorption and catalyst supports. In this presentation, we apply MOFs to hydrogen energy. MOF as a microporous support for platinum catalysts shows improved room-temperature hydrogen uptake via hydrogen spillover, in which hydrogen molecules are dissociated and further adsorbed on MOF surfaces, supported by spectroscopic observation of MOF hydrogenation.

Other than hydrogen adsorption, hydrogen generation from chemical hydride such as ammonia borane (AB, NH_3BH_3) draws attention, due to its high hydrogen storage (19.6 wt%). However, high temperature dehydrogenation and by-product generation during AB decomposition hinder the energy application. To address the issues, MOF serves as a microporous scaffold for hydride nanoconfinement, which leads to reduced by-products and dehydrogenation temperature. However, the mechanism is not clear to be nanosized or catalytic effect from MOFs.

We have applied AB infiltrated into MOFs with manipulated porosities and catalytic environments. It is found theoretically and experimentally that AB decomposition temperature reduces with reciprocal AB size when confined in MOFs. With known mechanism, we further apply AB surface functionalization on MOFs, which show shows improved kinetics in hydrogen generation, with comparable activation energy as that of AB catalytic hydrolysis.

Keyword: metal-organic frameworks (MOFs); hydrogen storage; Pt catalyst; hydrogen spillover; chemical hydride; ammonia borane; nanoconfinement.