Defect Engineering, Structural Transformation and Functional Application of Nanoporous Metal Organic Frameworks

Chia-Her Lin
Department of Chemistry, National Taiwan Normal University
E-mail: chiaher@ntnu.edu.tw

Abstract
Porous MOF materials are highly crystalline organic-inorganic composite complexes, which may be comprised of a secondary building unit (SBU) by metal ions or metal-containing clusters, assembled with a multitude of organic ligands by coordination. These porous materials undoubtedly have many practical applications with enormous potential including traditional applications such as gas storage, separation, and catalysis, which are mainly due to the size and shape of their pores.
In this talk, we'll present the defect engineering, structural transformation and functional application of MOFs.
For a mesoporous MOF, AlTz-68, it transforms from a defect and disordered amorphous metal-organic framework with low porosity to a highly porous and crystalline isomer within minutes upon solvent exchange and desorption, resulting in a dramatic increase in surface area from 725 to 2749 m^2/g. The process is shown to be reversible, achieving a solvent-controlled amorphous-crystalline switch between two topological distinct MOFs through simple immersion or removal from solvent.
For the other publication, we demonstrate a bioinspired encapsulationrearrangement strategy to construct superhydrophobic mesoporous metalorganic framework (MOF) systems by selectively modifying the external surface of an internal lattice-rearranged mesoporous MOF. The surface of a defective MOF with limited porosity named AlTz-53 is initially modified by hydrophobic alkyl chains through click reactions. Subsequently, the internal framework undergoes lattice rearrangement upon solvent desorption, leading to a significantly improved internal porosity and material crystallinity. Functionalizing the surface of AlTz-68 with octadecene (AlTz-68-C18) induces superhydrophobicity with a water contact angle of 173.6º. AlTz-68-C18 also exhibits one of the largest Brunauer-Emmett-Teller (BET) surface areas among all reported superhydrophobic framework materials. Furthermore, we illustrate that both superhydrophobic AlTz-68-C18 and the corresponding modified sponge exhibit excellent performance toward oil/water separation.

References
1.Sheng-Han Lo, Liang Feng, Kui Tan, Zhehao Huang, Shuai Yuan, Kun-Yu Wang, Bing-Han Li, Wan-Ling Liu, Gregory S. Day, Songsheng Tao, Chun-Chuen Yang, Tzuoo-Tsair Luo, Chia-Her Lin*, Sue-Lein Wang*, Simon J. L. Billinge, Kuang-Lieh Lu*, Yves J. Chabal*, Xiaodong Zou and Hong-Cai Zhou* *Nat. Chem.* **2020**, *12*, 90–97.
2.Liang Feng, Sheng-Han Lo, Kui Tan, Bing-Han Li, Shuai Yuan, Yi-Feng Lin, Chia-Her Lin*, Sue-Lein Wang*, Kuang-Lieh Lu*, Hong-Cai Zhou* *Matter* **2020**, *2*, 988–999.