Metal-Organic Frameworks: Assembly and Crystal Dynamics of Functional Materials

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Many efforts have been made for the design and synthesis of metal-organic frameworks (MOFs) having specific topologies and functions. MOFs containing pores and channels of controllable sizes and shapes can be applied to adsorption and separation processes, ion exchange, catalysis, and sensor technology. An exciting, yet little explored area is the transformation of the structures in the solid state by the input of external stimuli. Retaining single crystallinity even after chemical reaction is relevant to the development of certain devices. We have assembled porous metal-organic frameworks by various synthetic strategies such as 1D-, 2D-, and 3D- network construction from the pre-designed metal and organic molecular building blocks. Some exhibit simultaneously permanent porosity, high H_2 gas sorption capacity, thermal stability, and selective guest binding property. In particular, certain solids respond to the external stimuli, and change their colors and luminescence. In addition, some solids have flexible frameworks and undergo structural transformations, with retention of the single crystallinity, via shrinkage and swelling, sliding, or rotational motion of the molecular components.[1-3]

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