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Chemistry and Application of 4th Generation PCP/MOF

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We have found unique porous properties of porous coordination polymers (PCPs) or metal-organic frameworks (MOFs), which respond to specific guests, dissimilar to the conventional porous materials.[1] The third generation MOFs[2] possess flexible or dynamic porous frameworks, which reversibly respond to external stimuli, not only chemical but also physical, unlike the previous generations. They were developed in an effort to realize dynamic porous and collective functionality not found in conventional materials. Their compositions of metal ions and organic molecules have achieved diversity in the electronic states. That is, the spatial and electronic structures can be altered, realizing magnetic and dielectric properties as well as oxidation−reduction functions. Besides normal storage, dynamic MOFs have vast potential for separation with an extremely high selectivity, high-efficiency storage, and catalysis, as well as sensing and actuator functions. For these reasons, many studies investigate these materials. Here, I discuss porous materials with capabilities that exceed current ones (i.e., the fourth generation MOFs) and the future research direction.[3-5] It would be fabulous if novel porous materials possessed more features than just the third generation's excellent characteristics (flexibility, collectivity, and diversity). These additional features include 1) Hierarchy and Hybrid (double-H), which means to combine different functions and pursue the dynamic development of combined functions, (2) Anisotropy and Asymmetry (double-A), which means to learn from living organisms and then go beyond such organisms' capabilities, and (3) Disorder and Defect (double-D), which may lead to excellent catalytic reactivities and electronic functions. Hereinafter these three characteristics are referred to collectively as " HAD" characteristics.

References:

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