Functional zwitterionic metal-organic frameworks with multi stimulus-responsive properties

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Abstract

Zwitterions are composed of both cationic and anionic functional groups. Due to their well-separated intramolecular charges, an electric field gradient exists on their molecular surfaces. Therefore, their incorporation into metal-organic frameworks (MOFs) can create charged organic surfaces (COSs) within the pore environment, leading to polarization effects on guest molecules. Pyridiniums, cationic conjugate acids of pyridine, and their derivatives, are among the best-known zwitterions. Polarizable guest-molecules such as hydrogen and carbon dioxide can be attracted by these fields yielding to enhanced guest-framework interactions and thus, to well-defined adsorption properties. Since pyridnium-based zwitterions are well-known to be photo- and electrochemical-reducible into radicals, this offers a unique platform to tune their intramolecular electrostatic fields upon exposure to external stimuli. Systematic investigations were performed on the stimulus-responsive structure-property relationships of new MOFs based on neutral and anionic pyridinium-based zwitterionic ligands. In this context, we reported a new design strategy to rationally access zwitterionic MOFs through anionic viologen derivates. [1] Also, in a proof-of-concept study we showed that adsorption capacities can be significantly reduced in a reversible process upon light-irradiation resulting in exciting tunable adsorption properties [2]. In this presentation will focus on the fundamental understanding in the exciting structure-property relationships of new zwitterionic MOF materials with multi stimulus-responsive properties while exploring both, photo and electrochemical stimuli as potential trigger for the radical generation of pyridinium-based MOFs.

References

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