Highly Versatile Metal-Organic Frameworks

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The relationship between shape and properties is one of the fundamental concepts in modern colloid chemistry, and it constitutes a key issue both for interpreting nature and for designing materials. In this scenario, it is crucial to develop flexible and controlled synthetic approaches since they can reproduce those behaviors observed in nature and can further diversify the material's performance. Crystals are the most orderly manifestations of solid-state materials. In the nano-micro size scale the bottom-up design of such material relies mostly on the separate assembly of inorganic or organic elements and it has applicative relevance in fields such optics, catalysis, and electronics. Metal-organic frameworks (MOFs) are heterogeneous crystals that result from the assembly of organic ligands and metal ions through coordination bonds. [1,2] Thanks to the hybrid composition and the features of the coordination bond, MOFs display properties at the borderline of several material classes; for example, they have highly ordered porous structures with an ample degree of flexibility, thus uniquely combining regularity and softness. [3]

In this work we showed that this feature can also be extended at the morphological level by obtaining, in a controlled way, different complex crystalline architectures (Figure) with the same free-modulator MOF system. For this purpose, both general concepts of organic crystal growth and the peculiarities of the coordination bond were exploited. The plasticity of the framework is further confirmed by the mild thermodynamic and kinetic condition of the structure's evolution, which allowed us to analyze the morphology formation process. The high versatility and the degree of controlling the shaping process proved in this work, make MOFs hold promise as alternative strategies for crystal design.

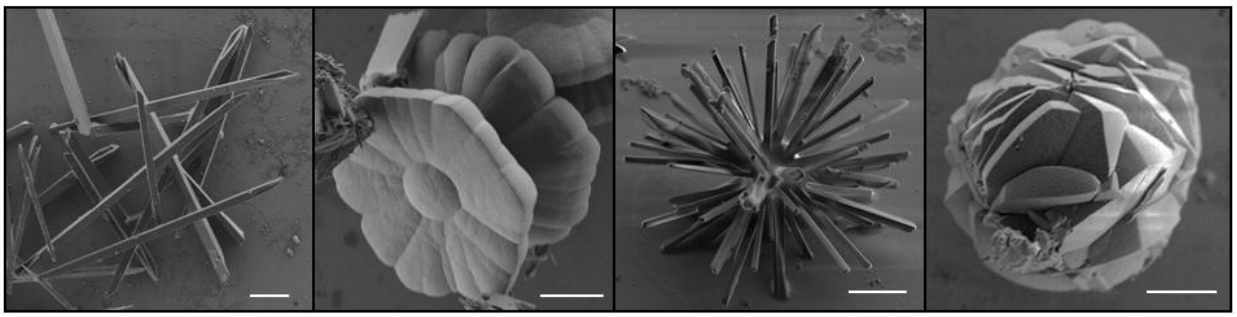

Figure representative structures obtained by a free-modulator MOF system; scale bars are 10 μm.

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[3] S. Horike, S. Shimomura and Susumu Kitagawa, *Nat. Chem.*, 2009, **1**, 695.