Assembling Designer Solids from Molecular Building Blocks: Principles, Prospects, and Problems

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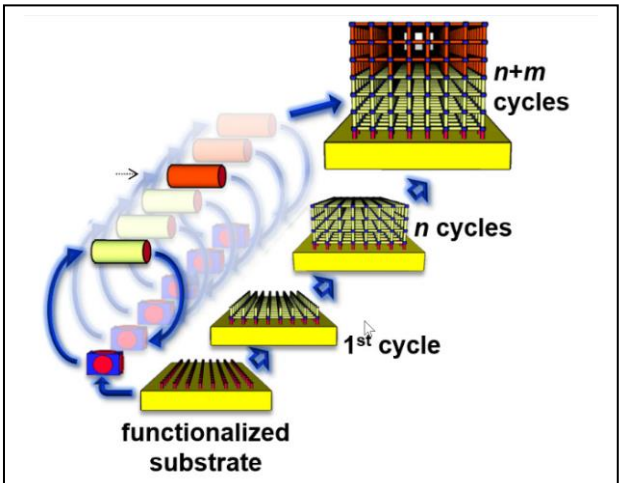

Fig. 1 Layer-by-layer scheme to fabricate SURMOFs

Realizing molecular "Designer Solids" by programmed assembly of building units taken form libraries is a very appealing objective. Recently, metal-organic frameworks (MOFs) have attracted a huge interest in this context. Here, we will focus on MOF-based electrochemical, photoelectrochemical and photovoltaic devices. Internal interfaces in MOF heterostructures are also of interest with regard to photon-upconversion and can be used for the crosslinking of sandwiched, reactive monomers. Since the fabrication of reliable and reproducible contacts to MOF-materials represent a major challenge, we have developed a layer-by-layer (lbl) deposition method to produce well-defined, highly oriented and monolithic MOF thin films on a number of different substrates. The resulting films are referred to as SURMOFs [1,2]. The fabrication of hetero-multilayers (see Fig. 1) is rather straightforward with this lbl method. In this talk, we will describe the principles of SURMOF fabrication as well as the results of systematic investigations of electrical and photophysical properties exhibited by empty MOFs and after loading their pores with functional guests. We will close with discussing further applications realized by loading MOFs with nanoparticles or quantum dots.

References:

[1] J. Liu, Ch. Wöll, Chem. Soc. Rev. 46, 5730-5770 (2017)
[2] L. Heinke, CH. Wöll, Advanced Materials 31 (26), 1970184 (2019)