Design of Crystalline 2D Materials: The SURMOF Approach

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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 applications. Internal interfaces within MOF heterostructures are also of interest with regard to photon-upconversion and can be used for the crosslinking of sandwiched, reactive monomers. This approach also allows for the synthesis of 2D-materials, e.g. interwoven fibres. In particular for the latter application the conventional MOF synthesis is not well suited, 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 strategies for fabricate 2D-materials and address the option to load SURMOFs with nanoparticles or quantum dots.

References

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

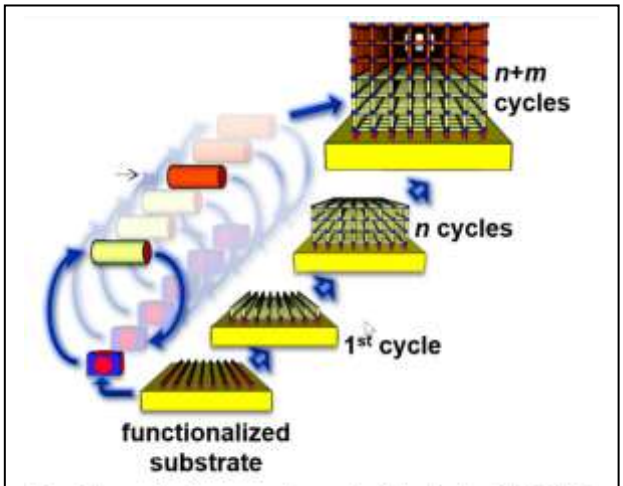

Fig. 1 Layer-by-layer scheme to fabricate SURMOFs