IMAP 2021 Webinar series

13th of July 2021 at 2pm

Online on Zoom

https://us02web.zoom.us/j/84719725729?pwd=UUl2bHRDcWJaQnpLNzRsS3JyeDlHQT09
Meeting ID: 847 1972 5729
Secret code: jwHG3k

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

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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, photoelectron-chemical, photovoltaic, and sensor devices. Internal interfaces in MOF heterostructures are also of interest with regard to photon-upconversion and the fabrication of diodes.

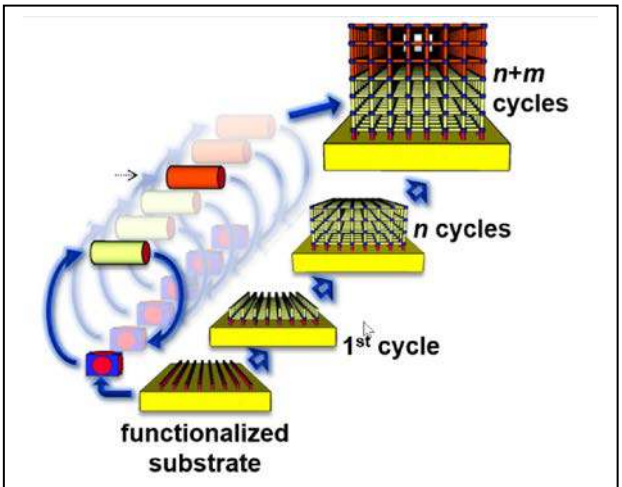

Fig. 1 Layer-by-layer scheme to fabricate SURMOFs

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 appropriately functionalized substrates. The resulting films are referred to as SURMOFs [1,2] and have very appealing properties in particular with regard to optical applications [3]. 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 [4] 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, Adv. Mater. 31 (26), 1970184 (2019)
[3] R. Haldar, L. Heinke, Ch. Wöll, Adv.Mater. 32, 1905, (2020)
[4] A. Chandresh, X. Liu, Ch. Wöll, L. Heinke, Adv. Sci.,8, 2001884 (2021)