ALD-Grown ZIF-8 Thin Films : Mechanism Insight Leads to Push Beyond the Current Thickness Limit

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Completely vapor phase-based routes for the synthesis of Metal Organic Frameworks (MOF) are recent [1-2]. Vapour-phase processes are usually preferred to obtain conformal coatings in the high aspect ratio features of devices but much still remains to be done to control the growth and understand the potential and the limits of these growth methods.

In this work, pinhole-free and crystalline zeolitic imidazolate framework-8 (ZIF-8) layers as thick as 250 nm were grown, by integrating the method previously reported[1]- which typically levels off below 100 nm- in a novel cycling process. Different types of substrates and devices were used, such as silicon wafers, Quartz Crystal Microbalance and silicon micro-pillars arrays, see Figure1).

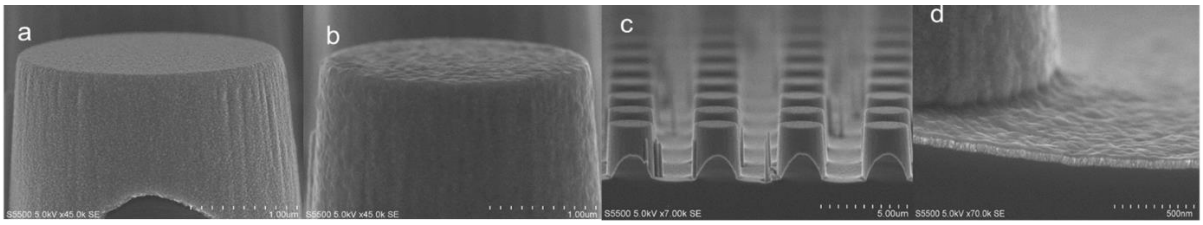

Figure 1. Scanning Electron Micrographs of (a) starting ZnO-covered silicon micropillars ; (b) (c) (d) ZIF-8 covered micropillars obtained through the gas-phase cycling process described herein.

The material properties as well as the impact of the process parameters on the MOF growth will be reported (data include electronic microscopy, ellipsometric-porosimetry, X-ray diffraction and a study on the influence of water pressure on the final thickness). Molecular-level mechanistic reasons behind the current thickness bottleneck will be discussed through a ToF-SIMS and XPS profil study at different stages of growth.

[1] I. Stassen et al., *Nat. Mat.*, **15**, 304–310 (2016) [2] E. Ahvenniemi et al., *Chem. Com.*, **52**, 1139-1142 (2016)

EM10: Metal Organic Frameworks