Comparative Study of Nano-Pillar Growth by Helium Ion and Gallium Ion Focused Beams

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Focused ion beam microscopes equipped with reactive gas injection systems are commonly used for the creation of nanostructures. One mode of such structuring is the deposition of conducting features by beam induced deposition from metal-bearing precursors. Such nano-scale structures are useful in several applications, such as electrical devices patterned on the nanoscale, photonic devices, basic nanoscience research, and the like. In the present work we extend the study on the deposition of pillars in the helium ion microscope (HIM)[1],[2] – with the goal of determining minimum achievable feature sizes and maximum patterning density.

In particular, we report on a comparison between the dynamics of pillar deposition of platinum-containing structures (from MeCpPt(IV)Me_3 precursor) in gallium FIB (Auriga; Carl Zeiss NTS) and HIM (Orion Plus; Carl Zeiss NTS). The microscopes are equipped with functionally similar gas injection systems. Pillars are grown both in isolation and in dense patterns, under variation of deposition parameters: dwell, beam current, number of pattern repeats, scan path. The set of data then allows analysis of the growth dynamics as a function not only of beam parameters but also pattern density. Presented measurements will analyze feature size and feature uniformity across the arrays for both ion species. Figure 1 gives an indication of the reduced proximity effect and smaller feature size possible with HIM.

[1] P.F.A. Alkemade, et al., Microsc Anal, 24(7), 5 (2010).
[2] D. Maas et al., Proc. of SPIE Vol. 7638, 763814

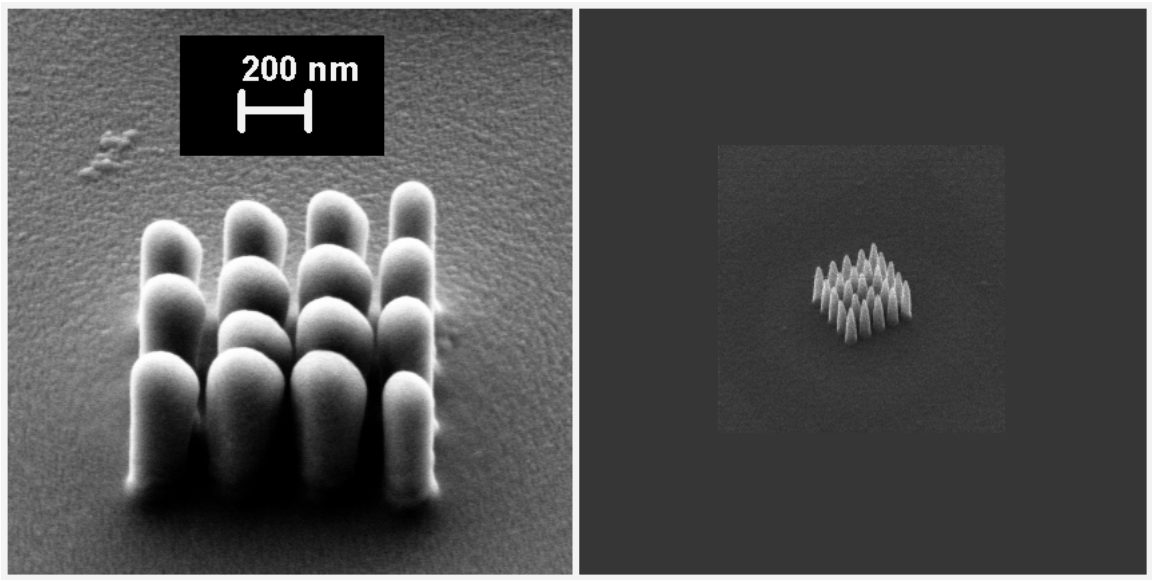

Figure 1. Ion beam deposited pillars. Left: Pillar array with 250 nm pitch, deposited by Gallium FIB system. Right Pillar array with 50 nm pitch (shown at same scale), as deposited by HIM.