3D nanolithography by means of Scanning Probe Lithography

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While patterning two-dimensional metallic nanostructures is well established through different techniques, three-dimensional printing still constitutes a major bottle neck on the way to device miniaturization. We used a fluid phase phospholipid ink as a building block for structuring with Dip-Pen Nanolithography.[1] Following a bioinspired approach that relies on the ink spreading inhibition, we present two processes to build 3D metallic structures. Serum albumin, a widely used protein with an innate capability to bind to lipids, is the key in both processes.[2] Covering the sample surface with it prior to lipid writing, anchors lipids on the substrate, which ultimately allows the creation of highly stable 3D lipid-based scaffolds to build metallic structures (Figure 1).[3]
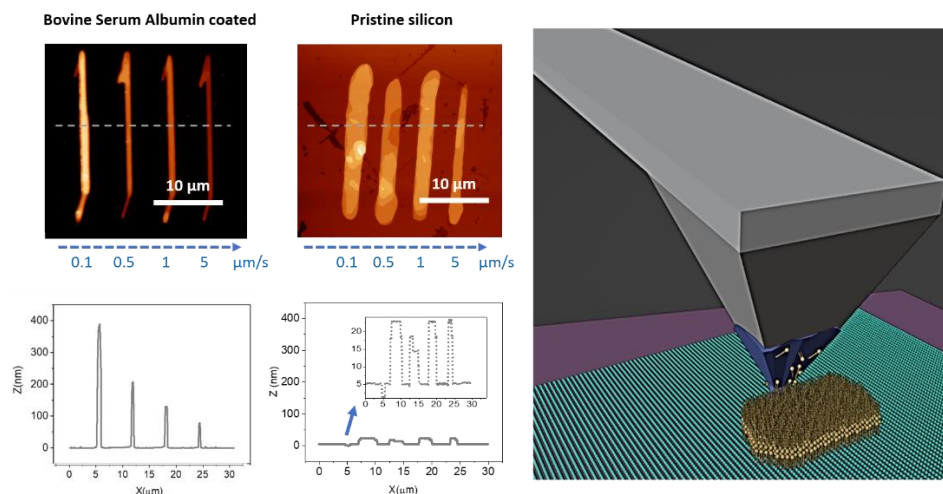

Figure 1: AFM images of lipid lines written on a BSA coated substrate with increasing speed and vs. lipid lines written on pristine silicon surface under the same writing conditions, and corresponding thickness profiles.

1 S. Lenhert, P. Sun, Y. Wang, H. Fuchs, C. A. Mirkin, Small 2007, 3, 71.
2 J. G. Vilhena, P. Rubio-pereda, P. Vellosillo, P. A. Serena, Langmuir 2016, 32, 1742.
3 Berganza, E., Boltynjuk, E.; Mathew, G.; Vallejo, F.F.; Gröger, R.; Scherer, T.; Sekula-Neuner, S.; Hirtz, M. Small 2023, In press. DOI: 10.1002/smll.202205590.