Lithography-free approaches to patterned multilayers based on wrinkling

PMSE 86

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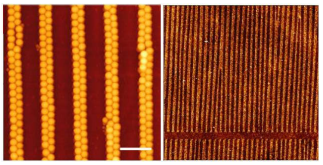
Surfaces that are structured on the micron or sub-micron-scale play an increasingly important role as building blocks for devices in areas as diverse as photonics, catalysis, sensorics or biotechnology. For these applications, surface architectures consisting of patterned surface properties (wettability, surface charge density, chemical or biological functionality) and/or patterned topography are sought for. While patterning can be achieved using modern lithography techniques, this approach is rather expensive and difficult to upscale to areas of macroscopic dimensions. In contrast, controlling mechanical instabilities like wrinkling can be exploited for creating patterns with considerably lower effort. Wrinkles develop (for example) if a soft substrate covered by a hard film is exposed to strain or if such a substrate-film combination is built up in a strained state and subsequently relaxed. In the latter case, permanent topographical patterns with periodicities between fractions of a micron and many microns are formed. Wrinkle patterns are highly regular and the lateral dimensions of the substrate can be macroscopic without loss of control. Apart from topographical patterning, the approach can be used for achieving chemical contrast as wrinkled surfaces can be subsequently employed for printing processes or controlled deposition of colloidal particles. We discuss recent developments and perspectives of the approach with special attention to polyelectrolyte multilayers. Figure 1. Left: wrinkle-templated deposition of colloidal particles (AFM-image, scalebar 2 microns); Right: chemical patterning of polyelectrolyte multilayers (AFM-image 20X20 microns).



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