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Sputter-Induced Surface Patterns as Templates for Thin Film Growth

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Nanostructured thin films are of growing relevance for all kind of applications in photovoltaics, plasmonics, or as magnetic materials. Various methods have been used to fabricate these nanostructured thin films with well defined morphology. Besides the top-down approaches using lithographic methods, bottom-up, self-organized methods have been used extensively in the last years because of their fast and easy way of producing patterns with structures down to 10 nm.
Ion beam sputtering has proven to be a promising way to produce self-organized patterns on various surfaces. Depending on the ion incidence angle hexagonally ordered dot patterns as well as ripple patterns oriented perpendicular or parallel to the ion beam direction are formed during the continuous sputtering. These patterns are excellent templates for the growth of metal thin films. Depending on the interface energy of the metal film with the substrate the films grow in a conformal way reproducing the surface topography or as nanoparticles on the substrate surface. Furthermore, depending on deposition angle, substrate temperature, beam flux, and deposition time, the nanoparticles align parallel to the ripples, eventually coalescing and forming nanowires [1].
Metal nanoparticlesgrown in this way exhibit distinct optical properties due to their localized surface plasmon resonance. Especially for nanoscale optics aligned equidistant chains of metal nanoparticles are favoured. Aligningthese nanoparticles along the ripple templatescauses strongly anisotropic optical properties [2]. In addition, the magnetic properties of ferromagnetic thin films are drastically change by the presence of the interface and surface periodic roughness [3].

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Keywords
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