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Magnetron Sputtering Depositions at Oblique Angles on Seeded Substrates for the Development of sub-Micron Structural and Chemical Patterns

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Thin films grown at oblique geometries by magnetron sputtering are well known for their high porosity and the formation of quasi-periodic tilted nanocolumnar arrays, whose morphology depends on the deposition conditions. We demonstrate that the existence of periodic or quasi-periodic patterns on the film substrate previous to the deposition originate a vast phenomenology of novel nano- and microstructured layers, whose chemical composition may also vary in the same spatial scale range. The result of numerous depositions of SiO_2 and SiO_x thin films on laser-patterned and ion-induced rippled substrates will be shown, supported by numerical simulations. It is found that the morphological patterns follow similar wavelength than that defining the distribution of seeds on the substrate for thicknesses in the order of 1 micron. For higher thicknesses, the substrate information is progressively lost and a fast convergence to typical morphologies of films grown on flat substrates. In addition, under certain conditions, surface protuberances may induce the appearance of compositional patterns in the same scale length as that of the seeds. Overall, an overview of a new variety of porous micro and nanostructures available by magnetron sputtering will be given, as well as the main principles governing the formation of such structures. The results of numerous experiments and numerical simulations will be presented and insights on the potential applications of these nanostructured layers given.

Keywords
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