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Perspectives on oblique angle deposition of thin films: From fundamentals to devices

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A B S T R A C T

The oblique angle configuration has emerged as an invaluable tool for the deposition of nanostructured thin films. This review develops an up to date description of its principles, including the atomistic mechanisms governing film growth and nanostructuration possibilities, as well as a comprehensive description of the applications benefiting from its incorporation in actual devices. In contrast with other reviews on the subject, the electron beam assisted evaporation technique is analyzed along with other methods operating at oblique angles, including, among others, magnetron sputtering and pulsed laser or ion beam-assisted deposition techniques. To account for the existing differences between deposition in vacuum or in the presence of a plasma, mechanistic simulations are critically revised, discussing well-established paradigms such as the tangent or cosine rules, and proposing new models that explain the growth of tilted porous nanostructures. In the second part, we present an extensive description of applications wherein oblique-angle-deposited thin films are of relevance. From there, we proceed by considering the requirements of a large number of functional devices in which these films are currently being utilized (e.g., solar cells, Li batteries, electrochromic glasses, biomaterials, sensors, etc.), and subsequently describe how and why these nanostructured materials meet with these needs.

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