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**Effects of shadowing and steering in oblique incidence epitaxial growth**[1]

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Recently the fabrication of novel nanostructures by oblique deposition has drawn much attention due to their potential application in electronic and mechanical devices as well as the interesting morphologies observed in various experiments, such as nanorods, nanocolumns, and nanohelicoids. Unlike self-organization by misfit strain in heteroepitaxial growth, oblique deposition provides a relatively direct way of controlling surface structures of growing films. Recent experiments indicate that oblique incidence deposition can significantly alter materials properties such as surface roughness, magnetic anisotropy, optical transmittance, and porosity. After a review of these experimental results, we first show that a series of morphological transitions observed in oblique incidence Cu/Cu(100) growth near room temperature can be explained primarily by geometrical shadowing effects [1]. We then discuss the modifying effects of steering due to short-range and long-range attraction [2] as well as of substrate rotation on the surface morphology. Finally, we present the results of recent multiscale simulations of Cu/Cu(100) growth at lower temperature (T = 160 - 200 K) [3] as well as parallel accelerated dynamics and molecular dynamics simulations at very low temperature [4]. Based on these simulations we have been able to explain a number of recent intriguing but previously unexplained experimental results including the strong dependence of the surface morphology and roughening behavior on temperature as well as the development of compressive strain in metal thin film growth.

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