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Island Alignment on Patterned Substrates DEMITRIS KOURIS, University of Wyoming, ROBERT KUKTA, SUNY Stonybrook — A recent approach to fabricating self-assembled epitaxial nanostructures involves the use of topographically patterned substrates to control the formation of material deposits during growth. This article investigates the energetic and kinetic mechanisms that guide the positioning of strained epitaxial islands in these systems. A continuum-level model is used wherein the free energy of system consists of surface energy and strain energy. The substrate shape is represented by small amplitude sinusoidal features. An energetic phase diagram is calculated to determine which sites are most favorable—peaks, valleys, or side walls—depending on factors as substrate shape, lattice mismatch, surface energy, and the amount of material deposited. The kinetic evolution through the processes of deposition and surface diffusion is then simulated. It is found that the resulting morphology depends largely on the rate of deposition relative to surface mobility. Relatively slow deposition rates produce configurations of minimum free energy while higher deposition rates give rise to novel metastable states. Mechanisms by which various configurations arise are discussed in detail. Results are found to be in excellent agreement with published experiments.

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