

Variational Models for Epitaxial Growth and Materials Defects

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Abstract: The formation and assembly patterns of quantum dots on strained epitaxial films grown on a relatively thick substrate have significant impact on the optoelectronic properties of semiconductors. The total free energy of the system is assumed to be the sum of the energy of the free surface of the film and the strain energy. Because of the lattice mismatch between film and substrate, there are regimes in which flat configurations cease to be energetically favorable and corrugated morphologies are preferred. Existence of equilibria will be established, and regularity results for volume constrained local minimizers of the total free energy will be obtained, leading to a rigorous proof of the zero contact-angle condition between islands and wetting layers. As time permits, the nucleation of misfit dislocations will be discussed.