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The effect of inhomogenous diffusion on the formation of quantum dots CHRISTIAN RATSCH, RAFFAELLE VARDAVAS, XIAOBIN NIU, RUSSEL CAFLISCH, UCLA — The simulation of the formation and self-organization of quantum dots is a major goal in modeling efforts of epitaxial growth. An anisotropic, spatially varying diffusion constant can lead to preferred island nucleation in certain regions. Such an anisotropic, inhomogeneous diffusion field can be achieved, for example, by burying defects (or other structures) underneath the surface: the inhomogeneous strain field leads to an inhomogeneous potential energy surface, and thus to an inhomogeneous diffusion field. The potential energy surface can change because the transition energy can be affected, as well as because the adsorption energy can be affected. The latter leads to a thermodynamic drift. Our results indicate that there is a competition between enhanced nucleation due to increased diffusion (kinetics), and enhanced nucleation due to a thermodynamic drift. Our results were obtained with an island dynamics model that employs the level-set technique. This approach is particularly well suited for this problem, as both, a spatially varying diffusion field, as well as microscopic events on vastly different time-scales can easily be implemented in our model, without extra computational cost.

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