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Rate-equation approach to irreversible island growth with cluster diffusion BRADLEY HUBARTT, YEVGEN KRYUKOV, JACQUES AMAR, University of Toledo — A self-consistent rate-equation (RE) approach to irreversible island growth and nucleation is presented which takes into account the effects of cluster mobility. As a first application we consider the irreversible growth of compact islands on a 2D surface in the presence of monomer deposition (with rate F) and monomer diffusion (with rate D_1) while the mobility of an island of size s is assumed to satisfy $D_s = D_1 s^{-\mu}$ where $\mu \geq 0$. For coverages up to the peak island-density, we find excellent agreement between our RE and simulation results for the dependence of the island-density $N(\theta)$ on coverage θ for all values of μ considered, ranging from $\mu = 1/2$ (Brownian motion) to $\mu = \infty$ (immobile clusters). For $\mu \leq 2$, excellent agreement is also found between our simulation and RE results for the island-size distribution (ISD), while for higher values of μ the effects of correlations become important. We also demonstrate that the discrepancies between recent theoretical predictions for the exponents $\tau(\mu)$ and $\zeta(\mu)$ describing the size-dependence of the ISD for $\mu < 1$ and simulations can be explained by the geometry of compact islands. Our self-consistent RE approach may also be generalized to higher dimensions as well as to an arbitrary dependence of the cluster mobility on island-size.

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