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Roughening rates of strainedlayer instabilities FUMIYA WATANABE, DAVID G. CAHILL, J.E. GREENE, Department of Materials Science and Engineering and the Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign — We study the evolution of the morphology of $Si_{0.75}Ge_{.025}$ strained layers using a wide range of deposition times, $60 < \tau < 2400$ s, at 600 $^\circ$C on laser textured substrates with miscuts $\theta < 15^\circ$ off Si(001). Ripple-shaped morphologies form spontaneously on miscuts along the <110> directions inside the laser textured dimples. At the shortest deposition times, roughening is suppressed as predicted by a linear stability analysis that uses previously measured values for the mass transport rate on the surface. The origin of the instability is thermodynamic, and not caused by kinetic effects related to step motion, confirmed by the fact that the morphology of the rapidly deposited layers roughens with annealing. The exponential time constant of the roughening measured is ≈ 80 s; a factor of 4 larger than that predicted by theory. Linear instability analysis is not only sufficient in describing the morphological changes in the layers qualitatively, but also is adequate in deriving the quantitative rate of the roughening.

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