SURFACE MORPHOLOGY OF SIGE ON S1 (100) AND THE PRODUCTION OF QUANTUM-SIZED FEATURES.*

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There have recently been a number of studies using atomic force microscopy (AFM) to profile the surface morphology of $Si_{1-x}Ge_x$ films grown on Si(100) substrates. For films grown both above and below the critical thickness for the introduction of dislocations, a cross-hatch pattern of surface features is observed. However, below critical thickness these features are aligned along $\langle 010 \rangle$ and $\langle 001 \rangle$ whereas above critical thickness the surface features run parallel to the 60° dislocation interracial misfit dislocation network, namely along $\langle 011 \rangle$ and $\langle 0\bar{1}1 \rangle$. In this work we will first present results on the transition in surface morphology as the film is grown through critical thickness. We have also used AFM and cross-sectional transmission electron microscopy to study the surface and interracial morphology of strain-symmetrised $Si/Si_{1-x}Ge_x$ superlattices grown on $Si_{1-x}Ge_x$ buffers. Undulations in the surface morphology in this case can be as large as the superlattice period, with alternating layers growing preferentially in the hollows of the surface of the underlying layer. Such growth results in three-dimensionally bounded embedded $Si_{1-x}Ge_x$ particles which may exhibit quantum confinenement effects. The mechanisms for the formation of the suface morphology for both single layer and superlattice growth will be discussed in terms of the relaxation modes available in such strained systems.

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