

Thermal Relaxation of Metastable Strained SiGe Epitaxial Layers

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ABSTRACT

In SiGe epitaxial heterostructures, there is a region of ‘metastable’ thicknesses in which the SiGe layer is strained as grown, but when sufficient thermal energy is applied, relaxation will take place by the formation of dislocations. Previous studies have focused on the initial phase of relaxation, which is the onset of dislocation formations. We complement that work by exploring the extent of thermal relaxation as a function of strain and relaxation conditions. The strain conditions are quantified using high resolution XRD, while surface morphology and threading dislocation density are determined by AFM and SEM, respectively. In this paper, we found that the relaxation of metastable SiGe varies as a function of Ge content. Before annealing, the initial relaxation decreases when the Ge content increases, whereas after annealing, the relaxation increases with Ge content. We attribute this to the different dominant relaxation mechanisms.

Keywords: SiGe, thermal stability, strain relaxation, XRD