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Utilizing Growth Kinetics to Self-Assemble Complex SiGe Nanostructures JENNIFER GRAY, ROBERT HULL, University of Virginia, JERROLD FLORO, Sandia National Laboratories — Heteroepitaxial growth of Si_xGe_{1-x} on Si (001) substrates under conditions of reduced adatom mobility results in limited formation of stress-relieving islands occurring only at energetically favorable sites. These favorable sites are at the edges of shallow pyramidal pits that form at random locations on the film surface under these conditions. However, by using a focused ion beam (FIB) to pattern the substrate before growth, it is possible to controllably create pits at predefined locations. This results in the formation of four self-assembled islands at the edges of each pit. In order to obtain uniform, well ordered islands, the FIB milling parameters and Si buffer thickness must be tailored to produce pits in the strained film with dimensions equal to or smaller than the compositionally-dependent natural length scale of the islands. The ability to produce islands at specific locations is important for applications such as quantum computing where quantum dots must be arranged into logic structures. Exploiting this constraint on islanding that occurs under kinetically limited growth may therefore provide a new route to hierarchical assembly of nanostructures when combined with substrate patterning techniques.

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