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### **Properties of Ge/Si Nanostructures: Alloying, Stability and Positioning**

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The self-assembly of Ge(Si) nanostructures on Si surfaces is a model system in crystal growth [1]. This process follows the Stranski-Krastanov (SK) mode, and may be exploited as a parallel approach to engineer dense low-cost arrays of quantum dots (QDs). This special opportunity has recently driven a wealth of theoretical and experimental efforts. Nonetheless, several critical issues remain to be addressed. These range over the uniform size, shape and positioning of the nanoislands, their thermal stability and the Ge/Si intermixing that occurs during growth [2]. Low energy electron / X-ray photoelectron microscopies (LEEM / XPEEM) proved very successful in addressing such problems. By dynamically monitoring evolution phenomena (by acquiring LEEM movies) and developing spectromicroscopic analytical tools [3], we have correlated the above phenomena to the underlying atomistic processes. This approach represents an effective means towards the bottom-up control over the system features. Our investigation led to a picture where entropy and kinetic factors play an overwhelming role in determining the overall properties of QDs. [1] F. Rosei, *J. Phys. Cond. Matt.* **16**, S1373 (2004). [2] F. Ratto et al. *Appl. Phys. Lett.* **84**, 4526 (2004). [3] F. Ratto et al. *J. Appl. Phys.* **97**, in press (Jan. 2005).