Mechanical Stability of Ultra Thin Ge/Si Film on SiO₂: the Effect of Si/SiO₂ Interface

MINGHUANG HUANG, University of Utah, JOHN A. NAIRN, University of Utah, M.G. LAGALLY, University of Wisconsin-Madison, FENG LIU, University of Utah — We perform two-dimensional linear elastic finite element analysis to investigate mechanical stability of ultra-thin Ge/Si film grown on or bonded to SiO₂, using imperfect interface elements between Si and SiO₂ to model Si/SiO₂ interfacial slippage. We show that the overall composite film is stable when only the tangential slippage is allowed. But it becomes unstable when normal slippage is allowed: the coherently strained Ge island induces a large local bending of Si layer, and debonds the Si layer from the underlying SiO₂ forming a void at the Si/SiO₂ interface. Thus, the quality of Si/SiO₂ interface is expected to play an important role in controlling the stability of those device structures employing the strained Si/SiO₂ film. *This work is supported by DOE.