

Optical characterization of $\text{Si}_x\text{Ge}_{1-x}$ films grown on nanostructured Si substrates

Abstract

High quality Ge and $\text{Si}_x\text{Ge}_{1-x}$ films grown on Si substrates are attractive for a wide range of applications in optics, optoelectronics, and high efficiency solar cells. In this study, heteroepitaxial growth of Ge on nanostructured Si surfaces has been investigated. Thermally evaporated amorphous Ge films are vacuum-deposited and crystallized by thermal annealing at 1000 °C. Scanning electron microscope (SEM), spectroscopy (RS), infrared (IR) transmission, and Raman methods are used to characterize amorphous and crystalline Ge films. SEM analysis reveals presence of dominant features including cracks, microscopic roughness, and islands. RS exhibits strong multiple peaks attributed to crystalline structures related to Si-Ge at $\sim 444 \text{ cm}^{-1}$ and Ge at 300 cm^{-1} ; narrow and stronger peaks are observed in thermally annealed films. A comparison of IR transmission measurements in 900-1700-nm spectral range shows that amorphous film absorption is significantly higher than that of crystalline films consistent with respective bandgaps. A more detailed analysis including EDX and XRD measurements will be presented at the conference.

Keywords

Ge and $\text{Si}_x\text{Ge}_{1-x}$ heteroepitaxial growth; IR transmission; Nanostructured Si; Raman spectroscopy; Solar cells