

Abstract Submitted
for the 4CF15 Meeting of
The American Physical Society

Determination of E_0 band gaps of Ge-rich GeSi films using UV-Vis ellipsometry CHI XU, JAMES GALLAGHER, CHARUTHA SENARATNE, JOHN KOUVETAKIS, JOSE MENENDEZ, Arizona State University — Ge-rich $\text{Ge}_{1-x}\text{Si}_x$ ($x=0.003-0.132$) films were grown in a gas-source molecular epitaxy reactor on Si(100) by using new-generation group-IV gaseous reactants Ge_4H_{10} and Si_4H_{10} . Films were around 1.5 micron thick with excellent crystallinity as shown by sharp and symmetric XRD peaks. UV-Vis ellipsometry data were taken in the range of 0.6-1.5 eV with 5 meV intervals. Dielectric functions were obtained from point-by-point fits, and two data analysis methods were employed to extract fundamental band gap E_0 values. The 1st method fits the imaginary part ϵ_2 with a theoretical expression consolidating all contributions to the dielectric function. The 2nd method first numerically smoothes and differentiates the experimental ϵ_1 and ϵ_2 to obtain second derivatives with respect to energy, which are then fitted together using an expression of a three-dimensional critical point. Effects of small residual strains were corrected to obtain band gap values for strain-free materials. Excellent agreement between these two methods has been achieved. Analysis of the compositional dependence of E_0 revealed a negative bowing parameter which is greater compared to literature.

Chi Xu
Arizona State University

Date submitted: 10 Sep 2015

Electronic form version 1.4