Abstract Submitted
for the 4CF13 Meeting of
The American Physical Society

Experimental and Theoretical Investigation of Critical Point Energy Shift of Ge Films Grown on Si(100) Substrate due to Strain NALIN FERNANDO, Department of Physics, New Mexico State University, Las Cruces, NM, AYANA GHOSH, Department of Physics, University of Michigan, Flint, MI, CAYLA NELSON, AMBER MEDINA, Department of Physics, New Mexico State University, Las Cruces, NM, SETH XU, Department of Physics, Arizona State University, Tempe, AZ — The strain generated due to the thermal expansivity mismatch between the Ge film and Si substrate affects the optical properties of the Ge film resulting in many applications in the field of engineering. The strain which is a function of temperature shifts the critical point energies. The complex pseudo dielectric functions of bulk Ge and Ge films grown on Si(100) were measured using spectroscopic ellipsometry in the 0.76-6.6 eV energy range between 77-700 K to investigate the strain dependence of E_1 and $E_1 + \Delta_1$ critical point energies (CP). CP energies and related parameters were obtained by analyzing second-derivative spectrum $d^2\varepsilon/d^2\omega$ of the ellipsometry data. Using a pseudo-quasi-harmonic model for thermal expansivity proposed by Robert Reeber (Mat. Che. and Phy, 1996) we were able to predict theoretical energy shifts due to the strain on Ge films grown on Si(100) substrate, the predicted energy shifts are in excellent agreement with the ellipsometry results. We will discuss the strain dependence of the CP energies due to the thermal expansivity mismatch of Ge films grown on Si(100) and effect of the temperature to the energy shift upon cooling to lower temperatures.

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Date submitted: 13 Sep 2013 Electronic form version 1.4