Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Strain measurements of Ge epilayers on Si by Spectroscopic Ellipsometry[1] A. GHOSH, University of Michigan-Flint, N. FERNANDO, A.A. MEDINA, C.M. NELSON, S. ZOLLNER, New Mexico State University, S.C. XU, J. MENENDEZ, J. KOUVETAKIS, Arizona State University — Using spectroscopic ellipsometry, we determined the strain of a Ge epilayer grown on a Si (100) substrate. This strain depends on the sample temperature and arises because of the difference in thermal expansion coefficients between Si and Ge. It can be calculated since the thermal expansion coefficients of Si and Ge are known very precisely, if we assume that the Ge epilayer was fully relaxed at the growth temperature, leading to an increase in strain as the temperature decreases. We calculate in-plane tensile strain values of 0.12% at 300 K or 0.19% at 77K for our Ge on Si layer, that compares favorably with an in-plane strain of 0.11% derived from shifts of the Ge lattice reflection at 300 K by x-ray diffraction. This temperature-dependent strain affects the energies of the E1 and E1+Delta1 critical points of the Ge epilayer, which can be measured very precisely using spectroscopic ellipsometry from 77 to 800 K.From the difference in the critical point energies between our Ge epilayers on Si and bulk Ge (up to 20 meV), we can calculate the strain from the known elastic constants and deformation potentials. The strain determined from ellipsometry agrees well with the strain calculated from the temperature-dependent thermal expansion coefficient.

[1]This work was supported by AFOSR, Award Number FA9550-13-1-0022.

Ayana Ghosh
University of Michigan-Flint

Date submitted: 12 Nov 2013 Electronic form version 1.4