Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Doping and strain dependence of the electronic band structure in Ge and GeSn alloys[1] CHI XU, JAMES GALLAGHER, CHARUTHA SENARATNE, CHRISTOPHER BROWN, Arizona State Univ, NALIN FERNANDO, STEFAN ZOLLNER, New Mexico State Univ, JOHN KOUVETAKIS, JOSE MENENDEZ, Arizona State Univ — A systematic study of the effect of dopants and strain on the electronic structure of Ge and GeSn alloys is presented. Samples were grown by UHV-CVD on Ge-buffered Si using Ge3H8 and SnD4 as the sources of Ge and Sn, and B2H6/P(GeH3)3 as dopants. High-energy critical points in the joint-density of electronic states were studied using spectroscopic ellipsometry, which yields detailed information on the strain and doping dependence of the so-called E_1, $E_1 + \Delta_1$, E_0' and E_2 transitions. The corresponding dependencies of the lowest direct band gap E_0 and the fundamental indirect band gap E_{ind}were studied via room-T photoluminescence spectroscopy. Of particular interest for this work were the determination of deformation potentials, band gap renormalization effects, Burstein-Moss shifts due to the presence of carriers at band minima, and the dependence of other critical point parameters, such as amplitudes and phase angles, on the doping concentration. The selective blocking of transitions due to high doping makes it possible to investigate the precise k-space location of critical points. These studies are complemented with detailed band-structure calculations within a full-zone k-dot-p approach.

[1]Supported by AFOSR under DOD AFOSR FA9550-12-1-0208 and DOD AFOSR FA9550-13-1-0022

Chi Xu
Arizona State Univ

Date submitted: 13 Nov 2014 Electronic form version 1.4