Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Digital superlattice model for the measurement of strain and interfacial intermixing by X-ray diffraction YIFEI MENG, HONGGYU KIM, JIAN-MIN ZUO, University of Illinois at Urbana-Champaign — We have developed a digital superlattice model that describes the discrete lattice fluctuation in high quality GaSb/InAs type II superlattices (T2SL) grown by molecular beam epitaxy. T2SLs have attracted considerable attention as a candidate for middle-wavelength and long-wavelength infrared light detection. However, so far the performance of T2SL materials has been limited by short carrier lifetime below the theoretical predictions. Interfacial defects have suggested as possible cause. To quantify the T2SL structure, we extract interfacial strain and composition profile at atomic monolayer scale using a combination of direct 2theta-omega scan and model fitting. The digital superlattice model we developed describes the discrete fluctuation in T2SL, which enables accurate simulation of peak widths, positions and intensities. The simulation results indicate more cation intermixing compared with anion. Also strong evidence of interfacial strain is revealed in the X-ray diffraction data. The development of this technique allows a systematic study of interfacial treatments and their influences on atomic structure of T2SL. The detailed structure information is extremely helpful for optimizing the growth and refining existing energy band calculation model.

Jian-Min Zuo
University of Illinois at Urbana-Champaign

Date submitted: 15 Nov 2013 Electronic form version 1.4