Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Optical measurements of trap state density and minority carrier lifetime in GaAs heterostructures grown at varying rates CHELSEA HAUGHN, KENNETH SCHMIEDER, JOSHUA ZIDE, University of Delaware, ALLEN BARNETT, Univeristy of New South Wales, CHRIS EBERT, Veeco MOCVD, ROBERT OPILA, MATTHEW DOTY, University of Delaware — Semiconductor growth rates are a critical factor for production costs and can have a significant impact on electrical properties. We use time resolved photoluminescence (TRPL) to characterize the effective lifetime of carriers in gallium arsenide - indium gallium phosphide (GaAs/InGaP) double heterostructures grown at varying rates. We measure the PL decay time as a function of laser fluence and extract an approximate trap state density by fitting this data with the Shockely-Read-Hall model of carrier recombination. Using the approximate trap densities, we then calculate minority carrier lifetimes for a range of doping conditions. The results suggest that the increased density of trap states associated with a two-fold increase in growth rate are less limiting to carrier lifetime than doping at the levels required for devices. The techniques and analysis developed here can be applied for rapid, non-destructive quantification of trap state densities in materials grown under varying conditions.

Chelsea Haughn
University of Delaware

Date submitted: 05 Nov 2012 Electronic form version 1.4