Old Dominion University
College of Engineering and Technology
Department of Electrical and Computer Engineering

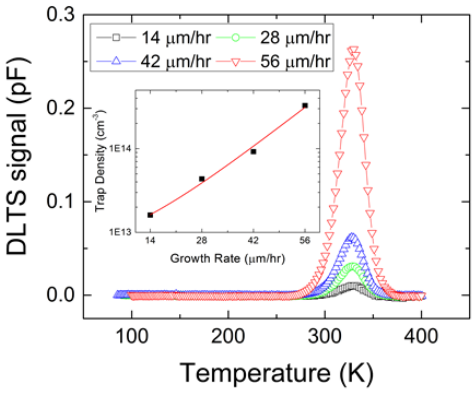
All lectures to be held at 3:00 p.m. on Tuesdays in Kaufman 224. For more information, contact Dr. Dimitrie Popescu at (757) 683-3741 or e-mail dpopescu@odu.edu. Refreshments provided after the seminar.

Tuesday, November 29, 2016 Seminar Topic:

PHOTOVOLTAICS RESEARCH IN NAVAL RESEARCH LABORATORY/BULK DEFECT AND SOLAR CELL PERFORMANCE CHARACTERIZATION OF HIGH GROWTH RATE GaAs

by Dr. Kenneth J. Schmieder and Michael K. Yakes
of the Naval Research Laboratory

Abstract:



This seminar will be delivered in two sections. The first section will provide a broad overview of photovoltaics research at the Naval Research Laboratory. This will include the experimental capabilities present within the photovoltaics section as well as discussion of current research thrusts in mobile solar power, concentrator solar power, low cost PV and PV for unmanned systems. The second section will be a more detailed scientific discussion about new breakthroughs in solar cells grown at extremely high growth rates. Increasing epitaxial growth rate is an important path toward III-V solar cell cost reductions; however, photovoltaic device performance has been shown to degrade with increasing growth rate. In this study, gallium arsenide (GaAs) material has been deposited via metal-organic chemical vapor deposition (MOCVD) at growth rates varying between 14 and 60 microns/hour. Deep-level transient spectroscopy is utilized to elucidate an exponential rise in EL2 trap density as a function of growth rate when all other growth conditions are held constant. Evidence is provided that this EL2 defect is responsible for limiting the Shockley-ReadHall (SRH) lifetime of very high growth rate solar cells. The effect of growth temperature on devices at high growth rate is subsequently investigated as a strategy to reduce trap density and improve solar cell performance. From this investigation, EL2 trap density is suppressed, and singlejunction on-substrate GaAs solar cells grown at 60 microns/hr are reported with 1.01 V 1-sun opencircuit voltage and 23.8% AM1.5G efficiency.

Bio:

Kenneth J Schmieder received his Ph.D. in Electrical Engineering from University of Delaware in 2013, having written his dissertation on *III-V/SiGe Tandem Solar Cells on Si Substrates*. He then joined the US Naval Research Laboratory as an NRC Postdoctoral Fellow to research topics related to high efficiency photovoltaics, including MOCVD epitaxial growth; device processing; electrical characterization techniques; defect characterization; and modeling of high efficiency solar cells. Upon completing his postdoc, Dr. Schmieder has been awarded a Karles Fellowship at NRL in order to expand his research on disruptive cost reduction strategies for III-V optoelectronics, including high throughput epitaxy and alternative substrate development. During his tenure at the University of Delaware, Dr. Schmieder was awarded the Bill N. Baron Fellowship for excellence in photovoltaic-based research.

Michael K. Yakes has been a research physicist at the Naval Research Laboratory since 2011, where his research has focused on molecular beam epitaxy growth, material characterization and device fabrication of photovoltaic devices for space and terrestrial applications, quantum dot devices for quantum information processing, and infrared detectors. In addition to his growth experience, he has expertise in many materials characterization techniques including cross sectional scanning tunneling microscopy, x-ray diffraction, and high resolution low energy electron diffraction as well as many semiconductor device fabrication techniques.