

MSE SEMINAR

February 17, 2017

113 McBryde Hall

3:30 – 4:30 PM

Refreshments at 3:00 PM

Professor Richard Mu

TIGER Institute, College of Engineering
Tennessee State University

“Functionalized ZnO Nanostructures and Possible New Applications”

ABSTRACT

ZnO with a band gap (3.37 eV) and an exciton binding energy (60 meV) is a promising material for ultraviolet (UV) light-emitting diodes (LEDs) and low-threshold lasing diodes. Much progress has been made to enhance band edge emission of ZnO nanowire (NW) structure through surface passivation and local surface plasmon enhancement with metal nanoparticles. Efforts have been made to fabricate electrically pumped near-ultraviolet lasing devices with metal/insulator/semiconductor laser diode based on ZnO/MgO core/shell nanowires with and without metal nanoparticle presences. The nanowire diode shows higher emission intensity at relatively low operating current density compared with the planar device. The improved efficiency is attributed to enhanced exciton oscillator strength and superior carrier transport properties of single-crystalline ZnO nanowires, and effective surface passivation by MgO coating. Random laser action was confirmed by the calculation of quality factor and the real-time changes of lasing spectra. The results reveal that the MgO coating serves as electron blocking, hole supplying and surface passivation layer for the nanowire heterostructure. In addition, a couple of other examples will also be discussed to illustrates the interplay between the structures of ZnO and capping layer and the interface affecting optical emissions of ZnO as well as the surface plasmonic effects due to metal nanoparticles. The talk will end with some suggestive photonic applications such as, possible scintillators, solar-blind detectors, and chemical sensors.

BIOSKETCH

Richard Mu has just become a Research Professor and Associate Director of Advanced Materials Initiative at recently funded TIGER (TSU Interdisciplinary Graduate Engineering Research) Institute, College of Engineering, Tennessee State University, and Adjunct Professor in Physics and Biomedical Engineering at Vanderbilt University. He was a Professor of physics at Fisk University till 2016. Richard received B.S. in physics at Northeast Normal University in China in 1982, MS in 1987, and Ph.D. in 1992 at SIU-C. He has over 200 publications, 3 patents, and 2 book chapters. He is the Nanomaterials Sensors group leader.

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