Department of Electrical and Computer Engineering

TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering

Fall 2023 Seminar Series

Seminar Title: *III-Nitride Nanowire Light-Emitting Diodes: Materials, Device Fabrication, and Applications*

Time: 2:00-2:50 PM, Friday, Sept 8, 2023

Location: Biology 101

Speaker:
Hieu P. T. Nguyen
TTU ECE Department

Abstract:
Group III-nitride nanowire heterostructures have been intensively studied as an emerging platform for future solid-state lighting, full-color displays, and medical applications. Compared to the conventional GaN based planar light-emitting diodes (LEDs), due to the effective lateral stress relaxation, III-nitride nanowires offer several distinct advantages including greatly reduced dislocation densities and polarization fields. Moreover, the use of nanowire structure provides an effective approach to scale down the dimensions of future devices and systems. However, the development of high-performance nanowire based optoelectronic devices remains several challenges, due to the lack of carrier confinement in the device active region, electron leakage and surface nonradiative recombination. In this talk, I will present the molecular beam epitaxial (MBE) growth, fabrication, and characterization of III-nitride nanowire LEDs on Si and patterned substrates. Multiple color emission across nearly the entire visible wavelength range. A high color rendering index of >95 was recorded for white-light emitted from such phosphor-free core-shell nanowire LEDs. Moreover, we have demonstrated ultraviolet LEDs using nanowire structures grown by MBE. Future prospects of these nanowire devices will also be discussed.

Speaker Bio:
Dr. Nguyen is currently an Associate Professor of Electrical Engineering at Texas Tech University (TTU). Before joining TTU, he was with the New Jersey Institute of Technology (NJIT), USA as an Associate Professor in Electrical Engineering. He was the founder and director of the molecular beam epitaxy facility at NJIT. He received his Ph.D. degree in Electrical Engineering from McGill University, Canada in 2012. His research interests focus on epitaxial growth, fabrication, and characterization of high performance photonic and electronic devices including light-emitting diodes, lasers, photodetectors, solar cells, high electron mobility transistor (HEMT), and memory devices. His research publication has been cited more than 4500 times with h-index ~ 30. He is the author/co-author of more than 100 journal articles and 100 conference presentations including several plenary and invited talks. He is the Editor of Journal of Materials Science in Semiconductor Processing (Elsevier). He is also serving as reviewer for more than 70 journals that include Nano Letters, Nature Scientific Reports, Nature Light: Sciences and Applications, Nature Flexible Electronics, Nanotechnology, Optica, Optics Express, Optics Letters. Dr. Nguyen is a recipient of the prestigious 2020 Faculty Early CAREER Development Program of the US National Science Foundation (NSF CAREER Award), the 2019 Saul K Fenster Innovation in Engineering Education Ward (for his creative and innovation in teaching method), the SPIE scholarship in Optics and Photonics 2012 (for his potential long-range contributions to the field of optics, photonics, or related field).