



Numerical Modeling of III-Nitride Semiconductors: From Material Properties to Device Performance

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Abstract: This talk presents the current research activities of the BU Computational Electronics Group, which are aimed at developing multi-scale modeling approaches for semiconductor materials and devices. The first part of this talk will discuss the application of this methodology in examining the breakdown properties of wide band gap semiconductors, in particular GaN and AlGa_N. Starting from DFT-based electronic structure calculations and computing the carrier phonon interaction without including fitting parameters, it will be shown that it is possible to predict macroscopic device performance of avalanche photodetectors and power rectifiers. The second part of this talk will discuss the current research aimed at understanding the behavior of dislocations, defect formation and migration in GaN, their impact on the electronic and optical material properties, and ultimately device reliability. The work at Boston Univ. has been supported in part by the U.S. Army Research Laboratory through the Collaborative Research Alliance (CRA) for MultiScale multidisciplinary Modeling of Electronic materials (MSME), NSF, ARO, CERDEC-NVESD and DRS.

Bio: Enrico Bellotti received the “Laurea in Ingegneria Elettronica” from Politecnico di Milano, Milano, Italy, in 1989, and the Ph.D. degree from the Georgia Institute of Technology in 1999. He has been with the Department of Electrical and Computer Engineering, Boston University since 2000, initially as an Assistant Professor and as Professor since 2013. He has more than 20 years of experience in electronic and optoelectronic device simulation, and computational electronics research. He has authored more than 100 journal papers, 80 conference papers, 4 book chapters and two U.S. patents. Dr. Bellotti leads the hybrid photonics electronics research area of the Army Research Laboratory (ARL) Multiscale multidisciplinary Modeling of Electronic materials (MSME) Collaborative Research Alliance (CRA). Dr. Bellotti was a recipient of the 2003 ONR Young Investigator Program Award and the 2005 NSF CAREER Award. His current research focuses on high-field transport in wide band-gap semiconductors, GaN-based MOS transistors for power applications, infrared and multispectral detector arrays, avalanche photodiodes, UV optoelectronics and LEDs, and quantum cascade lasers.