III-Nitride Quantum Well and Quantum Dot Opto-Electronic Devices

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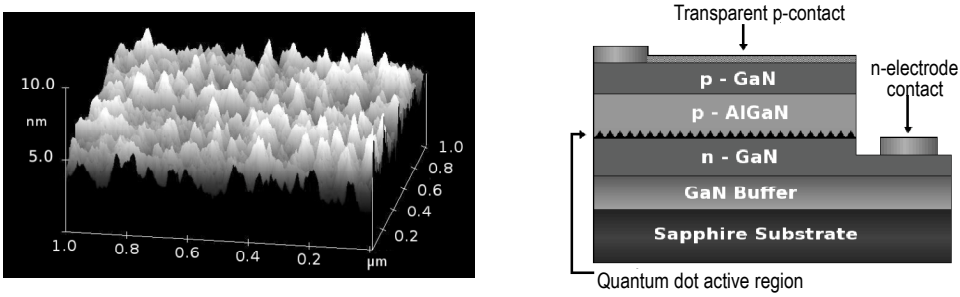
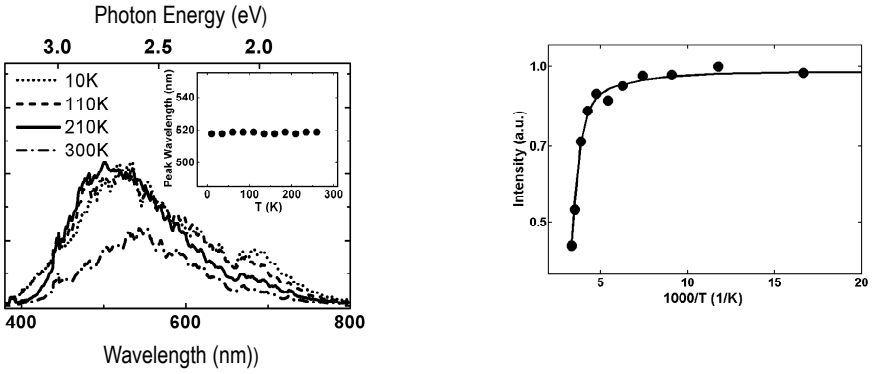
Superluminescent light emitting diodes (LEDs) with high brightness and efficiency, which emit in the blue-green range of the visible spectrum, are required for laser astronomy, laser collimators, and solid-state lighting. This project is concerned with the epitaxy and characterization of quantum well and quantum dot high-efficiency LEDs. Deep-level transient spectroscopy and time-resolved photoluminescence measurements are made to characterize quantum well devices. Fabrication of these devices also includes optimization of the ohmic contacts. Recently, we have successfully grown high-quality, self-organized InGaN QDs by RF-plasma assisted molecular beam epitaxy that exhibit, for the first time, strong emission at 500nm at 300K. We have characterized the structural and optical properties of these QDs by atomic force microscopy, X-ray diffraction, and temperature dependent photoluminescence. This project is partially supported by the Department of Energy under award number 1070083-202847.



Atomic force microscopy image of the InGaN/GaN QDs (left) and LED structure (right).



Temperature-dependent photoluminescence spectra (left) and the corresponding Arrhenius plot (right).