

Progress in the Development of Quantum-Dot Based Light-Emitting Diodes

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In recent years, solid-state lighting (SSL) has rapidly emerged as a viable alternative to traditional light sources in monochromatic applications. Highly-efficient violet to blue-green emission can be readily obtained with nitride-based LED's, whereas phosphide-based materials are used for red to yellow emission. However, overall visible SSL technology suffers because neither material system has been shown to provide an efficient emission in the deep green range (~ 555 nm). Our research group is attempting to combat this problem by fabricating GaN-based LED's in which colloidal quantum dots (QD) are used as the active layer.

This presentation will highlight some of the most recent results in our study of QD-active layer LED's. These structures were made by wet-deposition of CdSe quantum dots onto an MOCVD-grown n-type GaN template, followed by overgrowth with MBE-grown p-type GaN. These structures were then fabricated into devices using standard GaN fabrication techniques.

The devices' electrical and optical data, including efficiency will be discussed. The influence of MBE overgrowth conditions will be covered, as will post-growth evidence of the integrity of the LED structure. Finally, we will present data that differentiates between QD-based and defect-based emission in order to demonstrate that recombination is indeed happening in our samples' active layers.

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