S7-I1
Interwell carrier transport in InGaN quantum well LEDs

Saulius Marcinkevičius,[1] Rinat Yapparov,[1] Tanay Tak,[2] Jacob Ewing,[2] Cheyenne Lynsky,[2] Feng Wu,[2] Shuji Nakamura[2] and James S. Speck[2]

[1]Department of Applied Physics, KTH Royal Institute of Technology, AlbaNova University Center, 10691 Stockholm, Sweden

[2]Materials Department, University of California, Santa Barbara, California 93106, USA

The internal quantum efficiency of multiple quantum well (QW) light emitting diodes (LEDs) to a large degree depends on uniformity of hole distribution between the QWs. Typically, the transport between QWs takes place via capture to and thermionic emission out of the QWs. In InGaN/GaN QWs, however, the QWs are deep, and the thermionic transport might be hindered by the high quantum confinement and polarization barriers.
In this talk, our work on the interwell carrier transport in InGaN LED structures emitting from violet to red will be reviewed. The carrier transport effects were studied by time-resolved photoluminescence and scanning near-field optical microscopy. It was found that in short wavelength devices the interwell transport is thermionic and critically depends on the barrier height. In the long wavelength devices, QWs further away from the *p*-side can be populated via volumetric hole injection through semipolar QWs that form on facets of V-defects originating at threading dislocations in polar LED structures. Studies of the carrier transport via the semipolar QWs, carrier spreading in the polar QWs away from the V-defects, and lateral distribution of recombination times show that injection through the V-defects can indeed enhance the efficiency of long wavelength GaN-based LEDs.