Nanostructures and carrier localization behaviors of green-luminescence InGaN/GaN quantum-well structures of various silicom-doping conditions

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Abstract

The results of photoluminescence ~PL!, detection-energy-dependent photoluminescence excitation
~DEDPLE!, excitation-energy-dependent photoluminescence ~EEDPL!, and strain state analysis
~SSA! of three InGaN/GaN quantum-well ~QW! samples with silicon doping in the well, barrier and
an undoped structure are compared. The SSA images show strongly clustering nanostructures in the
barrier-doped sample and relatively weaker composition fluctuations in the undoped and well-doped
samples. Differences in silicon doping between the samples give rise to the differences in DEDPLE
and EEDPL spectra, as a result of the differences in carrier localization. In addition, the PL results
provide us clues for speculating that the S-shaped PL peak position behavior is dominated by the
quantum-confined Stark effect in an undoped InGaN/GaN QW structure.

Keyword：carrier localization
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