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Auger Recombination in Defect-Free III-Nitride Nanowires[1]
MENG ZHANG, WEI GUO, PALLAB BHATTACHARYA, JUNSEOK HEO, ANIMESH BANERJEE, University of Michigan — Defect free InGaN nanowires (NWs) and InGaN/GaN dot-in-nanowires (DNWs) were grown on (001) Si by plasma assisted molecular beam epitaxy. The nanowires have a density of $\sim$ 1x10^{11}cm^{-2} and exhibit photoluminescence emission peak at λ $\sim$500 nm. The Auger recombination coefficients of these nanowires are determined by excitation power dependent photoluminescence and time-resolved photoluminescence techniques. The measured Auger coefficients are 6.1x10^{-32} cm^6·s^{-1} and 4.1x10^{-33} cm^6·s^{-1}, in the NW and DNW samples, respectively, which are nearly two orders of magnitude lower than those measured in InGaN/GaN quantum wells and agree very well with theoretical calculations. This suggests that the abnormally high Auger coefficients measured in traditional wide bandgap nitride materials is related to the high density of dislocations. InGaN NW and InGaN/GaN DNW light emitting diodes are demonstrated. The external quantum efficiency does not decrease up to an injection current density of 400A/cm^2.

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