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Exciton emission from bare and hybrid plasmonic GaN nanorods FATEMESADAT MOHAMMADI, University of Cincinnati, GERD KUNERT, DETLEF HOMMEL, University of Bremen, Germany, JINGXUAN GE, GERD DUSCHER, University of Tennessee, Knoxville, HEIDRUN SCHMITZER, Xavier University, Cincinnati, HANS PETER WAGNER, University of Cincinnati — We study the exciton emission of hybrid gold nanoparticle/Alq3 (aluminiumquinoline)/wurtzite GaN nanorods. GaN nanorods of ~1.5 μ m length and 250 nm diameter were grown by plasma assisted MBE. Hybrid GaN nanorods were synthesized by organic molecular beam deposition. Temperature and power dependent time integrated (TI) and time resolved (TR) photoluminescence (PL) measurements were performed on bare and hybrid structures. Bare nanorods show donor (D^0, X) and acceptor bound (A⁰,X) exciton emission at 3.473 eV and at 3.463 eV, respectively. TR-PL trace modeling reveal lifetimes of 240 ps and 1.4 ns for the (D^0, X) and (A^0, X) transition. 10 nm gold coated GaN nanorods show a significant PL quenching and (D^0,X) lifetime shortening which is tentatively attributed to impact ionization of (D^0, X) due to hot electron injection from the gold nanoparticles. This is supported by electron energy loss spectroscopy that shows a redshift of a midgap state transition indicating a reduction of a preexisting band-bending at the nanorod surface due to positive charging of the gold nanoparticles. Inserting a nominally 5 nm thick Alq₃ spacer between the nanorod and the gold reduces the PL quenching and lifetime shortening. Plasmonic nanorods with a 30 nm thick Alq₃ spacer reveal lifetimes which are nearly identical to uncoated GaN nanorods.

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