Abstract Submitted
for the OSF12 Meeting of
The American Physical Society

Photoluminescence

Enhancement of Embedded Ga:GaAs Nanocomposites SUNYEOL JEON, MYUNGKOO KANG, JIA-HUNG WU, JIEUN LEE, VANESSA SIH, RACHEL GOLDMAN, University of Michigan — When electromagnetic radiation is incident upon metallic nanoparticles(NPs), surface plasmon resonance(SPR) is generated. Metallic NPs on semiconductors have shown significant promise for various applications, such as enhanced light emission, and negative refractive index metamaterials. Metallic NP-induced photoluminescence(PL) enhancement has been demonstrated and attributed to the matching of the NP SPR energy with the semiconductor band gap energy. To date, plasmonics research has focused exclusively on Ag and Au NPs; however, their optical response is limited to low SPR energies(3.5eV). It was recently shown that Ga NPs produce size-dependent SPR, ranging from near-IR to visible wavelengths. Furthermore, 2D and 1D Ga NP arrays with SPR quality factors comparable to Ag and Au were reported. Here, we fabricate embedded Ga:GaAs nanocomposites utilizing off-normal focused-ion-beam(FIB) irradiation followed by molecular beam epitaxy overgrowth. The density(diameter) of the close-packed Ga NPs increases(decreases) with increasing the off-normal irradiation angle. We discuss the relative influences of Ga NP diameters and GaAs overgrowth thickness on the enhancement of the GaAs near-band edge emission, including the donor-acceptor pair and band-to-band emission.

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Date submitted: 07 Sep 2012 Electronic form version 1.4