

III-Nitride-Based Ultra-High Bit-Rate Optoelectronic Semiconductor Nano-Devices for Operating at Fiber-Optics Telecommunication Wavelengths

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In this paper, Intersubband transition in quantum wells was investigated from the viewpoint of application to ultra-high bit-rate optoelectronic devices operating at fiber-optics telecommunication wavelengths at low switching powers. The advanced materials that we will investigate are nitride-based heterostructures GaN/AlGa_N. The electronic quantum confinement at a nanometer scale to realize active devices relying on intersubband absorption/emission at 1.3-1.55 μm has been engineered. In order to obtain accurate values for the Fermi energy, the energies of individual quantized levels, the occupancy of the various sub-bands, the intrasubband and intersubband coupling coefficients, and the sheet carrier concentration within the 2D quantum well at the AlGa_N/GaN interface, both the Schrödinger and Poisson equations have been solved simultaneously taking into account the electrostatic potential obtained from Poisson's equation, as well as including the image and exchange-correlation potentials using Numerov's numerical method. Also, in this paper, we report on a comparative study of electron Intersubband transition scattering times in GaN/AlGa_N single and coupled MQW samples at different excitation powers and wavelengths around fiber-optics telecommunication wavelengths.

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