POSSIBLE SPECTRAL REGIMES OF $Al_xGa_{1-x}N/GaN/Al_xGa_{1-x}N$ AND $AlN/Al_xIn_{1-x}N/AlN$ SINGLE QUANTUM WELLS

K. PREMARATNE,[1] MANJULA GURUSINGHE[2] AND T.G, ANDERSSON[2]

[1]*Department of Physics, Faculty of Science, University of Peradeniya*
[2]*Department of Microelectronics & Nanoscience, Chalmers University, 412 96 Göteborg, Sweden*

We report on the possible spectral regimes of $Al_xGa_{1-x}N/GaN/Al_xGa_{1-x}N$ and $AlN/Al_xIn_{1-x}N/AlN$ single quantum wells (SQW) based on a simplified model for the shape of the quantum well. Since some of the parameters for these materials have not been firmly established, we carried out the analysis for the two extremes of the reported values of conduction band discontinuities and the band gaps (in the case of InN). Also we have considered the practically useful ranges of quantum well widths and alloy composition ratios.

This analysis shows that the spectral regime of interband excitations covers a range of wavelength from 0.5 μm to about 4.0 μm for AlN/InN quantum wells and from 1μm to 6μm for AlN/GaN wells in the practically useful range of quantum well widths from 10 Å to about 40 Å. The spectral variation with alloy composition parameter x, is less pronounced in AlN/InN SQWs compared to AlN/GaN due to the higher electric field present across the SQW. The results of this calculation are in reasonable agreement with the reported experimental values and with those of more rigorous theoretical analyses applied to QWs having specific values of x-parameter and QW width.