GROWTH AND CHARACTERIZATIONS OF GaAs/GaNAs CORE-MULTISHELL MULTIPLE QUANTUM WELL NANOWIRES HAVING DIFFERENT PERIODICITY

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Dilute nitride semiconductor GaNAs is considered as a promising material due to the bandgap decreases significantly with decreasing lattice constant,[1] showing a prospect for its applications in telecommunications and photovoltaics working in the near infrared range. Multiple-quantum-wells structure can control the properties of the system by modulating the carrier confinement, interaction of wavefunctions in the wells, and total volumes of the matter by varying the properties of the consisting layers as well as their stacking periods. We here report the growth of GaAs/GaNAs core-multishell nanowires of multiple quantum wells grown by plasma-assisted molecular beam epitaxy having different periodicity. 4 series of samples were grown on Si(111) substrates with GaNAs quantum well stacking periods of 1, 2, 3, and 5. We observed clear formation of NWs which have their diameter of 400 nm and length of 5 µm, and the density of 5x10-7 cm-2 for the series of samples. X-ray diffraction showed a shift of the GaAs(111) peak with increase of GaNAs periods number. With the increase of GaNAs quantum well periods we observe show clear spectral peak shift of the room temperature photoluminescence emission peaks at wavelengths between 1115 and 1154 nm, decrease of their intensities, and broadening of the peak widths. These results suggest that multiple quantum wells are formed in which the wave functions of each quantum well interact. The effect of nitrogen concentration, well widths, and the distributions of the wavefunctions in the system on the observed transition energies are discussed with the calculation of Schrödinger equation.