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Study of AlGaAs/GaAs quantum Wells grown on GaAs (118) by MBE

In this work, we have grown AlGaAs/GaAs quantum wells using Molecular Beam Epitaxy (MBE) on high-index GaAs substrates. We performed a comprehensive study of the structures employing a variety of characterization techniques. AlGaAs layers, serving as barrier materials, are crucial for confining electrons within the GaAs quantum well region. This confinement is essential for the functionality of GaAs-based heterostructure devices, including Quantum Well Infrared Photodetectors (QWIPs) and double-heterostructure laser diodes, which operate in the red to near-infrared spectrum (700–1100 nm).

To understand the electronic structure and energy levels of the quantum wells, we solved the Schrödinger equation, providing insights into the quantum states and their respective energy levels.

For optical characterization, we employed photoluminescence (PL) and photoreflectance (PR) spectroscopy. PL measurements allowed us to probe the emission properties and confirm the quantum well's energy levels, while PR spectroscopy provided information on the electronic transitions and optical properties of the quantum wells.

Raman spectroscopy was used to analyze the vibrational modes within the quantum wells, offering valuable data on phonon interactions and Al composition. Additionally, atomic force microscopy (AFM) was utilized to assess the surface morphology and measure the root mean square (RMS) roughness of the quantum wells, which is critical for understanding the surface quality and its impact on device performance.

Keywords

Quantum Wells, energy levels, photoluminescence.

Reference

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Author approval

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