

AIII-BV Quantum Structures for NIR Emitters

Algirdas Jasinskas, Simona Pūkienė, Sandra Stanionytė, Martynas Skapas,
Bronislovas Čechavičius, and Renata Butkutė

Center for Physical Sciences and Technology, Saulėtekio ave. 3, LT-10257, Vilnius, Lithuania
algirdas.jasinskas@ftmc.lt

With the rapid development in modern sensing technologies, there is an increasing need for efficient near infrared (NIR) sources. Group AIII-BV semiconductor platform, namely GaAs, AlGaAs, GaAsBi, etc. is widely used in this wavelength region for various optoelectronics applications, such as solar cells, photodetectors, as well as lasers [1]. The ability to alloy different AIII-BV elements allows tuning various mechanical, electrical and optical properties and provides a great control of bandgap, therefore emission wavelength. Moreover, the use of quantum structures, such as quantum wells and quantum dots, results in improved device performance or even new devices (e.g. quantum cascade lasers) [2]. For these reasons, well-known AIII-BV compounds are widely studied with continuing alloying and engineering of new ternary, quaternary even quinary systems exhibiting the synergy of properties.

The samples for this research were grown by AIII-BV Molecular Beam Epitaxy (MBE) and Migration-Enhanced Epitaxy (MEE). Complex characterization study including Transmission Electron Microscopy (TEM), High Resolution X-Ray Diffraction (HR-XRD), Atomic Force Microscopy (AFM), and Photoluminescence measurements (PL), was used to determine the influence of growth conditions and design parameters on structural and optical properties of the quantum structures. Fig. 1 and Fig. 2 present the cross-sections of AIII-BV quantum wells and quantum dots containing samples, respectively, investigated in this work.

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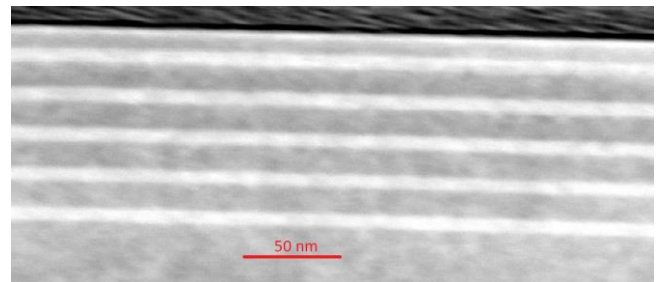


Fig. 1. STEM image of a sample with 5.7 nm GaAsBi quantum wells (bright areas) within GaAs barriers.

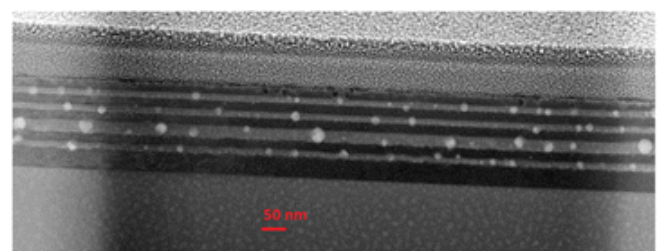


Fig. 2. STEM image of a sample with bismuth quantum dots (bright dots) within AlAs barrier layers.