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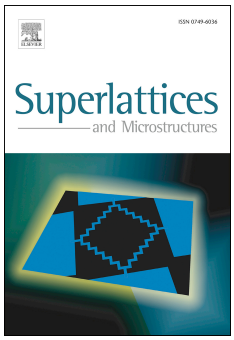

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Jhuma Saha, Debiprasad Panda, Subhananda Chakrabarti

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Tuning the Optoeletronic Characteristics of Strain Coupled InAs/GaAs Bilayer Quantum Dot Heterostructures through Compositional and Structural Variabilities

Jhuma Saha[a], Debiprasad Panda[b], and Subhananda Chakrabarti[b,*]

[a]Centre of Research in Nanotechnology & Science, Indian Institute of Technology Bombay, Mumbai 400076, Maharashtra, India

[b]Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai 400076, Maharashtra, India

ABSTRACT

Strain coupled quantum dots are the high priority research topic of the present day scientific community. The ability to enhance the photoluminescence properties is very important for enhancing performance of quantum dot based lasers and photodetectors. In this article, we study the impact of various sources of variability viz. different capping layer materials, different aspect ratio of QD, which may enhance or deteriorate the photoluminescence characteristics of these structures. A bilayer InAs/GaAs QD with varying GaAs barrier has been considered for this study. The photoluminescence wavelength emission can be tuned from 1.25 μm to 1.38 μm, by varying the capping material of various thicknesses (compositional variability). We have validated with the experimental data to judge the reliability of our simulation study and the average deviation obtained was within 4%. We have also studied the structural variability in terms of aspect ratio and its influence on the optical properties. Finally, we have combined the optimum structures from both compositional and structural variabilities to explore the possibilities of enhancing the performance of the heterostructures, so that they can be used in different applications.

Keywords: Variabilities, Bilayer, Aspect ratio, Strain, Eigenstates, Photoluminescence.