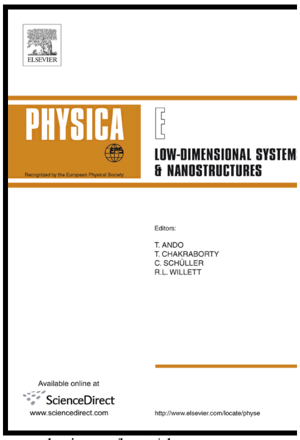
Author's Accepted Manuscript

2Deg Modulation IN Double Quantum Well Enhancement Mode Nitride hemt

Ankush Bag, Palash Das, Rahul Kumar, Partha Mukhopadhyay, Shubhankar Majumder, Sanjib Kabi, Dhrubes Biswas



www.elsevier.com/locate/physe

PII: S1386-9477(15)30084-9
DOI: http://dx.doi.org/10.1016/j.physe.2015.06.011
Reference: PHYSE11998

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received date: 11 March 2015
Revised date: 12 June 2015
Accepted date: 15 June 2015

Cite this article as: Ankush Bag, Palash Das, Rahul Kumar, Parth Mukhopadhyay, Shubhankar Majumder, Sanjib Kabi and Dhrubes Biswas, 2De Modulation IN Double Quantum Well Enhancement Mode Nitride hemt, *Physic E: Low-dimensional Systems and Nanostructures* http://dx.doi.org/10.1016/j.physe.2015.06.011

2DEG Modulation in Double Quantum Well Enhancement Mode Nitride HEMT

Ankush Bag[1], Palash Das[1], Rahul Kumar[1], Partha Mukhopadhyay[1], Shubhankar Majumder[1], Sanjib Kabi[1]and Dhrubes Biswas[2]

[1]*Advanced Technology Development Centre, Indian Institute of Technology Kharagpur, India-721302.*

[2]*Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology Kharagpur, India-721302.*

E-mail: bag.ankush@gmail.com

Abstract

A double quantum well (QW) based nitride HEMT has been conceptualized through numerical simulation of Schrödinger and Poisson’s equations for enhancement mode operation by introduction of a deeper secondary QW along with primary AlGaN/GaN triangular potential well. The carriers for drain current are populated in the shallower primary QW through energy band bending with positive V_{GS}. Participation of the concerned QW in drain current conduction depends upon the magnitude of the band offsets and polarization effects of the materials. Effect of the gate bias on energy band delineates the modulation of 2DEG carriers in the shallow energy quantum well from 1.6×10^{-3} cm^{-3} to 9.47×10^{17} cm^{-3} with gate bias from 0.5 V to 1.0 V to confirm the drain current conduction with V_{th} > +0.5 V at typical depth of source and drain Ohmic contacts.

1. Introduction

Recently, there has been an enormous advancement of solid-state technology in high power as well as high-speed applications. Devices fabricated from wide band gap materials such as III-nitrides are more energy efficient than its silicon counterparts. The pyroelectric properties of group III-nitrides open up unique possibilities for the realization of heterostructures with novel electronic characteristics and it is common to achieve normally ON or depletion mode device through spontaneous and piezoelectric polarization [1]. To make nitride devices applicable in complementary FET based high power digital logic and low power loss circuits, enhancement mode (E-mode) or normally