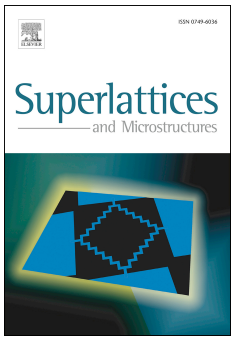
Accepted Manuscript



Donor binding energies in a GaN/$ZnGeN_2$ quantum well

Hasan Yıldırım

PII: S0749-6036(17)31172-2

DOI: 10.1016/j.spmi.2017.07.008

Reference: YSPMI 5118

To appear in: *Superlattices and Microstructures*

Received Date: 11 May 2017

Revised Date: 2 July 2017

Accepted Date: 2 July 2017

Please cite this article as: H. Yıldırım, Donor binding energies in a GaN/$ZnGeN_2$ quantum well, *Superlattices and Microstructures* (2017), doi: 10.1016/j.spmi.2017.07.008.

Donor Binding Energies in a GaN/$ZnGeN_2$ quantum well

Hasan Yıldırım[a,*]

[a] *Department of Occupational Health and Safety, Faculty of Health Sciences, Karabuk University, Karabuk 78050, Turkey*

Abstract

Binding energies of a donor atom within a GaN/$ZnGeN_2$ quantum well structure have been investigated. Hydrogenic type wave functions are assumed and the Schrödinger and Poisson's equations are solved self-consistently. The binding energies of the donor states $1s$ and $2p_{\pm}$ associated with the first subband in the quantum well and the transition energies between them are represented as a function of the quantum well width, the donor position and the external magnetic field. The ground state $1s$ and the excited states $2p_{\pm}$ have maximum binding energies as much as 64 and 11 meV, occurring in quantum wells of widths 10 and 18 Å, respectively. The binding energies are found to be an asymmetric function of the donor position with respect to the quantum well center because of the asymmetry in the band profile introduced by the built-in electric field in the structure. An external magnetic field up to 10 T is included into the calculations and it is seen that the excited states show a small Zeeman splitting, very close to the bulk GaN value, because of the heavy effective mass of electron.

Keywords: $ZnGeN_2$, donor, binding energy, quantum well

2010 MSC: 00-01, 99-00

*Corresponding author

Email address: hasanyildirim@karabuk.edu.tr (Hasan Yıldırım)