EFFECT OF MIXED DISORDER ON MINIBAND STRUCTURE AND RESONANCE ENERGY OF GaAs/$Al_xGa_{1-x}As$ SUPERLATTICES

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Abstract

Theoretical analysis of mixed disorder (association between topological and structural disorder) on resonance energy and miniband structure formation for rectangular GaAs/AlxGa1-xAs superlattices is presented in this studies. The Airy functions model based on the transfer-matrix technique with the assuming of the effective mass approximation and using Bastard's boundary conditions are applied to Schrodinger's equation for an asymmetric potential. A detailed analysis of the resonance energy and miniband formation is given.The transmissions spectra reveal the appearance of a miniband structure with a concomitant disappearance of the localized states. The possibility of the creation of resonant states, with a good control of the energy differences is pointed out. Also the high bias voltage led to the emergence of a phase transition from the metallic state to the insulating.

The results show that for structures with short range correlation and stronger disorder, the electronic states of the system are delocalized since the localization length is greater than the system size. The quantum states in the well play a key role in the transmission.

Compared to other types of disorder structures already studied by the authors [1-2], we have shown in this study that the mixed disorder which is a combination between topological and structural disorder, gives the miniband that resists well to low applied bias voltages.

[1] R. Djelti, S. Bentata, Z. Aziz and A. Besbes, *Eur. Phys. J. Appl. Phys*. **48**, 10605 (2009) p1-p6.
[2] R. Djelti, S. Bentata, Z. Aziz and A. Besbes, *Can.J. Phys*, **87** (2009) 981-988.

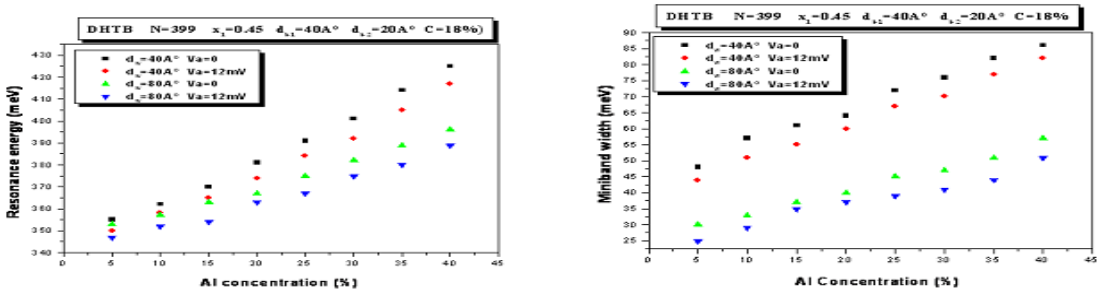

Fig. 1 Resonance energy and miniband width versus Aluminium concentration

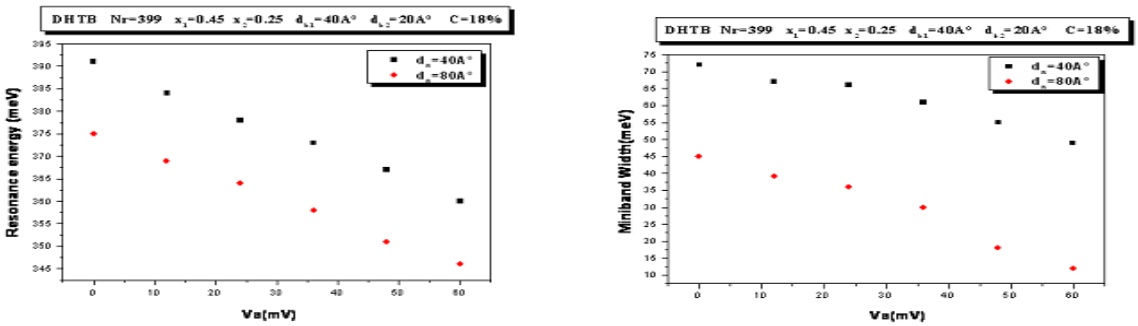

Fig. 2 Resonance energy and miniband width versus an applied bias voltage