TRANSMITTIVITY OF A DISORDERED SUPERLATTICE WITH THE SCATTERERS INSIDE BARRIERS IN THE EXTERNAL ELECTRIC FIELD

A.M. Korol

Ukrainian State University for Food Technologies
Volodymyrska 68, Kiev, Ukraine

It is known that the deep levels strongly effect the characteristics of various resonant tunneling structures [1-3]. In this work the tunneling spectra of a disordered semiconductor superlattice (SL) in the presence of external electric field are evaluated. The disorder arises because the widths of the quantum wells assume random values along the SL chain. The effect of deep impurities, located in the barriers, on the tunneling transmittivity of SL considered is analyzed. The potential of the deep centers is modeled by δ-function of the power β. Calculations are provided within the framework of the effective mass approximation using the transfer matrix technique; the eigenfunctions are expressed via Airy functions.

In the absence of impurities the effect of the electric field on tunneling spectra results in decrease of the transmission rates T, shift of the minibands, widening of intervals between the resonant peaks.

Incorporation of impurities into the potential barriers results in the following changes in the tunneling spectra. The additional band associated with impurities appears in the spectra. This band is affected by the electric field to a much lesser extent than the bands generated by the wells. Strong interaction of impurity states with the well states is observed, this being dependent significally both on β and the distance from the impurity center to the nearest interface. The tunneling transparency is increased by several orders of magnitude as a result of this interaction. Energetic intervals with high values of the transmission rates T widen due to impurities. Nonmonotonic dependence of T on the electric field is observed for certain values of β.

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2. A.M. Korol, Phys.Rev. B50, 2661 (1994)
3. A.M. Korol, Pisma v JETP 59, 659 (1994)