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Modeling of voltammetric characteristic for tunneling-resonant structure based on AlGaAs/GaAs semiconductor.

Transport of charge carriers in low-dimensional structures is often caused by tunneling effect. Tunneling means transiting of electron through the area limited by the potential energy barrier higher than the energy of electron [1]. Tunneling of electrons in low dimensional structures is determined not only by the energy of potential barriers, but also by allowed energy states for electrons within the structure. A rapid increasing often occurs in a low-dimension structure which is limited by two potential barriers. This phenomenon can be observed in accordance to Fermi level of injector electrode material and one of the discrete energy levels in the low dimensional structure. This phenomenon is called a resonant tunneling [2]. In this paper we have made a quantum-mechanical calculation of tunneling through the two-barrier structure AlGaAs/GaAs/AlGaAs, grounding on the given solutions of Schrodinger equation within the barriers and out of their limit. A general tunnel current is calculated as an integral sum of tunneling electron probabilities $T(E_z)$ through two including the electron distribution function by their energies:

$I = \frac{e}{4\pi^3\hbar}\int_0^\infty dk_x dk_y \int_0^\infty dk_z T(E_z)[f(E) - f(E')](\frac{\partial E}{\partial k_z})$, where $f(E)$ and $f(E')$ - Fermi-Dirac distribution functions for electrons in emitter and collector.

Reference

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