Transport characteristics of gated core-multishell nanowires: Self-consistent approach

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III-V semiconductor core-shell nanowires can be applicable in nanoelectronics, for example as transistors with characteristics controlled by electrostatic gates and operating in the coherent transport regime. Technologies developed in last few years allow manufacturing of smaller, more complex and more efficient devices than before [1, 2]. The earlier computational study [3] allowed determining the optimal design of such nanodevices, i.e., influence of the geometrical parameters of conduction and insulating layers on electric current was examined.

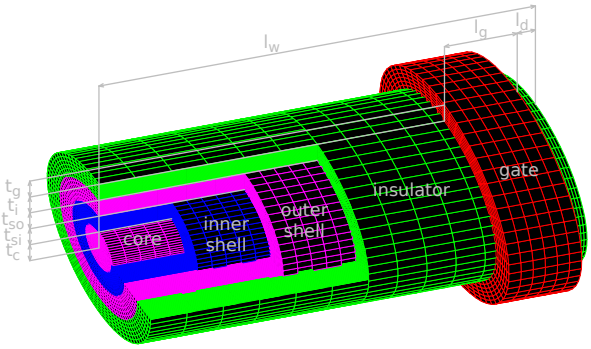

Figure 1: Schematic of core-multishell nanowire with the surrounding gate.

The influence of the applied gate voltage on the coherent propagation of the conduction electrons through the InGaAs/InP core-multishell nanowires with with varying dimensions of the core and shells and the surrounding gate is considered in this report.

The present calculations are based on the adiabatic and effective mass approximation of the three-dimensional Schrödinger equation [4]. The electrostatic potential distribution generated by the all-around gate placed in the vicinity of the drain electrode is determined using the self-consistent procedure applied to solve the Schrödinger-Poisson problem. Quantum transmission boundary method is used to calculate the transmission coefficient, and the transport properties of the considered nanosystem are obtained within the Landauer-Büttiker formalism.

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