Abstracts

Space-Charge Wave Considerations in MIS Waveguide Analysis

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A transport-based small-signal analysis of the fundamental mode of propagation in a metal-insulator-semiconductor (MIS) waveguide is presented. The formulation incorporates the full set of Maxwell's equations, the equations of motion of the carriers based on a drift-diffusion model, providing a quantitative description of the space-charge wave induced at the surface of the semiconductor. Effects of an external dc bias on the propagation characteristics are also accounted for. Numerical solutions to the system of equations for a waveguide with typical material parameters, dimensions are obtained using an iterative algorithm. Results indicate that the transverse component of the electric field in the semiconductor is strongly influenced by the screening effect of the charge carriers, whereas the longitudinal component is governed mainly by energy dissipation arising from the conduction current. The presented formulation can also find application for other multilayer structures which support a strong interaction between the electro-magnetic field, the charge carriers.

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