7th International Conference on

Electrical , Electronic Engineering and Smart Grids

Scaling Behavior of p-type Junctionless Field Effect Transistors with Different Channel Materials

F. Bajelan
Department of Electrical Engineering, Abhar Branch, Islamic Azad University, Abhar, Iran

Abstract

Performance analysis of junctionless (JL) gate all around (GAA) metal oxide semiconductor field effect transistors (MOSFETs) is investigated by employing the Non-Equilibrium Green's Function (NEGF) formalism. In this work, p-type JL-GAA-FETs with different channel materials such as GaP, InGaP, InP, and Si are studied and the performance of such devices is compared with each other. The results of this study show that the suppression of the tunneling current of such devices is occurred by using large band gap and high carrier effective mass materials. Based on the comparison between the device characteristics of different channel material, the optimum electronic characteristics are obtained, where the channel material is chosen as GaP. Plus, in the present study the scaling behavior of JL transistors (JLTs) is studied by varying the gate length of all devices from 6 nm to 12 nm. By decreasing the device length the performance is degraded in terms of OFF-state current (I_{OFF}), ON/OFF current ratio (I_{ON}/I_{OFF}), subthreshold slope (SS), and drain induce barrier lowering (DIBL).

Keywords: Non-Equilibrium Green's Function (NEGF), Gate all around (GAA), Junctionless field effect transistors (JL-FETs).