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Discrete random distribution of source dopants in nanowire tunnel transistors (TFETs)[1] SOMAIA SYLVIA, University of California Riverside, M. ABUL KHAYER, Intel Corporation, KHAIRUL ALAM, East West University, Dhaka, Bangladesh, HONG-HYUN PARK, Samsung Semiconductor Inc., GERHARD KLIMECK, Purdue University, ROGER LAKE, University of California Riverside — InAs and InSb nanowire (NW) tunnel field effect transistors (TFETs) require highly degenerate source doping to support the high electric fields in the tunnel region. For a target on-current of 1 μA, the doping requirement may be as high as 1.5×10^{20} cm^{-3} in a NW with diameter as low as 4 nm. The small size of these devices demand that the dopants near tunneling region be treated discretely. Therefore, the effects resulting from the random distribution of dopant atoms in the source of a TFET are studied for 30 test devices. Comparing with the transfer characteristics of the same device simulated with a continuum doping model, our results show (1) a spread of $I - V$ toward the positive gate voltage axis, (2) the same average threshold voltage, (3) an average 62% reduction in the on current, and (4) a slight degradation of the subthreshold slope. Random fluctuations in both the number and placement of dopants will be discussed. Also, as the channel length is scaled down, direct tunneling through the channel starts limiting the device performance. Therefore, a comparison of materials is also performed, showing their ability to block direct tunneling for sub-10 nm channel FETs and TFETs.

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