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Accuracy of Boltzmann Full-impurity-ionization Approximation on Surface Recombination DC Current-Voltage Characteristics. ZUHUI CHEN, BIN B. JIE, CHIH-TANG SAH, University of Florida — Surface recombination DC Current-Voltage (RDCIV) characteristics are used to extract interface properties of Metal-Oxide-Semiconductor (MOS) structure, such as interface trap density and surface dopant impurity concentration. The steady-state Shockley-Read-Hall kinetics with Boltzmann distribution and full-impurity-ionization (BI) approximation are used. Compared with the Fermi distribution and impurity-deionization (FD) theory, the BI approximation gives orders of magnitude higher computation speed required in computer aided integrated circuit design. Accuracy of BI approximation is analyzed by computing the derivation from the exact FD theory, with wide ranges of MOS parameters (substrate dopant impurity concentration, gate oxide thickness, forward source/drain junction bias, interface trap energy level, and transistor temperature). It is shown that BI approximation deviates from the exact FD theory by less than 5% over the practical range of these five parameters.

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