Simulation of Carrier Trapping in an Embedded Nanowire and Its Effect in the Nano-EBIC Technique

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Effect of an isolated Ge nanowire embedded in an *n*-doped Si on electron beam induced current is simulated by a Monte-Carlo calculation algorithm. A circular nano-contact is used to collect the current generated by the use of primary energy of 5 or 10 keV in a perpendicular configuration along a line passing through the contact center. The nanowire, considered as a recombination center, is vertically positioned beneath the contact. Calculation takes into account various parameters such as a nano-scale depletion zone under the nano-contact, the depth of the nanowire, and its size. The surface recombination velocity is taken equal to zero. Competition between both carriers collected by the nano-contact and those captured by the nanowire is studied. Both processes are affected by the depth of the nanowire and by the primary energy. Moreover, the nanowire−Si contact behaves as a nano-scale hetero-junction, and hole storage in the nanowire leads to accentuation of energy band bending, especially in the longitudinal direction of the nanowire. Consequently, tunnel recombination would be present.

Keywords: nanowire, nano-EBIC, Monte-Carlo simulation, carrier trapping, carrier collection.

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