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Title: A modified gate oxide tunnel Field-Effect transistor (TFET) biosensor to identify receptor Tyrosine-Protein kinase 2 (C-erbB-2) in Serum/Saliva

Author: Karmakar P.; Sahu P.K.; Mohapatra S.K.; Alanazi N.; Alodhayb A.N.

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Abstract: This research demonstrates an analysis of a modified gate oxide tunnel field-effect transistor (TFET) with pocket (Poc-MGOTFET) biosensor for the incredibly sensitive and real-time identification of the breast cancer (BC) biomarker receptor tyrosine-protein kinase (C-erbB-2) in serum and saliva. This research investigates the impact of interface charge modulation in Poc-MGOTFET biosensor with embedded cavities for rapid, accurate, and reliable identification of antigens in bodily fluids, like serum and saliva. The TCAD Sentaurus is used to numerically simulate the proposed biosensor in 2D. The dual cavity etched underneath the dual gate electrode of the proposed biosensor facilitates biomolecule immobilization. This enhances the ability of biomolecules to regulate the source/channel tunneling rate and the proposed biosensor's electrical performance metrics. A numerical model is developed for the interface charge equivalent of the C-erbB-2. The sensitivity of the device to different C-erbB-2 concentrations in serum/saliva has been studied. The results of our research demonstrate that Poc-MGOTFET, featuring an extended gate structure, modified gate oxide, and pocket along the source side, reduces the leakage current ($I_{Leakage}$) and OFF current (I_{OFF}), enhances the probability of tunneling, boosts gate control for a greater ON current (I_{ON}) and I_{ON}/I_{OFF} ratio, and increases sensitivity. Moreover, increased sensitivity by an order of magnitude 10^6 results from the effect of interface charges corresponding to varying concentrations of C-erbB-2 biomarkers on the sensitivity of the biosensor (as measured by the I_{ON}/I_{OFF} ratio).

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