

Assessment of Highly Sensitive Dielectric Modulated GaN-FinFET for Label-Free Biosensing Applications

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Abstract : This work presents the sensitivity assessment of Gallium Nitride (GaN) material-based FinFET by dielectric modulation in the nanocavity gap for label-free biosensing applications. The significant deflection is observed in the electrical characteristics such as drain current (ID), transconductance (gm), surface potential, energy band profile, electric field, sub-threshold slope (SS), and threshold voltage (Vth) in the presence of biomolecules owing to GaN material. Further, the device sensitivity is evaluated to identify the effectiveness of the proposed biosensor and its capability to detect the biomolecules with high precision or accuracy. Higher sensitivity is observed for Gelatin (k=12) in terms of on-current (SION), threshold voltage (SVth), and switching ratio (SSR) by 104.88%, 82.12%, and 119.73%, respectively. This work is performed using a powerful tool 3D Sentaurus TCAD using a well-calibrated structure. All the results pave the way for GaN-FinFET as a viable candidate for label-free dielectric modulated biosensor applications.

Keywords : biosensor, biomolecules, FinFET, sensitivity

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