

(54) Title of the invention : 2D dual gate biosensor FET device and method of performance evaluation of the device in nanometric scale through multiscale simulation approach

(51) International classification :G01N0027414000, G01N0033543000, H01L0029780000, H01L0029786000, H01L0031035200

(86) International Application No :NA
Filing Date :NA

(87) International Publication No : NA

(61) Patent of Addition to Application Number :NA
Filing Date :NA

(62) Divisional to Application Number :NA
Filing Date :NA

(71)Name of Applicant :

1)INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES), DHANBAD

Address of Applicant :Dhanbad - 826004, Jharkhand, India
Dhanbad -----

Name of Applicant : NA

Address of Applicant : NA

(72)Name of Inventor :

1)Dr. Manodipan Sahoo

Address of Applicant :Department of Electronics Engineering,
Indian Institute of Technology (Indian School of Mines),
Dhanbad, Dhanbad - 826004, Jharkhand, India Dhanbad -----

2)Saptarshi Neogi

Address of Applicant :4, Jagadhatritaala road, Bhadreswar,
Hooghly-712124, West Bengal, India Bhadreswar -----

(57) Abstract :

The present invention relates to a two-dimensional (2D) material dual gate biosensor field effect transistor (FET) device (1) and a method of performance evaluation of the device (1) in nanometric scale through multiscale simulation approach. The device (1) comprises a top gate (T) on the top end and a back gate (B) at the bottom end, a front oxide layer (FO) with a cavity (C) under the top gate (T), a channel layer (Ch) under the front oxide layer (FO). The cavity (C) in the oxide layer captures the biomolecules near the channel (Ch), wherein the interaction of the channel (Ch) material with the biomolecules modulates the current flow through the channel (Ch). During the proposed method, visualization and manipulation of the atomic structures of 2D materials is done. Next, quantum mechanical calculations are done to provide insights into the electronic properties of these materials. Then simplifying the calculation of electronic properties with reduced computational cost while maintaining accuracy is done. Finally, the sensitivity to various biomolecules is calculated, and the performance of the developed biosensor is evaluated. This multiscale simulation method enables a thorough understanding of the sensor operation, from atomic structures to device characteristics. This method technically enables the simulation of any material as the channel of the FET for analysing the biosensing application. [figure 6]

No. of Pages : 25 No. of Claims : 8

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