

Supporting Information

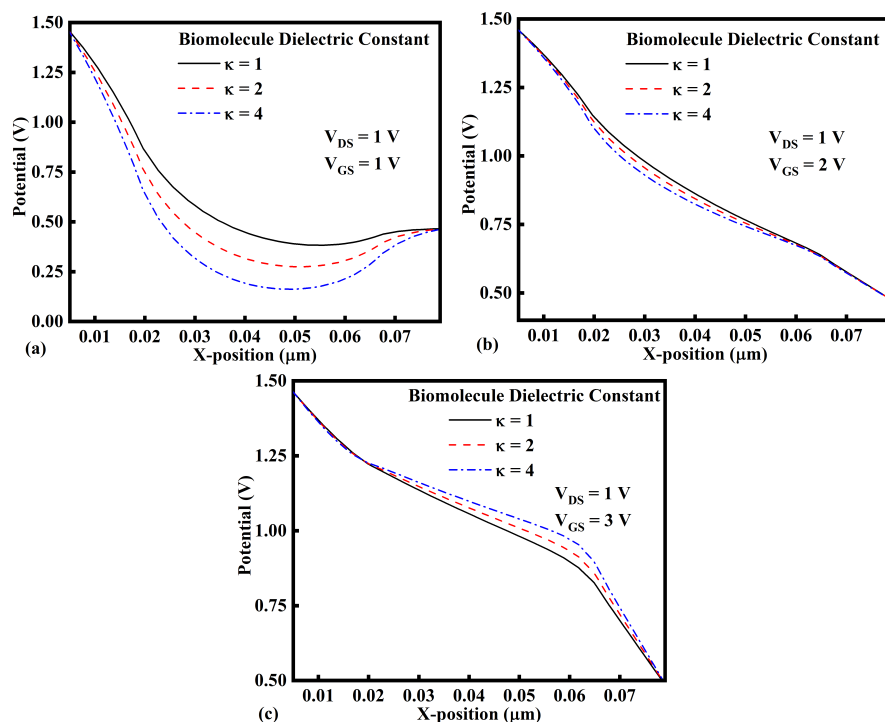


Fig. 1 Surface potential along channel length for bio-molecule with dielectric constant variation at $V_{DS} = 1\text{ V}$ and (a) $V_{GS} = 1\text{ V}$, (b) $V_{GS} = 2\text{ V}$ and (c) $V_{GS} = 3\text{ V}$.

The variation in surface potential of the device for bio-molecule with dielectric constant variation is shown in Fig. 1 (a), (b) and (c) for $V_{GS} = 1\text{ V}$, $V_{GS} = 2\text{ V}$ and $V_{GS} = 3\text{ V}$ respectively with $V_{DS} = 1\text{ V}$. The surface potential decreases with an increase in the dielectric constant for $V_{GS} = 1\text{ V}$ leading to a decrease in drain current and an increase in the threshold voltage with an increase in the dielectric constant. The decrease in surface potential with an increase in dielectric constant is minimized for $V_{GS} = 2\text{ V}$ thus the decrease in drain current with an increase in dielectric constant reduces. Further, the surface potential increases with an increase in dielectric constant for $V_{GS} = 3\text{ V}$ leading to an increase in the drain current with an increase in the dielectric constant.

The potential contour shows an increase in potential with increase in positive charge density of bio-molecules, which is clearly shown in surface potential plot in Fig. 2. The increase in surface potential with an increase in positive charge density leads to an increase in drain current and thus a decrease in threshold voltage. The potential contour shows a decrease in potential with an increase in negative charge density of bio-molecules, which is clearly shown in the surface potential plot in Fig. 3. The decrease in surface potential with an increase in the negative charge

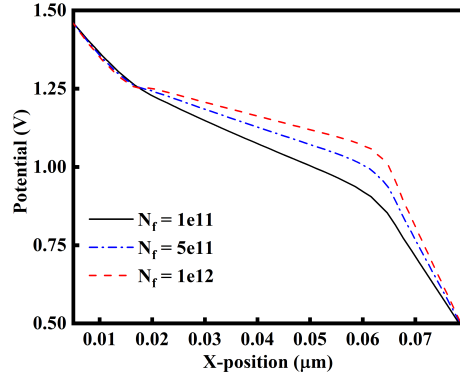


Fig. 2 Surface potential variation along with the channel-length for different positive N_f values at $V_{DS} = 1$ V and $V_{GS} = 3$ V.

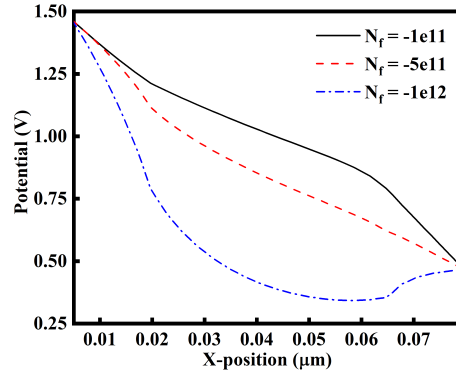


Fig. 3 Surface potential variation along with the channel-length for different negative N_f values at $V_{DS} = 1$ V and $V_{GS} = 3$ V.

density leads to a decrease in the drain current and thus an increase in threshold voltage.