HW 16 Bias Voltage

20202041 Park, Nuri

Our system from now is equilibrium.
Now we adopt nonequilibrium case with bias voltage.

$$\phi_N = V_T \log\left(\frac{N_{dop}}{n_i}\right) + V_{applied}$$

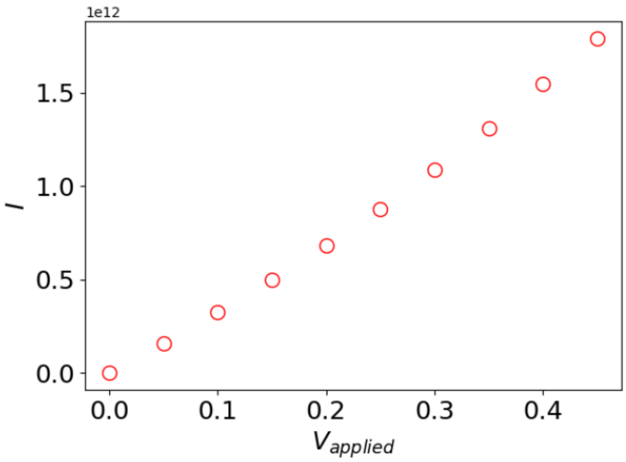
Electron would favor the biased region. We want to know the terminal current. Incoming current density contributes positively. Thus, the component of J_N contributes negatively.

$$J_{n,z} = -q\mu_n\left(n\frac{d\phi}{dx} - V_T\frac{dn}{dx}\right)$$
$$\frac{I_{Right}}{A} = q\mu_n\left(n\frac{d\phi}{dx} - V_T\frac{dn}{dx}\right)$$

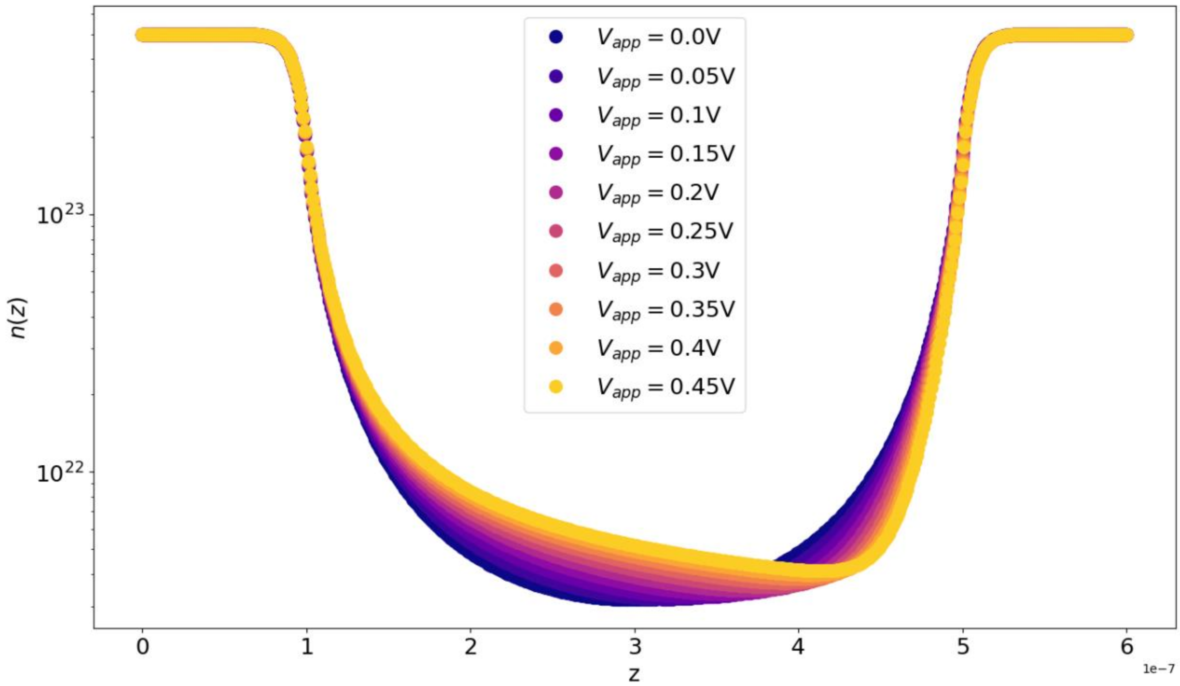
Result

The area here is $1cm^2 = 10^{-4}m^2$

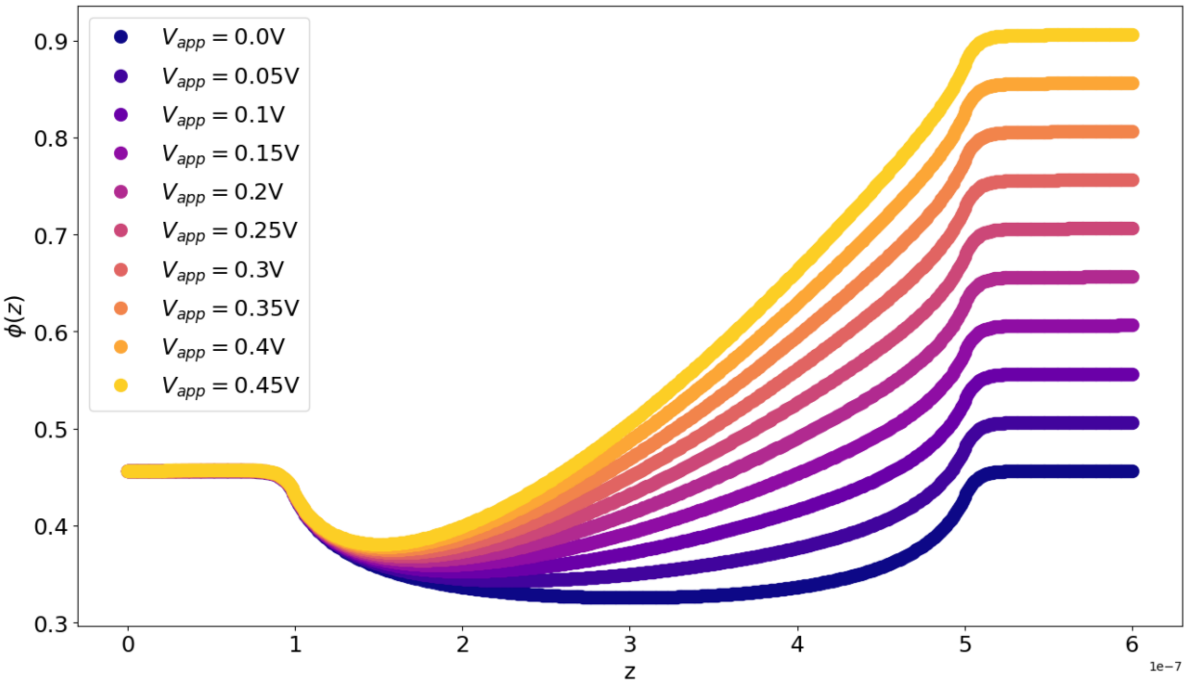
1. $600nm$ case



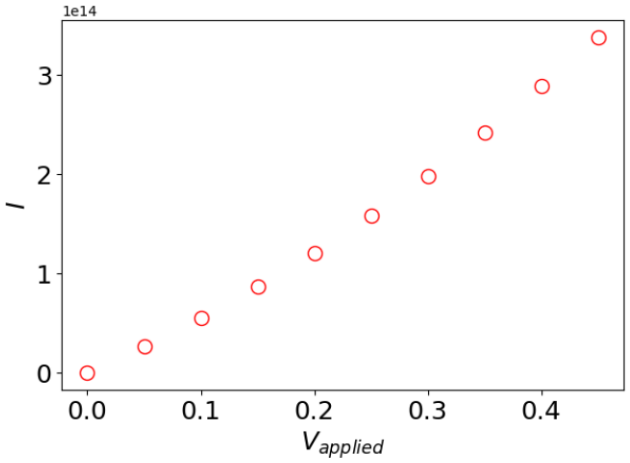
The terminal current monotonically goes up with bias voltage.



Electric density is tilted to the biased voltage region.



2. $60nm$ case



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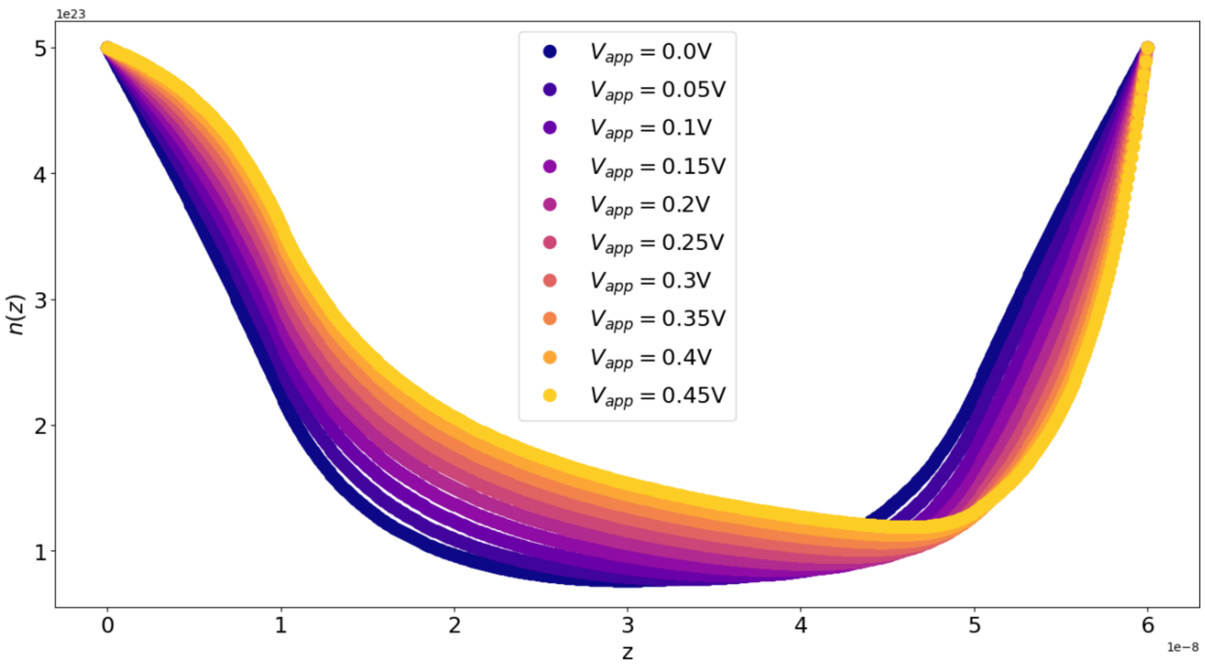
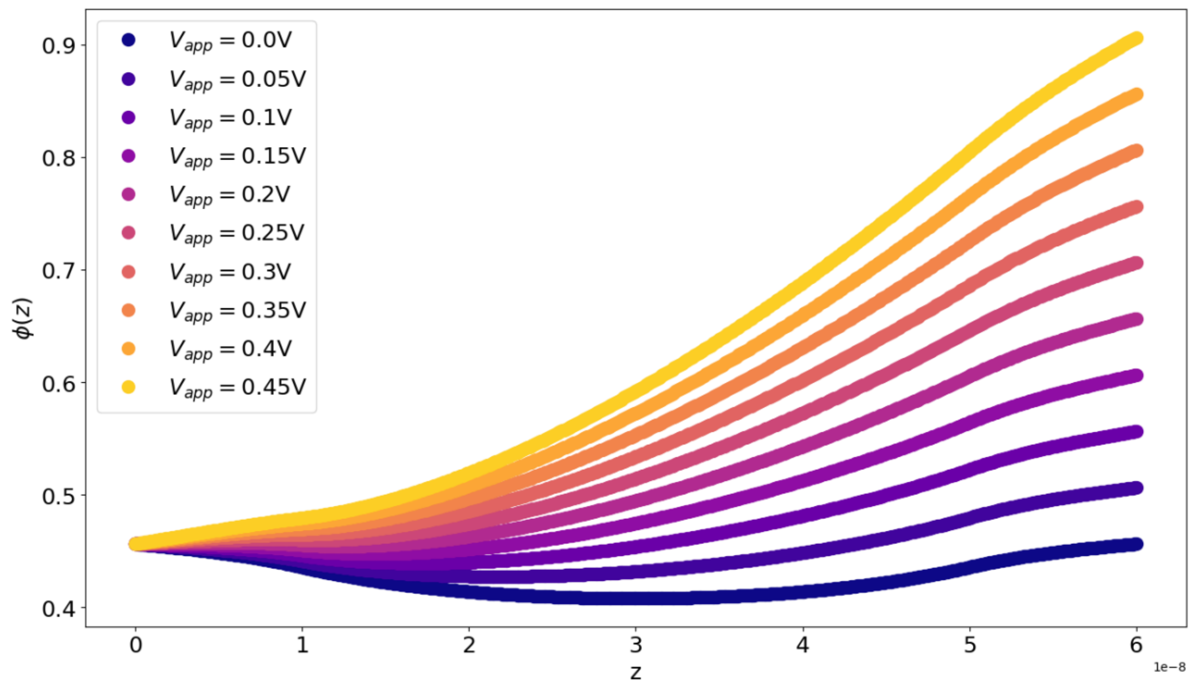


Electric density is tilted to the biased voltage region. Since it has short range as 60nm, the electron density more biased to the right.



It loses its symmetrical behavior by the biased voltage.