

Quiz 2024-10-17

Name: _____

Student No : _____

1. For dry etching, we need to balance between the physical etching and chemical etching. There are some major parameters that can be tuned for a dry etching process.

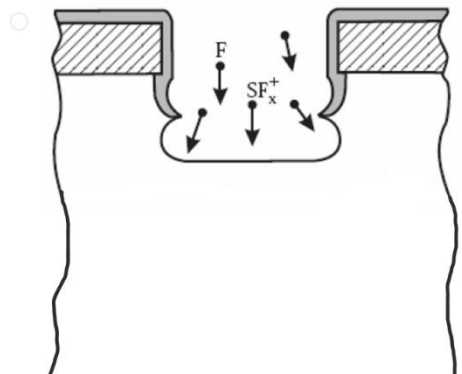
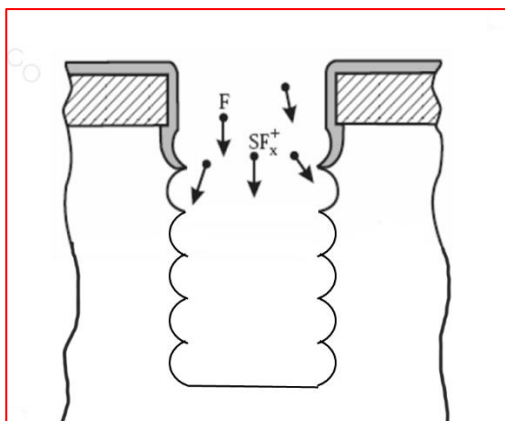
i) When the pressure of chamber is increased, which will give more gain, physical etching or chemical etching? Why? (20 points)

Chemical etching; Increase the pressure, you need to add more plasma and etching gas.

ii) When the bias voltage of etching system is increased, which will give more gain, physical etching or chemical etching? Why? (20 points)

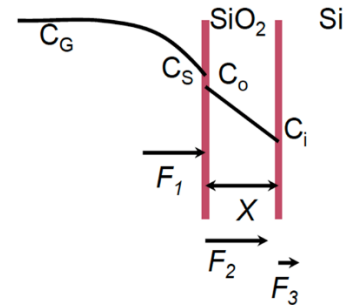
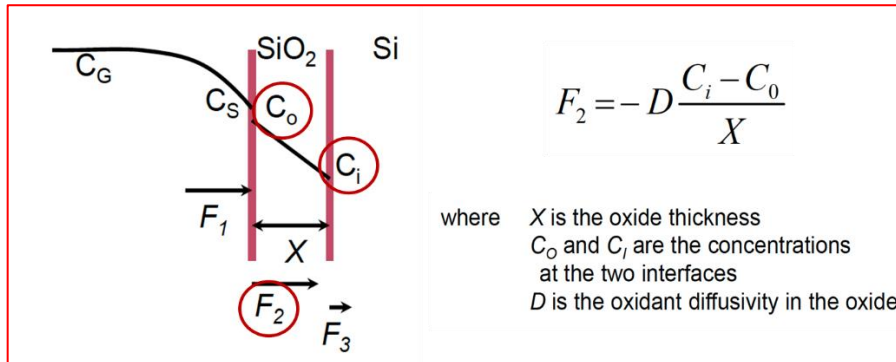
Physical etching; the bias voltage will increase the accelerate physical bombardment speed.

2. Bosch process can achieve even deeper etching by the cycling control between isotropic etching step (SF_6 , 7-16s) and passivation step (C_4F_8 , 5-15s). If the etching time of the isotropic etching step is increase, what will be the result? You can write down by text or draw on the figure below. (10 points)



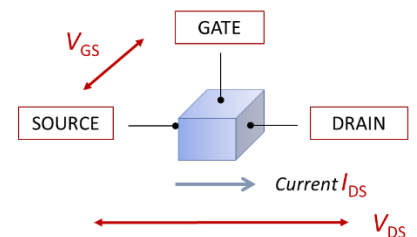
3. There are 3 steps (flux) of the modeling the oxidation process. The second step is the diffusion of oxidant through oxide to Si/SiO₂ interface. The figure below is the schematic diagram of the second step. Please try to write down the expression of the diffusion flux F_2 . (20 points)

(note: X is the oxide thickness. C_0 and C_i are the concentrations at the two interfaces. D is the oxidant diffusivity in the oxide.)



4. A small positive voltage is applied ($0 < V_{GS} < V_T$), the channel between the source and the drain is _____ (open or close). Why? (20 points)

- Holes are pushed away from the contact region
- A negatively charged depletion layer is formed with no free carriers
- Conductivity is still very low
- The channel between the source and the drain is still close.



5. Current is created by moving electrons in external E field.

Please try to write down the expression of the current by follows terms.

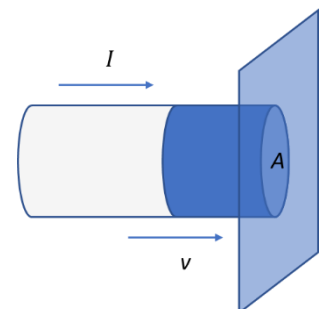
e : electron charge;

n : electron number density;

A : cross-section area;

v : average velocity of electrons

You can start from $I = \frac{dQ}{dt}$.



$$I = \frac{dQ}{dt} = enA \frac{dx}{dt} = enAv$$