HW #6

EECS, GIST College

Undergraduate student

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Newton – Raphson method for entire structure

1. Si - SiO_2 structure.

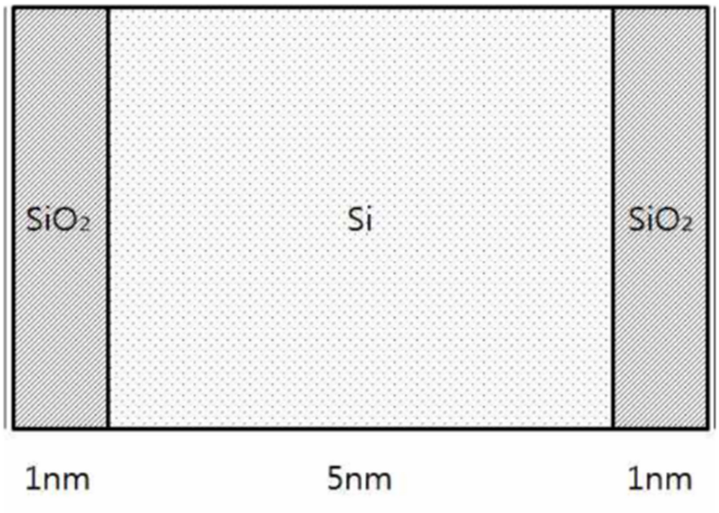

Figure 1. Structure

Thickness of SiO_2 layers : 1nm
Thickness of Si layer : 5nm
Number of mesh points : 71
Initial acc electron density
: $1.0 \times 10^{18}\ \mathrm{cm}^3$
Electron charge : $1.602192 \times 10^{-19}\ \mathrm{C}$
Vacuum permittivity
: $8.854187817 \times 10^{-12}\ \mathrm{F/m}$
Relative permittivity
: SiO_2 - 3.9, Si - 11.7

Figure 2. Settings of the structure

2. Result

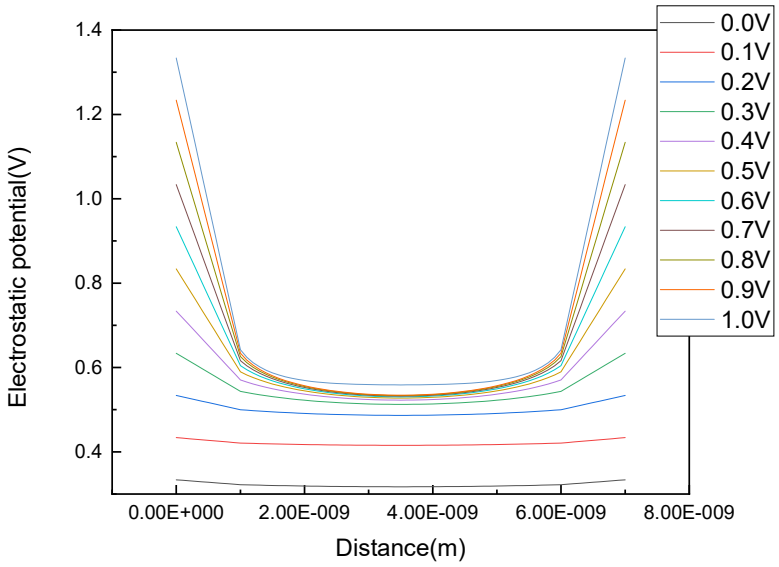

Figure 3. Electrostatic potential of each gate voltage

Gate voltage가 증가할수록, silicon layer에서 Electrostatic potential 값의 증가량은 감소하는 것을 볼 수 있다. 이와 같은 결과는 다음 그래프에서 원인을 확인할 수 있다.

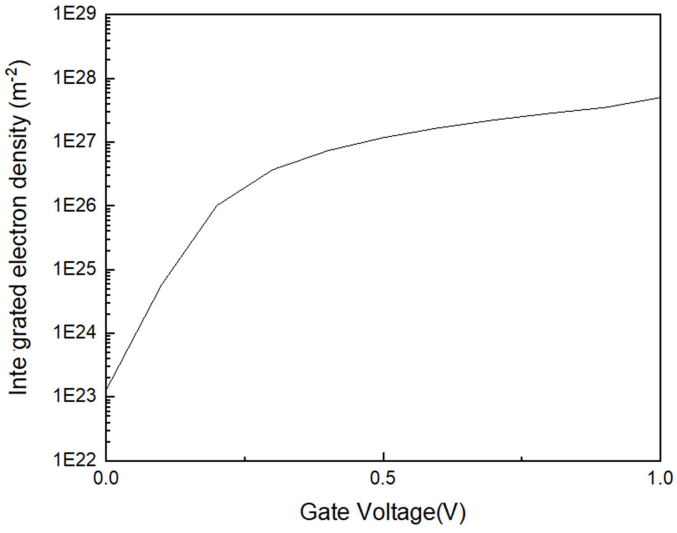

Figure 4. Integrated electron density with each gate voltage

Integrated의 electron density가 exponential 하게 증가함(Silicon layer에만 electron 존재 가정)에 따라 electron이 electrostatic potential에 영향을 미치는 정도가 커지므로, gate voltage가 증가하더라도 electrostatic potential의 증가량이 커지지 않는다.