

Experiment No. 7

Aim: Simulate diffusion process for different conditions (e.g. source, time, temperature, dopant etc.) and comment on the results obtained.

Software Tool: Technology Computer aided Design lab (TCAD) on nanohub.org

Theory:

Diffusion Process Description:

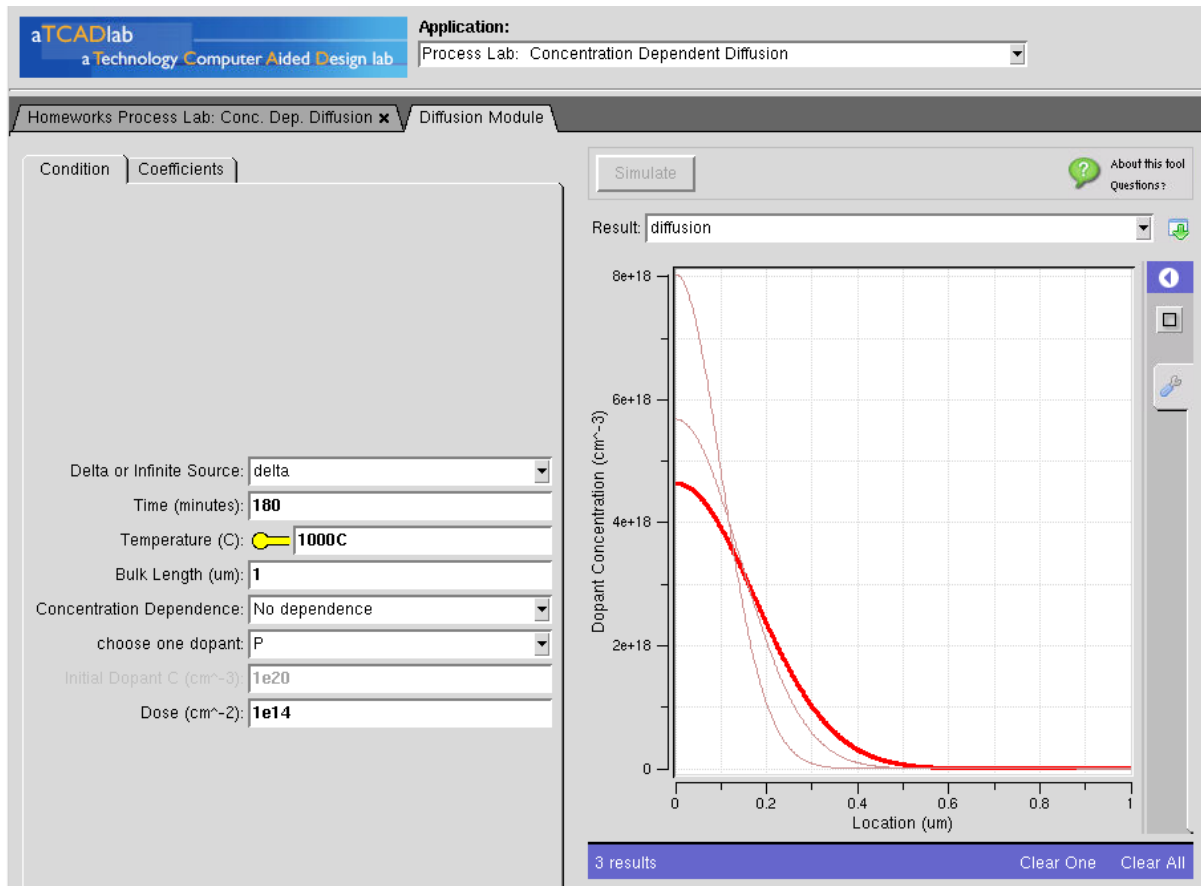
The diffusion process is one of the most important processes in VLSI fabrication. It is implemented in processes such as the drain and source doping, the quality of which is extremely important for the electrical properties and performance of today's integrated circuit technology.

This simulation tool simulates the dopant diffusion process by solving the partial differential equations. The tool gives users the freedom to adjust critical parameters and conditions in the process, such as the initial doping profile, time, temperature, length, and so on. It also gives users opportunities to choose between the delta or box-shaped dopant source, concentration dependency, as well as the type of dopants among 6 commonly used dopant species.

A dopant concentration versus diffusion depth figure is plotted almost instantaneously after the users specify the necessary parameters and conditions. The entire diffusion process is simulated after one click on the web interface, while all the complicated details and PDE-solving procedures are hidden behind the scene. The interactive interface of the module and its simplicity of usage build intuition into the diffusion process with minimum learning curve. Insightful comparison, such as one between concentration dependent and independent diffusion, can be done easily. Moreover, the module can be used as a handy and efficient "diffusion calculator".

In this diffusion process lab ,user can specify dopant sources either as delta or infinite source. The “infinite source” selection assumes an infinite source of dopants. This results an erf(error function) diffusion profile. The “delta source” selection assumes only a dose of delta function dopant. This results a Gaussian diffusion profile.

Diffusion process GUI



Question1: Explain the effect of time on the diffusion profile ?

Question2 : Explain the effect of dopant type on the diffusion profile?

Question3 : Explain the effect of temperature on the diffusion profile?

Question4 : Explain the effect of dopant source on the diffusion profile?

Simulation Plots

Dopant concentration vs location i.e diffusion profile can be plotted for different times , dopant source, temperature and dopant type may be plotted after each simulation.

Conclusion: