Assignment 7

Part A: Sprocess Simulations

1. Create a pn junction by implanting Phosphorus on a Boron substrate. Check the impact of (a) implant energy (use 10, 20 and 40keV) and (b) implant dose (use 1E14, 5E14 and 1E15cm^{-3} for comparison) on the peak concentration and junction depth by plotting the net-active concentration (N_D-N_A) along the device depth. Explain your observations.
2. In question 1 use **Arsenic** instead of Phosphorus and compare the results. Explain the observations.
3. Create a n^+p junction of depth ~ 100 nm and width ~ 150nm. Make n-side doping as uniform as possible with Phosphorus concentration N_D = 1e18 cm^{-3}, by changing the parameters such as implant dose, implant energy, diffusion time, diffusion temperature etc. Assume Boron to be N_A = 1e16 cm^{-3}. Show the net-active concentration both in linear and log scale.

Part B: Sdevice Simulations

1. In the given pn junction structure, plot the energy band diagram (E_C, E_V, E_F) along the junction depth under the application of (a) forward bias 2V and (b) reverse bias -5V. Also, plot the quasi Fermi level in these cases.
2. Plot the IV curve of the diode with applied voltage V_A ranging from -10V to 2V in log scale.
3. Check the impact of (a) Band2Band tunneling (b) SRH (c) Avalanche by turning them ON and OFF in the Physics section.

Note: Required material is given in the slides for more details refer to the sprocess user guide attached with this assignment.