

Theory and Technology of Semiconductor Devices
Assignment 2

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Due Date: Dec 20

Problem 1 Doing an Arsenic diffusion on a p-type wafer with background doping of 10^{17}cm^{-3} and limited 10^{14}cm^{-2} amount of Arsenic (constant-total-dopant) at 1100°C for 1.5 hours, find the surface concentration and junction depth.

Note: $D = 2.07 \times 10^{-14} \text{ cm}^2/\text{s}$ for Arsenic at 1100°C

Problem 2 A two-step Boron diffusion is used on an n-type wafer to form a p-type region; first 30 minutes with constant surface concentration of $1.1 \times 10^{20} \text{cm}^{-3}$ at 900°C followed by 4 hours (the constant-total step) at 1100°C . find (a) junction depth at the end of each step (b) the gradient of concentration for $x = x_j$ at the end of each step (c) the surface concentration at the end of step 2

Note: $900^\circ\text{C} \rightarrow D = 1.45 \times 10^{-15} \text{ cm}^2/\text{s}$

$1100^\circ\text{C} \rightarrow D = 2.96 \times 10^{-13} \text{ cm}^2/\text{s}$

Note: solving step 2 has Bonus score (not required)

Problem 3 Drive the concentration equation ($C(x, t)$), solving the Fick's equation for (a) constant surface source (b) limited amount of dopant (constant-total-dopant)

Note: this Problem has Bonus score (not required)

Note: Solving all bonus parts can boost the score up to 120%