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1.1 Diffusion Theory:

There are two major approaches for tackling diffusion problems:

1.4 Diffusion Equation

$$\frac{\partial C}{\partial t} = D\,\frac{\partial 2C}{\partial x^{2}}$$

Ex 4 A P^+N junction is made by diffusing boron into an n-type substrate with background concentration C_B = 10 1016cm-3. A constant source concentration is maintained during the diffusion. Calculate the time required to form the junction at a depth of 1 μm if the diffusion temperature is 1050^o

Ex. 5 A boron predeposition lasting 30 min is performed at 950^{o}C on a wafer having a background concentration C_B = 5 x 10^{15}cm^{-3}. Calculate the junction depth x_J. How many impurity atoms/cm^2 have been deposited? The wafer is then subjected to a drive-in lasting 2 hr at 1150^{o}C. Calculate the junction depth. What is the new surface concentration?

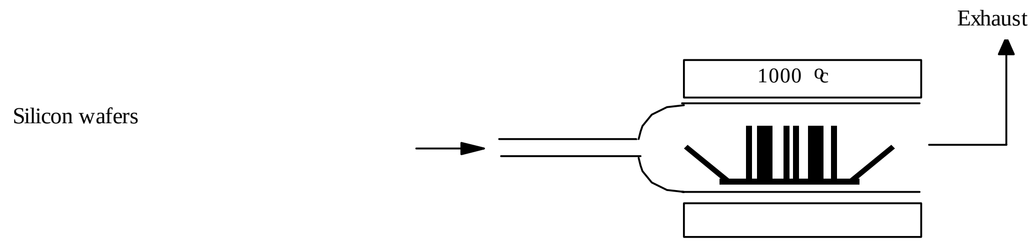
Ex. 6 A p-type wafer of background concentration $10^{16} cm^{-3}$ is diffused with phosphorous at a temperature of $1,000^{o}$

Ex. 7 Determine the diffusivity of phosphorus at 1200^{o}C if the diffusivity at 1050^{o}

1.10 Lateral Diffusion: The one-dimensional diffusion equation satisfactorily describes the diffusion process except at the edge of the mask window. Here the impurities will diffuse downward and sideways (laterally). The sketch

	n-type			p-type			
	P	As	Sb	B	Al	Ga	In
SS	1.3×10^{21}						

To carry out a diffusion the discs are placed parallel with the silicon wafers about 2 mm apart and at right angles to the carrier gas flow. Using this set-up good yield and reproducibility are obtained. Each wafer has its own diffusion source so gas-flow patterns are less critical leading to better uniformity across the wafer and good reproducibility. The need for connection of liquid or gaseous sources is obviated.



1000◦C C