Tute - 7

1 Physical significance of Diffusion coeff.

2 Constant surface concentration of diffusing atoms

3. A N- type semicond. is diffused in a P type Si substrate of doping $1 \times 10^{16}/cm^3$. Diffusion is being done in such a way that dopant surface conc. is maintained at $2 \times 10^{20}/cm^3$. What would be the product of $D \cdot t$ in order to get junction of 0.5 μm (Diff. coeff)

4. In Q.3 if D_0 (frequency factor) of Si = 8.85 cm^2/s activation energy E of P in Si = 3.076 eV. Temp of diffusion is 860°C. What would be the time of diffusion to get junction depth of 0.5 μm

5. If efficiency of Si wafer cell in lab is ≈ 25% but commercially it is only ≈ 15%. Why?

6. An a-Si p-i-n structure e^- mobility of 15 $cm^2/V\text{-}s$ is illuminated such that e^--h pair generate at $5 \times 10^{19}/s$ Photo conductivity in this case is $1.2 \times 10^{-6}/\Omega cm$

(a) What is drift length in layer if E in i layer is 10^3 V/cm

(b) Diffusion length in the layer

Tute - 6

Q.1. Design a tandem a-Si cell. having two p-i-n in series. 1 μm total thickness of cell should be optimized so that currents are matched for a 600 nm light. If ab. coeff of Si is 3×10^6 /m at 600 nm, how thick should each of two i region be? Assume. p-n thickness negligible & charge seperation eff. is 100% in i region

Q.2 Cu-InSe$_2$ (CIS) n-p junction Solar cell has 0.2 μm heavily doped emitter layer & 5 μm lightly doped p layer. Calculate relative Q.E at 750 nm. When CIS emitter layer is replaced with CdS, given abs. coeff. (α) of CIS at 750 nm = 2×10^7/m. Band gap of CdS = 2.4 eV, diff length of holes in n-type CIS = 0.01 μm diff length of e in p-type CIS = 2.0 μm

Q.3 A-Si wafer based solar module is rated power 100 Wp with V_m & I_m = 17.5 V & 5.714 A. nominal operating cell temp & ambient temp. are 50°C & 40°C. Find max V & W

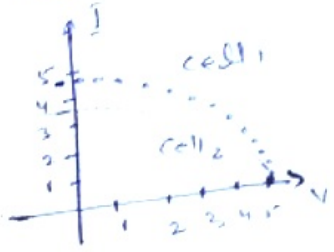
Tutr. 9

1 A solar cell has $I_{sc} = 0.5$ A & $V_{oc} = 0.55$ V. What will be the V_{oc} & I_{sc} of a combination of 5 strings cells, each string has 4 series connected cells.

2 A solar cell PV module has peak $W_p = 75$ W, Order STC. Calculate module temp. & peak power if its operated at 40°C under 800 W/m² given NOCT 42°C

3 Design a PV module for providing $V_m = 30$ V (STC) & $V_m = 28.5$ V (at 55°C of cell temp). Given V_{oc} of cell $V_m = 0.8 V_{oc}$

4 I-V curve of two cell are given as



Find I_{sc} & V_{oc} of combined cell if
(i) both connected in series
(ii) both connected ||

5 A PV module has rated $W_p = 100$ W at 1000 W/m² Pin (sunlight) $V_{oc} = 22$ V & $I_{sc} = 5.75$ A., $V_m = 17.5$ V. Its V_m falls from 17.5 V to 16.5 V when Pin falls to 100 W/m². Calculate its power at Pin = 300, 500, 700 W/m²

6 A PV module is operating at ambient temp of 35°C under solar radiation of 900 W/m². Find module temperature?

Tutc-10

1. What are the mismatch losses and their sources in PV module?
2. How are cells normally connected in PV module? series or parralled? How many cell of o/p V are typically connected in a PV module?
3. What are the hot spot? What is the cause of hot-spot. Discuss the role of by pass diode?
4. Discuss the effect of temp on the out put of PV module. with suitable I-V curve.
5. Effected of solar radiation on the power output of module
6. Discuss the rating parameter of PV module in brief
7. Write down the I-V equn for a module having (i) N_s cell in series (ii) N_p cell in parrall (iii) $N_s + N_p$
8. Differentiate b/w (i) Stand alone (ii) Grid connected (iii) hybrid PV system with proper example
9. Discuss optimization of GaAs Solar cell
10. Design & Strategies for maximum efficiency