Diode Analysis

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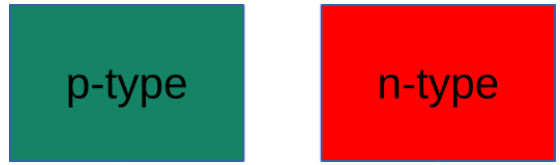
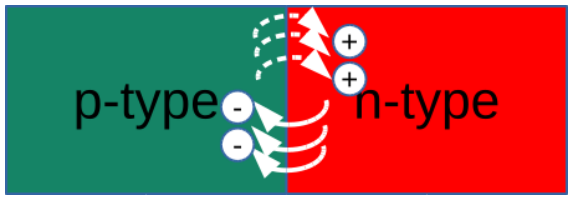
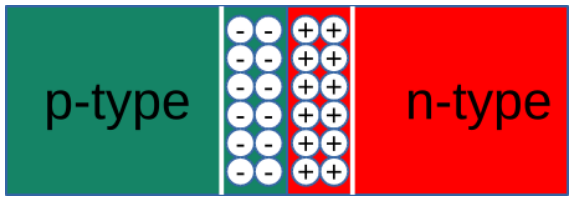
Diode In Equilibrium

- When two blocks of n-type and p-type are brought in contact.
- The holes from the p-side move to n-side there by leaving a negatively charged ion on the p-side.
- The electrons from the n-side move to p-side there by leaving a positively charged ion on the n-side.
- This region which is devoid of free carriers is called as the depletion region.
- This creates a potential barrier (Electric field) that blocks the further transfer of the charge carriers.

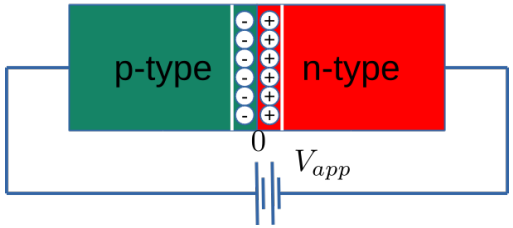


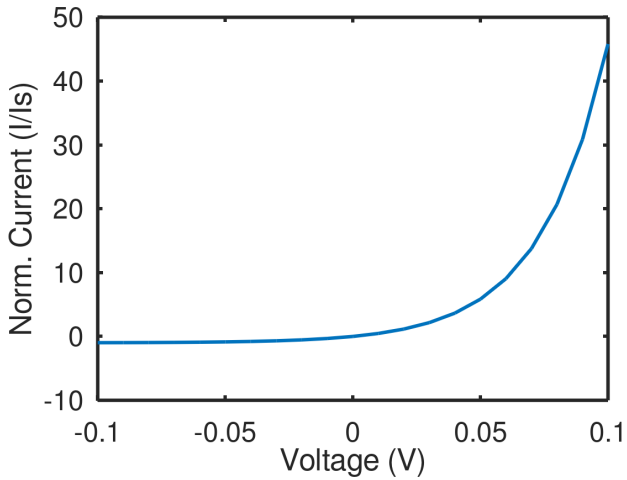




Diode In Forward Bias

- In this case we apply a positive bias on the p-side (or equivalently a negative bias on the n-side)
- This reduces the built-in electric field.
- The positive bias pushes the hole into the p-side and the negative bias pushes the electron into the n-side.
- This results in the flow of the current.
- As the bias increases the built-in electric field reduces further and thus increases the current





Problem Statements

- Using Diode in ABACUS tool on nanohub.org perform the following experiments

1. Analyse the electron and hole concentration on the p-side and n-side respectively in equilibrium and Va = 0.1 V and Va = 0.3 V.
2. Analyse the band structure for Va = 0 V (equilibrium), Va = 0.1 V and Va = 0.3 V.
3. Explain the electric field in the device at Va = 0 V (equilibrium), Va = 0.1 V and Va = 0.3 V.
4. Analyse the current-voltage characteristics (Explain the flow of the carriers in the diode)

Groups

Group No	$N_D(cm^{-3})$	$N_A(cm^{-3})$
Group 1	1E17	1E18
Group 2	5E17	5E18
Group 3	1E18	1E15
Group 4	5E18	5E15
Group 5	7E18	8E17