

Variation of carrier concentration with temperature [EXTRINSIC SEMICONDUCTOR]

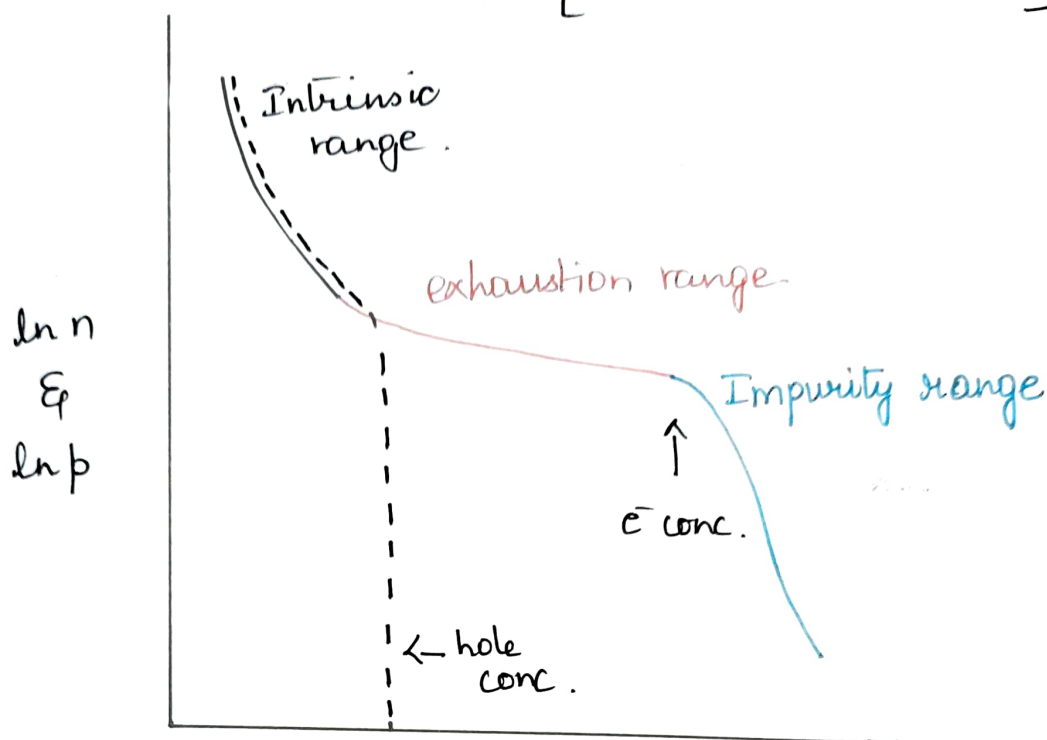


Fig: Variation of e^- concentration with temperature in N type semiconductor.

From the above plot of $1/T$ v/s $\ln n$ (& $\ln p$) one can observe three different regions —

- (i) Impurity region
- (ii) Exhaustion region
- (iii) Intrinsic region.

Impurity region —

Starting at low temperature, as temperature increases, donor atoms get ionized & e^- moves to CB. This increases e^- concentration in CB which is marked by Impurity range in above plot.

(ii) At ~~room~~ temperature all the donor atoms are ionized.

As the temperature increases further, the e^- concentration in CB remains constant over a certain temperature range. This is called exhaustion range.

(iii) As the temperature increases further, high enough to break the covalent bonds, generate e^-h pair. Electron from VB move to CB and semiconductor behaves like an intrinsic semiconductor wherein Fermi level reaches mid of the forbidden gap.

This range is called intrinsic range.

(iv) Meanwhile when the temperature where extrinsic to intrinsic transition takes place, the concentration of hole shoots up in VB, which is shown with dotted lines in the graph.