Fundamentals of Electronics Devices

Unit-2

Lecture-2

Optical absorption

- An important technique for measuring the band gap energy of a semiconductor is the absorption of incident photons by the material.
- In this experiment photons of selected wavelengths are directed at sample, and relative transmission of the various photons is observed.

Introduction

- Since photons with energies greater than the band gap energy are absorbed while photons with energies less than the band gap are transmitted, this experiment gives an accurate measure of the band gap energy.

Photon absorption

- It is apparent that a photon with energy

$$h\nu \geq E_g$$

  can be absorbed in a semiconductor.
- Since the valence band contains many electrons and the conduction band has many empty states into which the electrons may be excited, the probability of photon absorption is high.

- An electron excited to the conduction band by optical absorption may initially have more energy than is common for conduction band electrons (almost all electrons are near E_c unless the sample is very heavily doped).

- Thus the excited electron loses energy to the lattice in scattering events until its velocity reaches the thermal equilibrium velocity of other conduction band electrons.
- The electron and hole created by this absorption process are excess carriers; since they are out of balance with their environment, they must eventually recombine.

- While the excess carriers exist in their respective bands, however, they are free to contribute to the conductivity of the material.
- A photon with energy less than E_g is unable to excite an electron from the valance band to the conduction band.