

Fundamentals of Electronics Devices

Unit-1

Lecture-3

Crystal Lattice Structure

- In this lecture we will discuss the arrangements of atoms in various solids.
- We shall distinguish between single crystals and other forms of materials and then investigate the periodicity of crystal lattices.

Introduction

- Certain important crystallographic terms will be defined and illustrated in reference to crystals having a basic cubic structure.
- These definitions will allow us to refer to certain planes and directions within a lattice.

Periodic Structures

- A crystalline solid is distinguished by the fact that the atoms making up the crystal are arranged in a periodic fashion.
- That is, there is some basic arrangement of atoms that is repeated throughout the entire solid.

- Thus the crystal appears exactly the same at one point as it does at a series of other equivalent points, once the basic periodicity is discovered.
- However, not all solids are crystals; some have no periodic structure at all (amorphous solids), and others are composed of many small regions of single-crystal material (polycrystalline solids).

Lattice

- The high-resolution micrograph illustrates the periodic array of atoms in the single-crystal silicon of a transistor channel compared with the amorphous SiO_2 (glass) of the oxide layer.
- The periodic arrangement of atoms in a crystal is called the lattice.

- Since there are many different ways of placing atoms in a volume, the distances and orientation between atoms can take many forms.
- However, in every case the lattice contains a volume, called a unit cell, which is representative of the entire lattice and is regularly repeated throughout the crystal.