

## SEMICONDUCTORS & TRANSPORT PHYSICS

### 3.1 Introduction

#### Definition:

Materials which are partially conductors and partially insulators are called semi conducting materials.

#### Based on energy band diagram

A semiconductor has nearly empty conduction band and almost filled valance band with very small energy gap ( $\approx 1\text{eV}$ ).

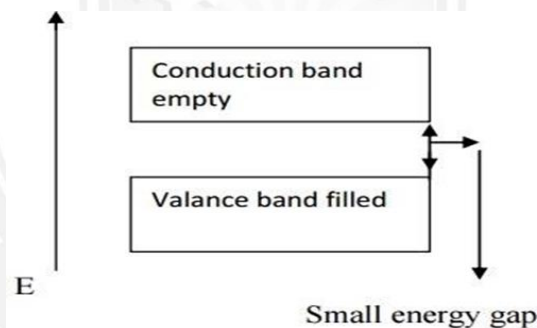


FIG 2.1-ENERGY GAP

#### General Properties of semiconductors:

1. They have empty conduction band and filled valance band at 0K
2. They are formed by covalent bonds.
3. They have small energy gap They possess crystalline structure
4. They have negative temperature co efficient of resistance
5. If the impurities are added to a semiconductor, its electrical conductivity increases. Similarly, if the temperature of the semiconductor increased, its electrical conductivity increases.

#### Elemental And Compound Semiconductors

##### Elemental Semiconductors (Indirect semiconductor)

Semiconductors which are made from a single element of fourth group elements of the periodic table. They are also known as indirect band gap semiconductors

Example –Germanium, silicon

### **Compound semiconductors(Direct semiconductor**

Semiconductors which are formed by combining third and fifth group elements or second and sixth group elements in the periodic table are known as compound semiconductors. These compound semiconductors are also known as direct band gap semiconductors

Example –Gallium phosphide (GaP) , Gallium arsenide (GaAs)

### **3.1.2 TYPES OF SEMICONDUCTORS**

Based on the purity semiconductors are classified in to the following two types.

1. Intrinsic semiconductors

2. Extrinsic semiconductors

#### **INTRINSIC SEMICONDUCTORS**

A semiconductor in pure form, is known as intrinsic semiconductors. Its electrical conductivity can be changed due to thermal excitation.

#### **EXTRINSIC SEMICONDUCTORS**

A semiconductor in impure form, with the addition of impurities is known as extrinsic semiconductors.