

PHY404- Solid State Physics II

Assoc.Prof. Yeşim Moğulkoç

Recommended Books

- Introduction to Solid State Physics (Charles Kittel)
- The Physics of Solids (Richard Turton)
- Condensed Matter Physics (Michael P. Marder)

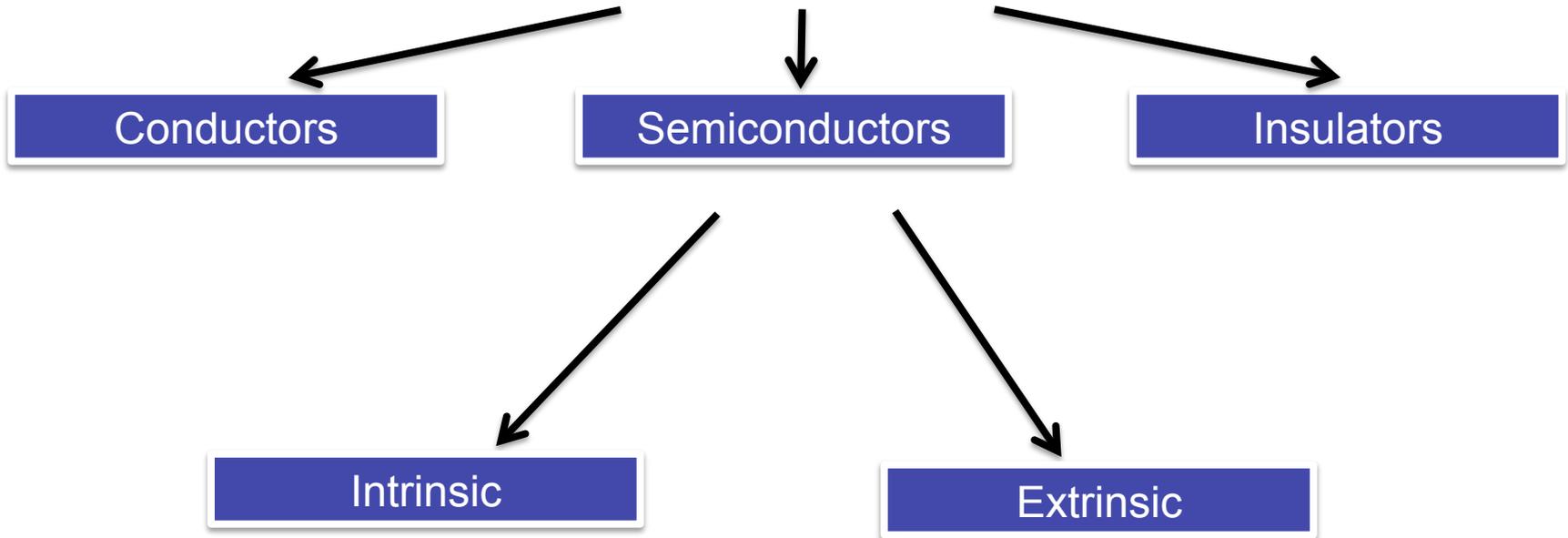
```
graph TD; Solids --> crystalline; Solids --> Non-crystalline;
```

Solids

crystalline

**Non-
crystalline**

Materials



Semiconductor Crystals

- Semiconductors are generally classified by their electrical resistivity at room temperature.
- The semiconductor compounds of chemical formula AB, where A is a trivalent element and B is a pentavalent element, are called III-V (three-five) compounds. ex: InSb, GaAs.
- Where A is divalent and B is hexavalent, the compound is called a II-VI compound. ex: ZnS, CdS

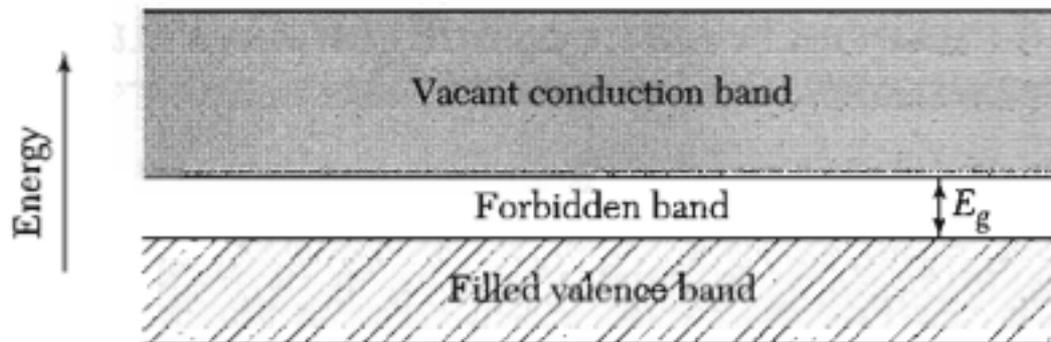
Band Gap

The band gap is the difference in energy between the minimum point of the conduction band (CBM) and the maximum point of the valance band (VBM).

Fermi level is in the middle of the forbidden gap.

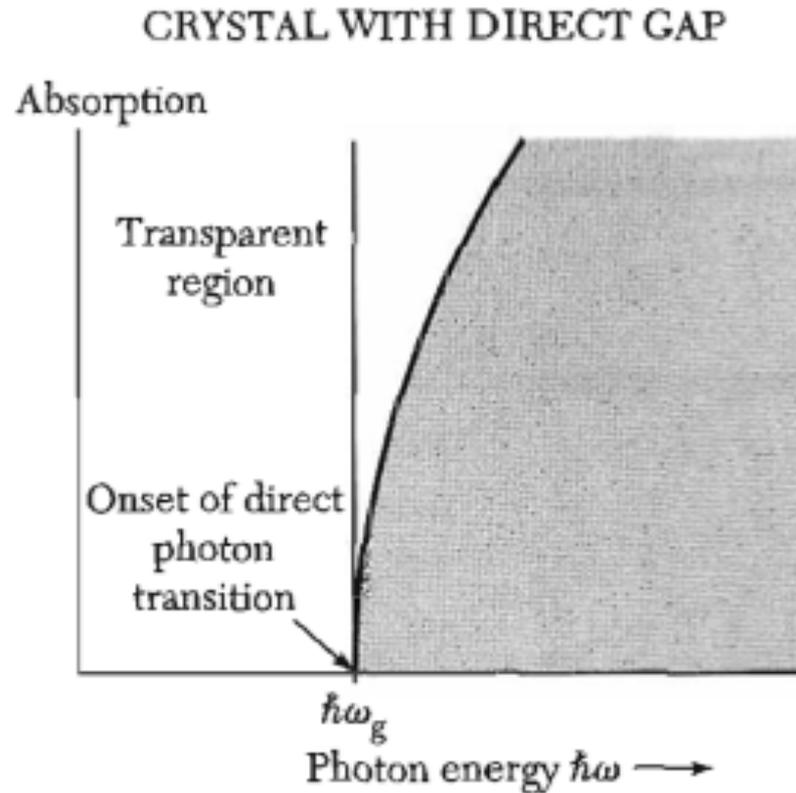
Intrinsic conductivity

As temperature is increased, electrons are thermally excited from the valance band to the conduction band where they become mobile. Such carriers are called “intrinsic” materials.



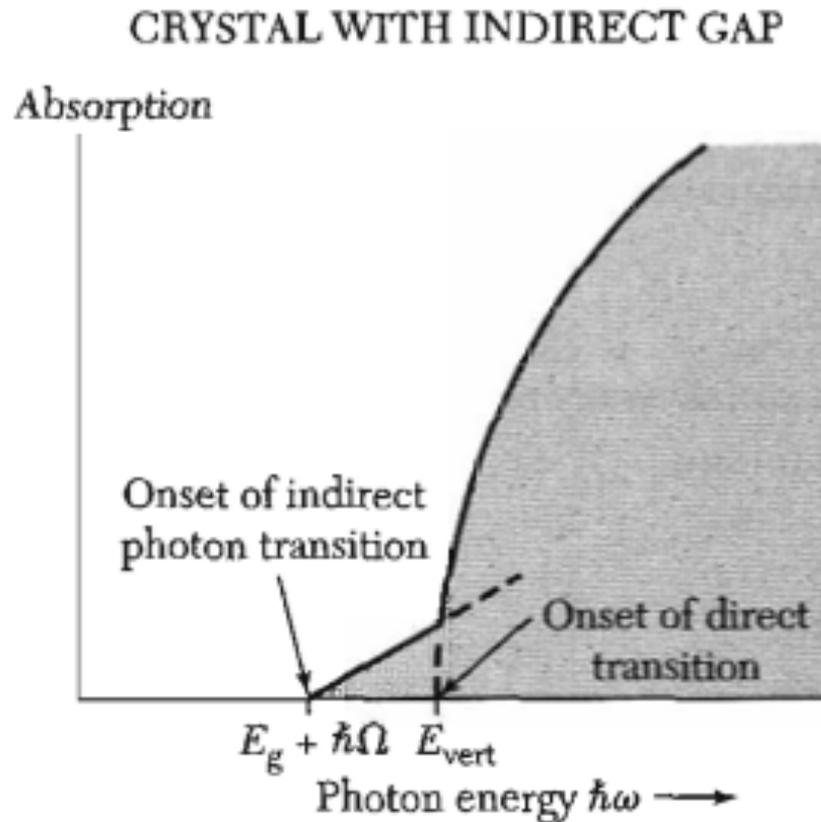
Band scheme for intrinsic conductivity in a semiconductor
(The figure is used from *Introduction to Solid State Physics*, C. Kittel)

Optical Absorption for Direct Band Gap



(The figure is used from *Introduction to Solid State Physics*, C. Kittel)

Optical Absorption for Indirect Band Gap



(The figure is used from *Introduction to Solid State Physics*, C. Kittel)