

CLASSIFICATION OF MATERIALS BASED ON ENERGY BAND THEORY

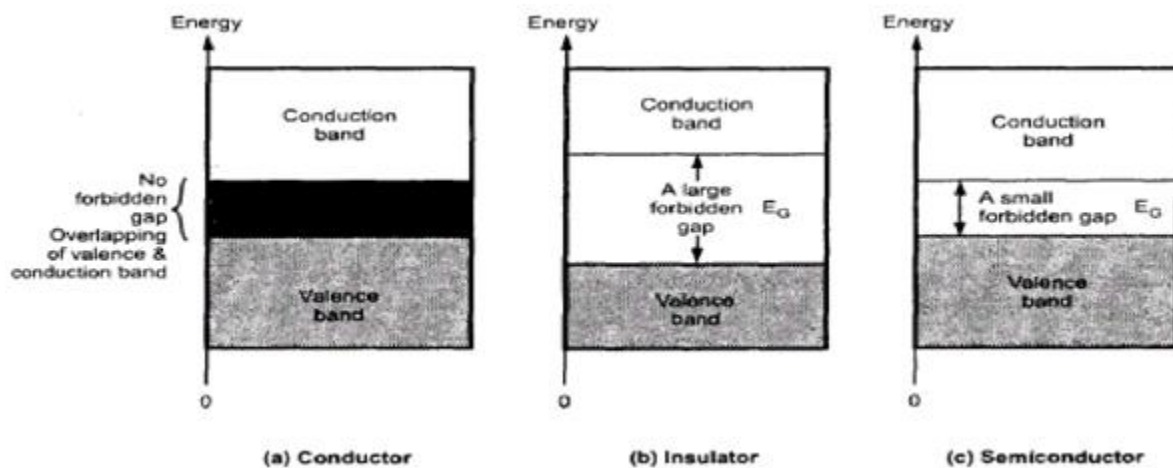
Based on the ability of various materials to conduct current, the materials are classified as conductors, insulators and the semiconductors.

A metal which is very good carrier of electricity is called conductor. The copper and aluminium are good examples of a conductor

A very poor conductor of electricity is termed as insulator. The glass, wood, mica, diamond are the examples of an insulator.

A metal having conductivity which is between conductor and an insulator is called semiconductor. The silicon and germanium are the examples of a semiconductor. This does not conduct current at low temperatures but as temperature increases these materials behave as good conductors..

ENERGY BAND DIAGRAMS



CONDUCTORS

In the metals like copper, aluminium there is no forbidden gap between valence band and conduction band. The two bands overlap.

Hence even at room temperature, a large number of electrons are available for conduction.

So without any additional energy, such metals contain a large number of free electrons and hence called good conductors.

INSULATORS

In case of such insulating material, there exists a large forbidden gap in between the conduction band and the valence band.

Practically it is impossible for an electron to jump from the valence band to the conduction band. Hence such materials cannot conduct and called insulators.

The forbidden gap is very wide, approximately of about 7 eV is present in insulators. For a diamond, which is an insulator, the forbidden gap is about 6 eV.

Such materials may conduct only at very high temperatures or if they are subjected to high voltage. Such conduction is rare and is called breakdown of an insulator.

The other insulating materials are glass, wood, mica, paper etc.

SEMICONDUCTORS

The forbidden gap in such materials is very narrow as shown in Fig. Such materials are called semiconductors.

The forbidden gap is about 1 eV.

In such materials, the energy provided by the heat at room temperature is sufficient to lift the electrons from the valence band to the conduction band.

INTRINSIC SEMICONDUCTORS

A sample of semiconductor in its purest form is called an intrinsic semiconductor.

The impurity content in intrinsic semiconductor is very small, of the order of one part in 100 million parts of semiconductor.

Source : <http://mediatoget.blogspot.in/2011/06/classification-of-materials-based-on.html>