

5.7 SOLAR CELL

Solar Cell converts light energy into the electrical energy. A solar cell is basically a p-n junction diode. It utilizes photovoltaic effect to convert light energy into electrical energy.

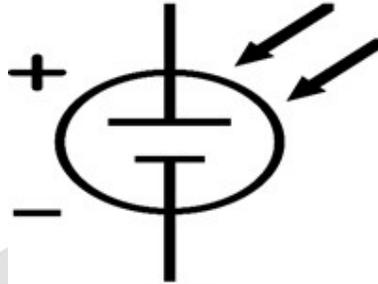


Fig:5.7.1 Symbol of Solar Cell

Construction of Solar Cell

Although this is basically a junction diode, but constructionally it is littlebit different form conventyional p-n junction diode. A very thin layer of p-type semiconductor is grown on a relatively thicker n-type semiconductor. We provide few finer electrodes on the top of the p-type semiconductor layer. These electrodes do not obstruct light to reach the thin p-type layer. Just below the p-type layer there is a p-n junction. We also provide a current collecting electrode at the bottom of the n-type layer. We encapsulate the entire assembly by thin glass to protect the solar cell from any mechanical shock.

Working Principle of Solar Cell

When light reaches the p-n junction, the light photons can easily enter in the junction, through very thin p-type layer. The light energy, in the form of photons, supplies sufficient energy to the junction to create a number of electron-hole pairs. The incident light, breaks the thermal equilibrium condition of the junction. The free electrons in the depletion region can quickly come to the n-type side of the junction. Similarly, the holes in the depletion can quickly come to the p-type side of the junction. Once, the newly created free electrons come to the n-type side, cannot further cross the junction because of barrier potential of the junction.

Similarly, the newly created holes once come to the p-type side cannot further cross the junction became of same barrier potential of the junction. As the concentration of electrons becomes higher in one side i.e. n-type side of the junction and concentration of

holes becomes more in another side i.e. the p-type side of the junction, the p-n junction will behave like a small battery cell.

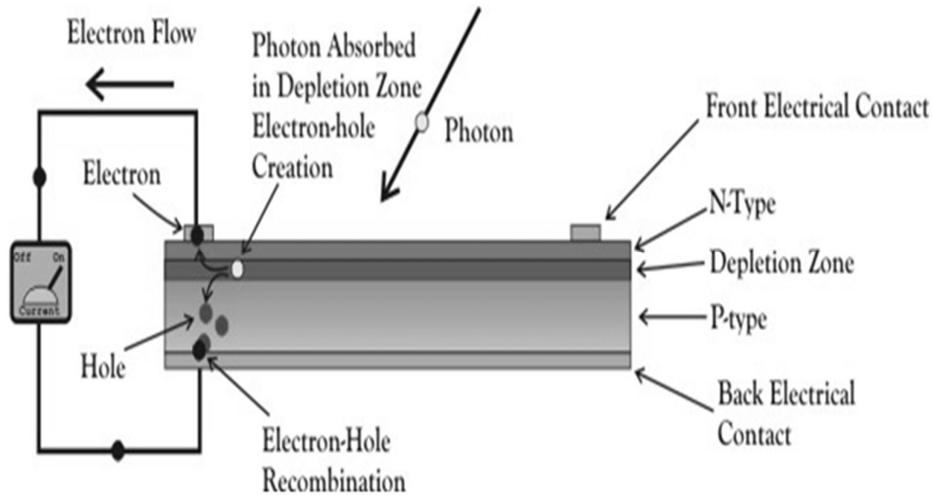


Fig:5.7.2 Working of Solar Cell

A voltage is set up which is known as photo voltage. If we connect a small load across the junction, there will be a tiny current flowing through it.

V-I Characteristics of a Photovoltaic Cell

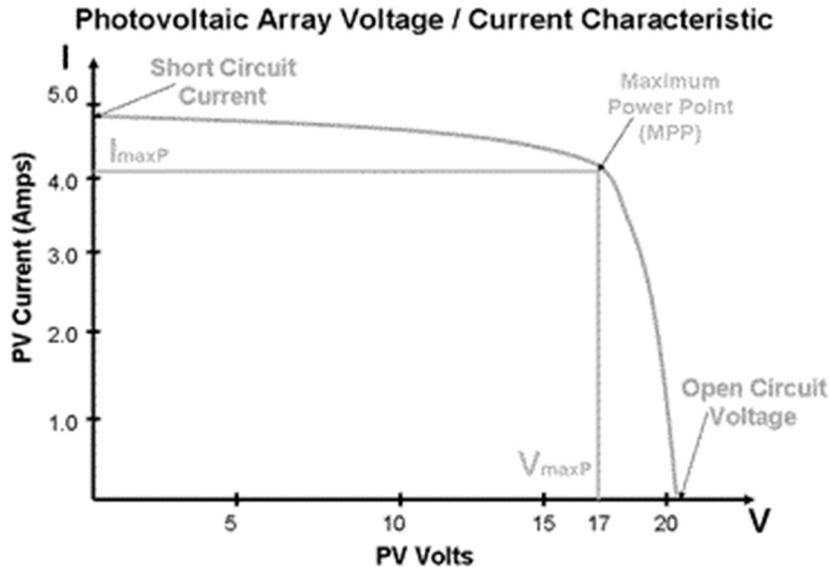


Fig:5.7.3 Characteristics of Solar Cell

Materials Used in Solar Cell

The materials which are used for this purpose must have band gap close to 1.5eV. Commonly used materials are-

1. Silicon.

2. GaAs.
3. CdTe.
4. CuInSe₂

Materials to be Used in Solar Cell

1. Must have band gap from 1eV to 1.8eV.
2. It must have high optical absorption.
3. It must have high electrical conductivity.
4. The raw material must be available in abundance and the cost of the material must be low.

Advantages of Solar Cell

1. No pollution associated with it.
2. It must last for a long time.
3. No maintenance cost.

Disadvantages of Solar Cell

1. It has high cost of installation.
2. It has low efficiency.
3. During cloudy day, the energy cannot be produced and also at night we will not get solar energy.

Uses of Solar Generation Systems

1. It may be used to charge batteries.
2. Used in light meters.
3. It is used to power calculators and wrist watches.
4. It can be used in spacecraft to provide electrical energy.