

## Optical properties of Materials

### 4.5.Solar cell

It is a P-N junction diode which converts solar energy (light energy) into electrical energy.

#### 4.5.1Construction

It consists of P-N junction diode made of Silicon. The P-N diode is packed in a can with glass window on top such that light may fall upon P and N type materials.

The thickness of the P-region is kept very small. Therefore, electrons generated in P region can diffuse to the junction before recombination takes place.

The thickness of N region is also kept small to allow holes generated near the surface to diffuse to the junction before they recombine.

The nickel ring is provided around the P-layer which acts as the positive output terminal. A metal contact at the bottom serves as the negative output terminal.

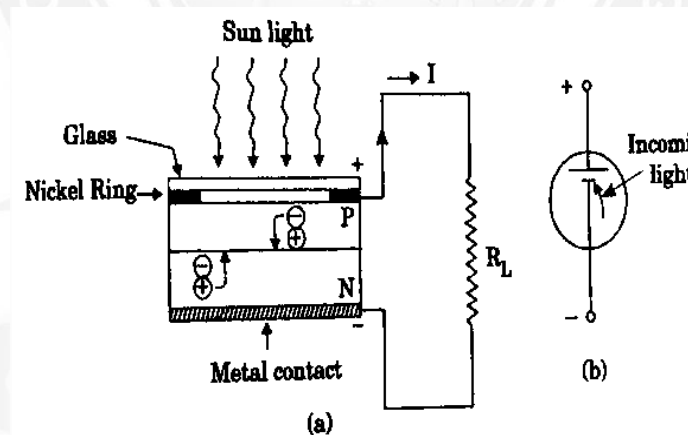


Fig 5.5.1 Solar cell

#### 4.5.2Working

When light radiation from sun falls on the P-N junction diode, it produces an electron-hole pair. Thus, electron-hole pairs are generated in both P and N sides of the junction.

The majority carrier electrons in the P-side cross the barrier potential to reach the N-side, and the holes in the N-side move to the P-side (Fig. b). Their flow constitutes the minority current.

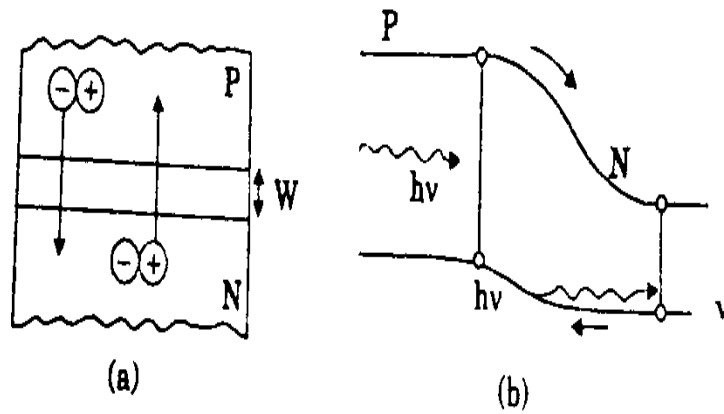


Fig 4.5.2. Energy band

The electrons and holes are accumulated on the two sides of the junction. This leads to an open circuit voltage  $V_{oc}$  which is a function of illumination.

#### 4.5.3 V-I Characteristics

The V-I characteristics of the solar cell, corresponding to different levels of illumination is shown in figure. The maximum power output is obtained when the solar cell is opened at the knee of the curve.

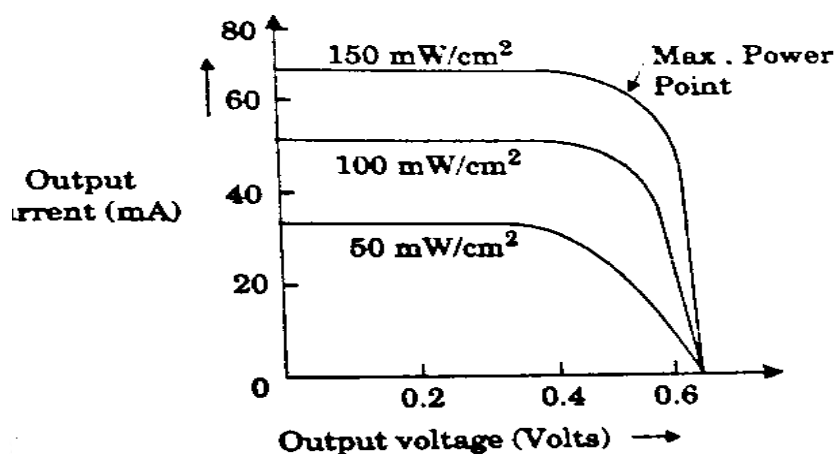


Fig 4.5.3 V-I characteristics

#### 4.5.4 Advantages of Solar Energy

- Renewable Energy Source. Among all the benefits of **solar panels**, the most important thing is that **solar** energy is a truly renewable energy source. ...
- Reduces Electricity Bills. ...
- Diverse Applications. ...
- Low Maintenance Costs. ...

- Technology Development.

#### 4.5.5 Dis advantages

- Solar energy is somewhat more expensive to produce than conventional sources of energy
- Solar power is a variable energy source, with energy production dependent on the sun.

