SOLAR CELL

It is a P-N junction device which converts solar energy into electrical energy.

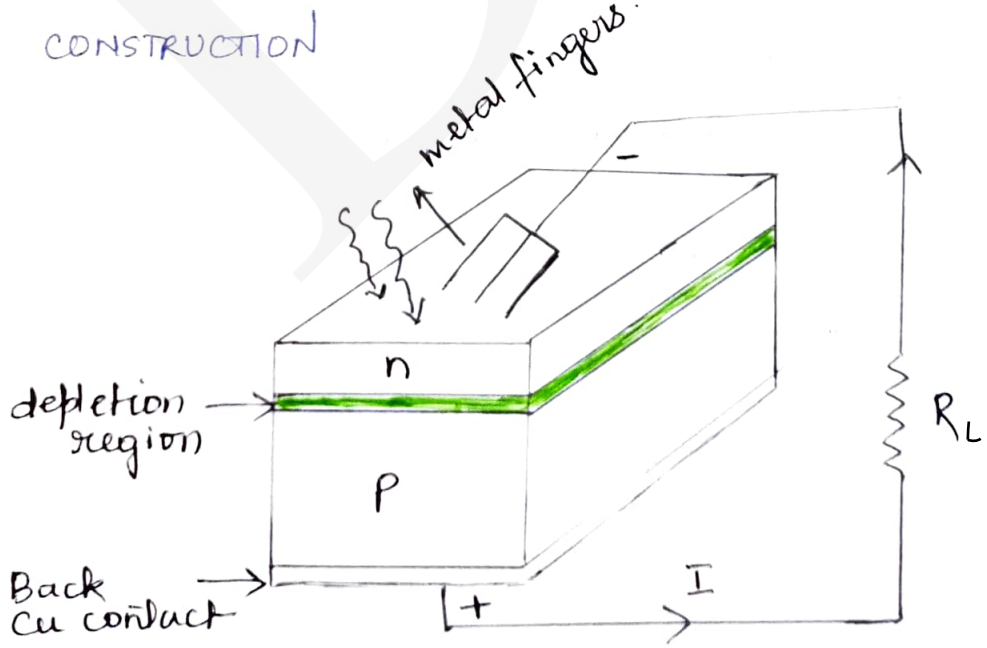
PRINCIPLE

It works on the principle of photovoltaic effect. When a P N jn is illuminated with sunlight, e-hole pairs are produced Due to the electric field of the depletion region the holes are drifted towards P region & electrons are drifted towards N region. The build up of charge on either side generates emf known as photovoltaic effect.

Solar cell is aka photovoltaic cell.

NOTE: Major difference between photodiode ~~detector~~ & solar cell is photodiode requires reverse biasing whereas solar cell do not require biasing.

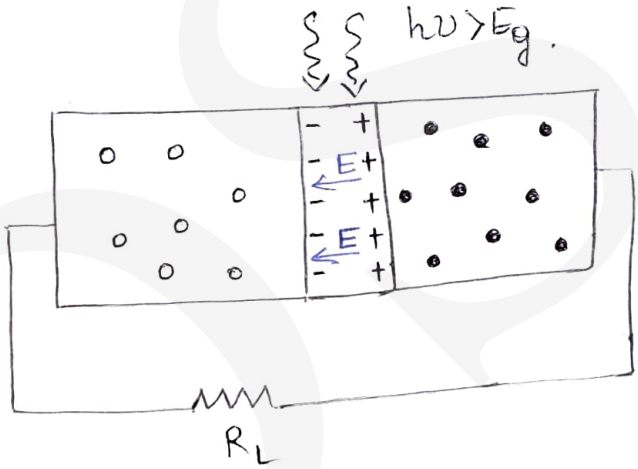
CONSTRUCTION



1. On a semiconductor, P & N regions are grown of approximate thickness of 300 μm & 0.3 μm respectively.
2. Below P region/layer back metal contact is provided.
3. On top of thin N layer, metal fingers are attached. They are mostly Ag or Al fingers.
4. Between P & N region, depletion region is formed.
5. A load is connected across P & N layers with the aid of back contact & metal fingers tip as shown in figure.

WORKING.

1.



When sunlight shines on the solar cell, it quickly penetrates N layer due to its low thickness and reaches depletion region.

2. In the depletion region e⁻ & hole pairs are generated due to breakage of covalent bonds by sunlight when $h\nu > E_g$.

3. The generated electrons are drifted towards N region & holes are drifted towards p region due to the electric field set up inside depletion region.

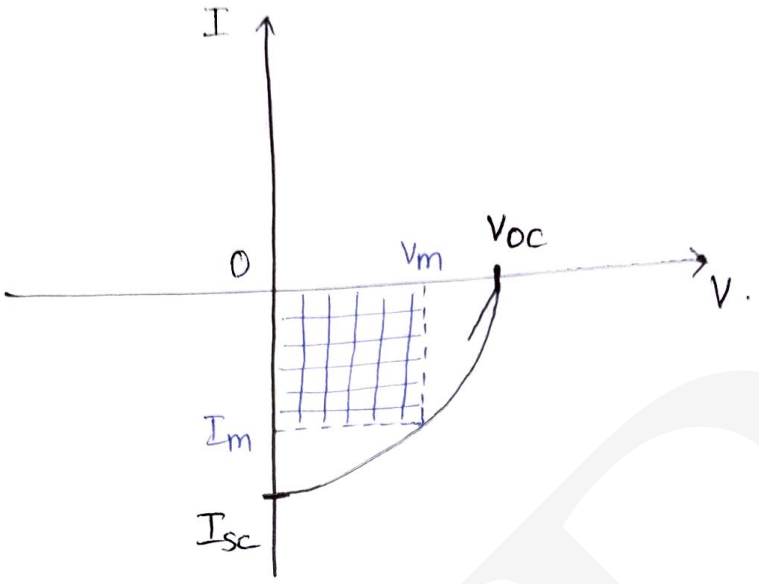
4. The electrons need to be drawn towards ~~out of~~ N region which is done by metal fingers attached on the N layer forming ohmic contact.

5. Electrons are accumulated at the edge of N type & holes towards base of P type. When an external load is ~~appli~~ connected across the photovoltaic cell/ solar cell, e^- travel from N region across load & recombine with hole at the other end on p side. constituting photo current.

6. If there is no load connected, i.e. open circuit. scenario wherein one observes maximum voltage at the ends of N & p region and zero current.

V-I CHARACTERISTIC.

As there is load connected across solar cell, one needs to operate it in fourth quadrant of V-I plot.



maximum voltage possible is open ckt voltage. ($R_L = \infty$)

" current " " " short " current. ($R_L = 0$)

The maximum power is delivered to the load when VI is maximum.

V_m & I_m are maximum values of voltage & current