

Topic

SOLAR CELL

Or

**PHOTO-VOLTAIC
CELL**

By

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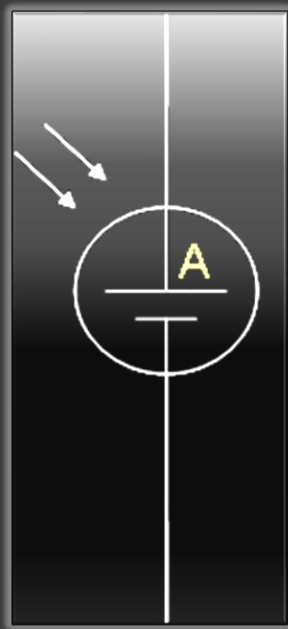


Introduction

- ⦿ *Solar cells are operate on the principle of Photovoltaic Action i.e. conversion of Light energy into Electrical energy.*
- ⦿ *This action occurs in all semi-conductors which are constructed to absorb energy.*

SYMBOL

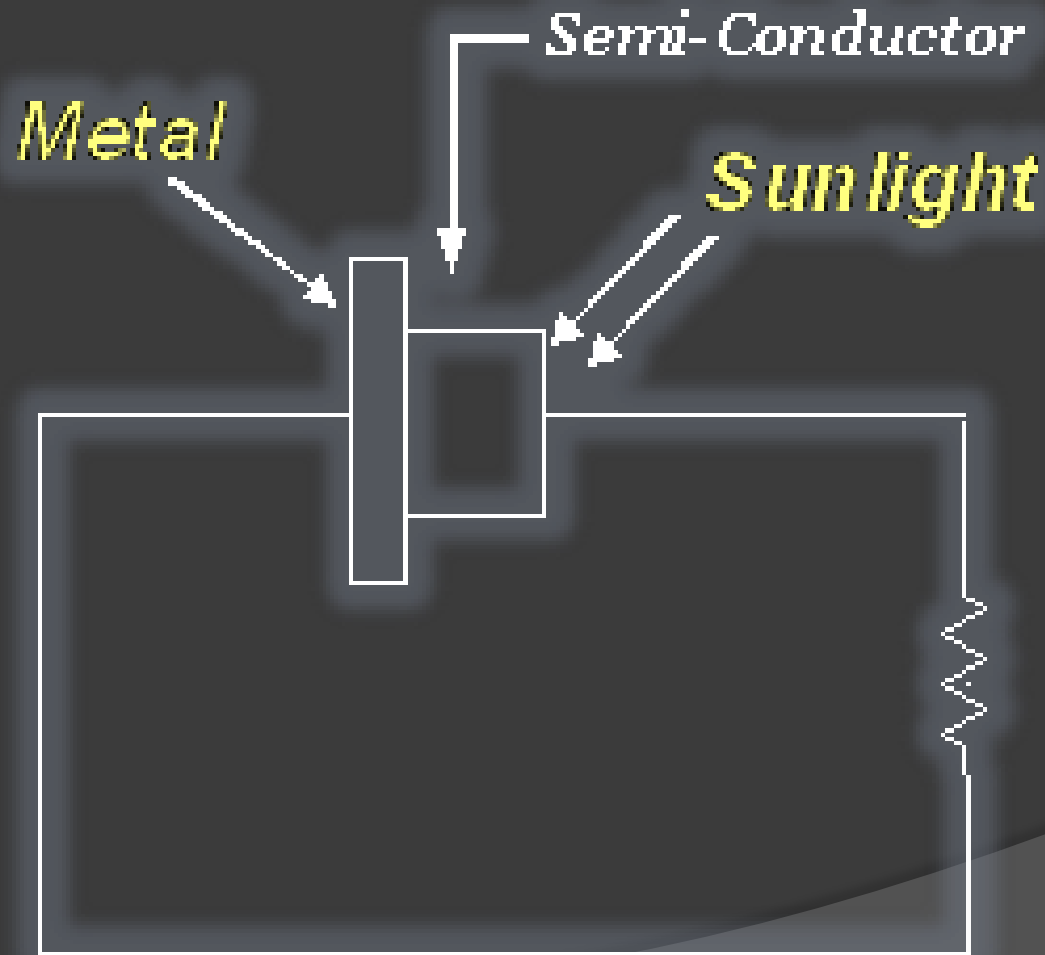
- Two alternative circuit symbols are shown in figure below:



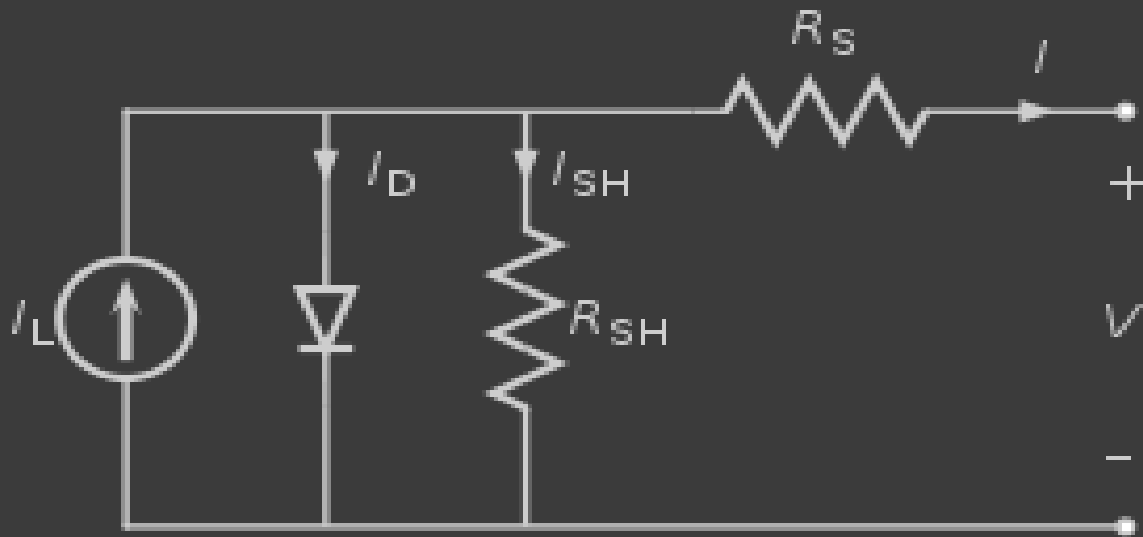
OR



BIAS CIRCUIT



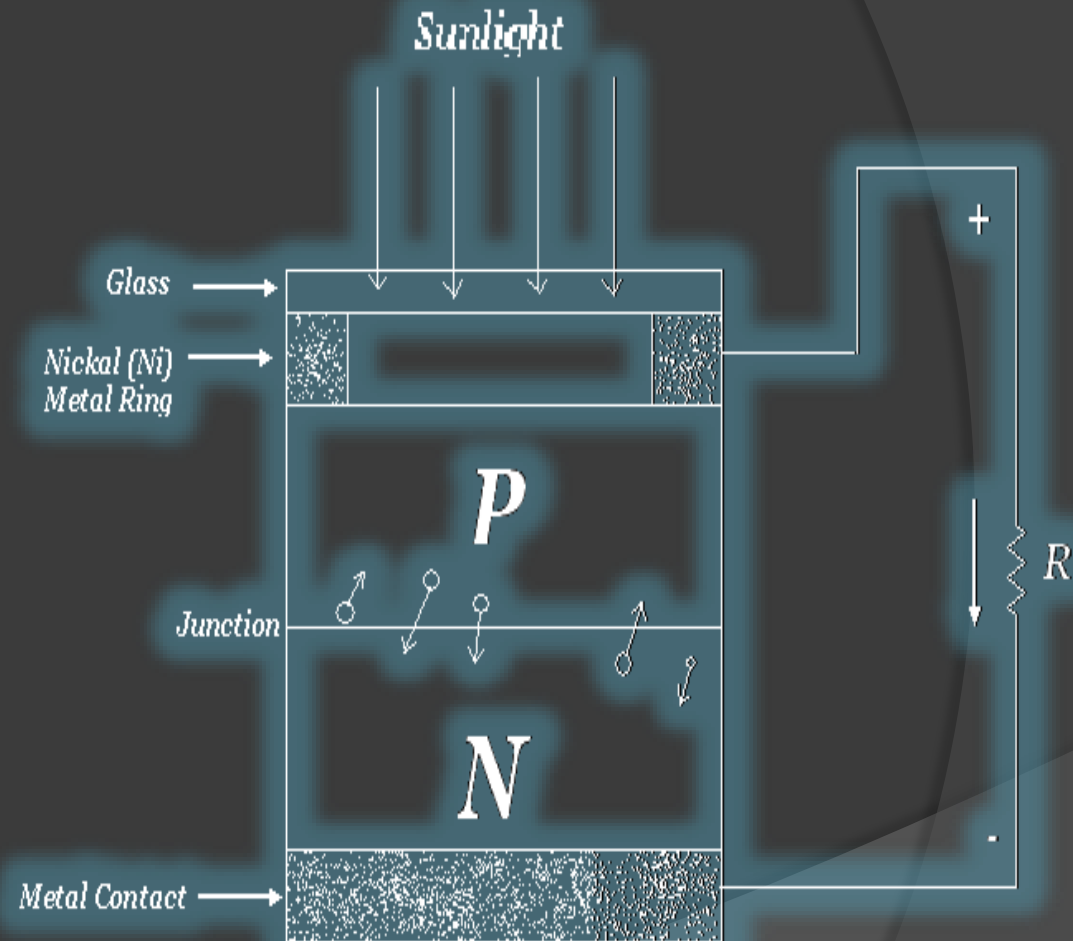
Equivalent Circuit



- *To understand the electronic behavior of a solar cell, it is useful to create a model which is electrically equivalent, and is based on discrete electrical components whose behavior is well known. An ideal solar cell may be modelled by a current source in parallel with a diode; in practice no solar cell is ideal, so a shunt resistance and a series resistance component are added to the model. The resulting equivalent circuit of a solar cell is shown above.*

Construction

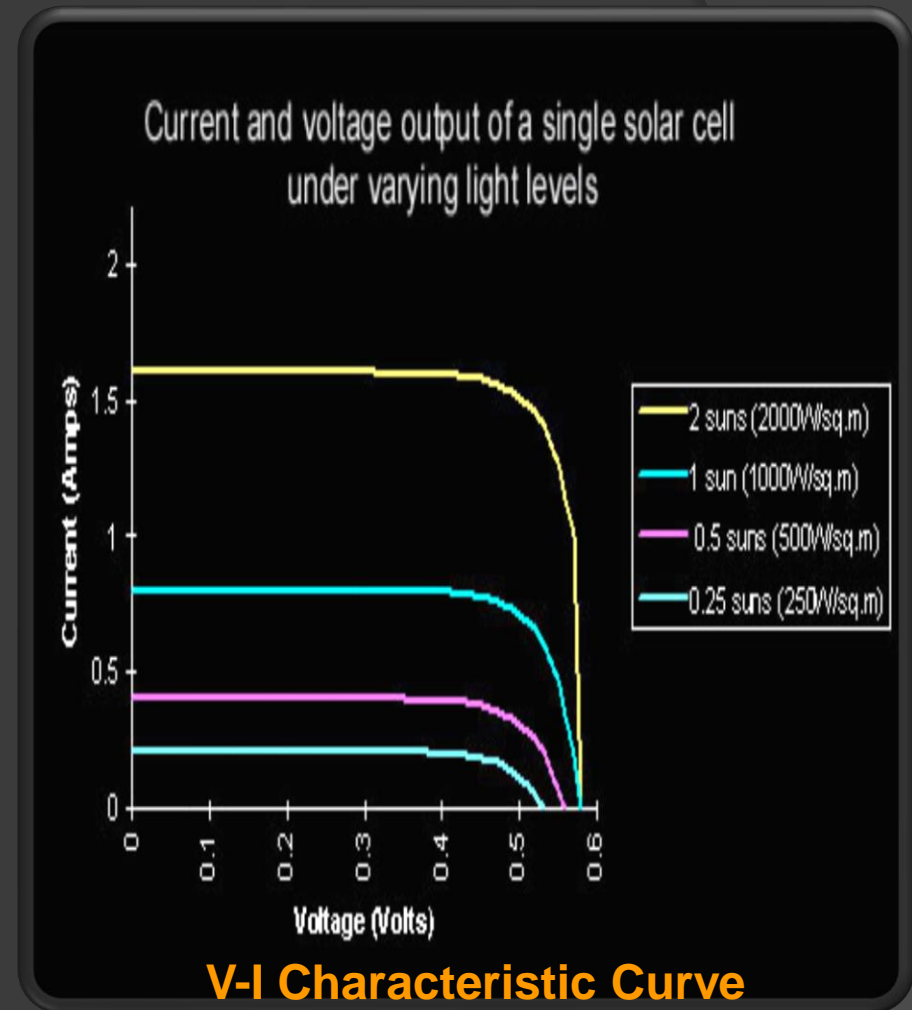
- **A solar cell consists of P-type and N-type semi-conductor material (silicon, germanium and selenium) forming a P-N junction.**
- **The bottom surface of the cell (which is always away from light) covered with a continuous conductive contact to which a wire lead attached.**
- **The upper surface has max: area exposed to light with a small contact either a long the edge or around the perimeter.**



- Silicon is commonly used for fabricating solar cells, another construction consists of P-type selenium covered with a layer of N-type cadmium-oxide to form P-N junction.
- The surface layer of P-type material is extremely thin (0.5 mm) so that light can penetrate to the junction.
- Power solar cells are also fabricated in flat strips to form efficient coverage of available surface area.
- Indecently the maximum efficiency of a solar cell in converting sunlight into electrical energy is nearly 15% at present.
- Another material used to make solar cells are Th-Ar (Thallium Arsenide), Ga-Ar (Gallium Arsenide), In-Ar (Indium Arsenide).

Working Principle

- *It converts solar energy into electrical voltage or current.*
- *When photons of solar light are strike with glass of solar cell, they eject into P-N junction, so replacement occurs in electron and holes, hence conduction takes place.*
- *In short circuit the voltage becomes zero and current becomes maximum, so power gets zero.*
- *In open circuit voltage is maximum and current becomes zero so also we get power zero.*
- For the mentioned reasons it is not useable, so we use it at knee point of the of circuit, where voltage and current both in circuit, as shown in the V-I curve.
- Solar cell gives maximum voltage of 0.6v at knee point.
- For maximum voltage we use series-parallel algorithm of solar cells, so it acts like a battery source.



Applications

- ① *A solar cell operates with fair efficiency, has unlimited life, can be easily mass-produced and has a high power capacity per weight.*
- ② *It is because of these quantities that it has become an important source of power for earth satellites.*
- ③ *It can be used in commercial point of view. It is used in solar cars, house usage etc.*

Advantages

- ⦿ *The main advantage of solar cell is the input of the solar energy free of cost.*
- ⦿ *In future it is more beneficial for the purpose of power generation.*