SOLAR CELL: A COMPLETE REVIEW

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Abstract: As energy requests is expanding step by step. The greater part of the procedures and innovation is going to enhanced to satisfy energy needs. Researcher and analysts are in battle to use the Solar Energy. As the energy from sun convey to earth in one hour is equivalent to energy devoured by individuals in a single year. So extraordinary sorts of solar Cells are going to presented, and parcel of changes and alteration is going ahead in this field. Here in this paper we have disk the nuts and bolts and some Solar Cells. This paper reviews about the solar energy and solar cell characteristics.
Keywords Solar Energy, Solar Cells

I. INTRODUCTION

A solar cell (photovoltaic cell or photoelectric cell) is a strong state electrical device that changes over the energy of light straightforwardly into electricity by the photovoltaic impact. The energy of light is transmitted by photons-little bundles or quantum of light. Electrical energy is put away in electromagnetic fields, which thusly can influence a current of electrons to stream. Congregations of solar cells are utilized to make solar modules which are utilized to catch energy from sunlight. At the point when various modules are collected together, (for example, before establishment on a post mounted tracker system), the subsequent coordinated gathering of modules all arranged in one plane is alluded as a solar board. The electrical energy created from solar modules, is a case of solar energy. Photovoltaic is the field of innovation and research identified with the down to earth utilization of photovoltaic cells in delivering electricity from light, however it is regularly utilized particularly to allude to the age of electricity from sunlight. Cells are portrayed as photovoltaic cells when the light source isn't really sunlight. These are utilized for distinguishing light or other electromagnetic radiation close to the noticeable range, for instance infrared finders, or estimation of light power.

Solar Cells

Solar cells, which to a great extent are produced using crystalline silicon chip away at the rule of Photoelectric Effect that this semiconductor displays. Silicon in its purest frame Intrinsic Silicon-is doped with a dopant debasement to yield Extrinsic Silicon of wanted characteristic (p-sort or n-sort Silicon). Whenever p and n sort silicon consolidate they result in development of potential obstruction. Working of Solar cells would thus be able to be founded on two crystalline structures.

- Intrinsic Silicon
- Extrinsic Silicon

Pure Silicon (Intrinsic) Crystalline Structure

Silicon has some uncommon concoction properties, particularly in its crystalline shape. An iota of silico n has 14 electrons, organized in three distinct shells. The initial two shells-which hold two and eight electrons separately are totally full. The external shell, in any case, is just half full with only four electrons (Valence electrons). A silicon molecule will dependably search for approaches to top off its last shell, and to do this, it will impart electrons to four close-by particles. It resembles every iota clasps hands with its neighbors aside from that for this situation, every particle has four hands joined to four neighbor s. That is the thing that structures the crystalline structure. The main issue is that unadulterated crystalline silicon is a poor conduit of electricity since none of its electrons are allowed to move about, not at all like the electrons in more ideal transmitters like copper.

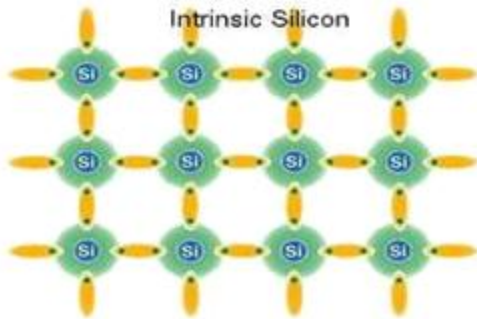

Fig 1 Impurity Silicon (Extrinsic): P-type and N-type Semiconductors

Extraneous silicon in a solar cell has included polluting influence particles purposefully mixed in with the silicon iotas, possibly one for each million silicon molecules. Phosphorous has five electrons in its external shell. It bonds with its silicon neighbor molecules having valence of 4, yet it could be said, the phosphorous has one electron that doesn't have anybody to bond with. It doesn't shape some portion of a bond, however there is a positive proton in the phosphorous core holding it set up. At the point when energy is added to unadulterated silicon, as warmth, it makes a couple of electrons break free of their securities and leave their molecules. An opening is left behind for each situation. These electrons, called free bearers, at that point meander haphazardly around the crystalline cross section searching for another opening to fall into and convey an electrical momentum. In Phosphorous-doped Silicon, it takes significantly less energy to thump free one of "additional" phosphorous electrons since they aren't tied up in a bond with any neighboring molecules. Accordingly, the vast majority of these electrons breaks free, and discharge significantly more free carriers than in unadulterated silicon. The way toward including pollutions reason is called doping, and when doped with phosphorous, the coming about silicon is called N-sort ("n" for negative) in view of the pervasiveness of free electrons. N-sort doped silicon is a greatly improved conductor than unadulterated silicon. The other piece of a run of the mill solar cell is doped with the component boron, which has just three electrons in its external shell rather than four, to end up P-sort silicon. Rather than having free electrons, P-sort ("p" for positive) has free openings and conveys the inverse positive charge.

II. MANUFACTURING TECHNOLOGY & PROCESS OF SOLAR CELL

Step 1 - Purification of Silicon

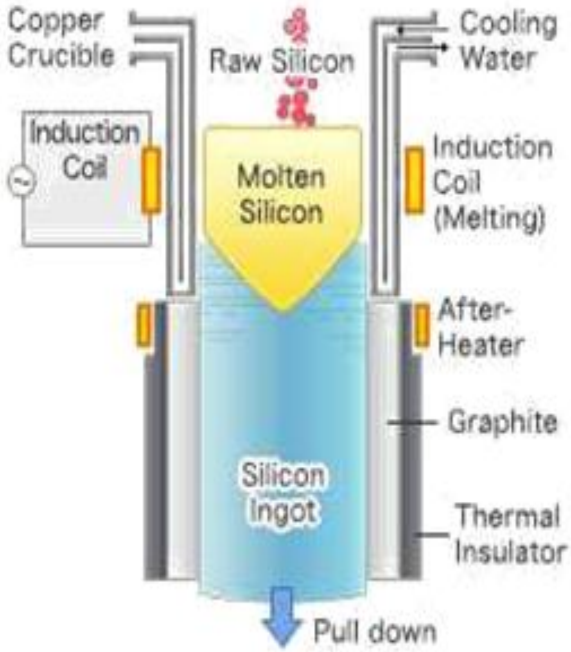

Fig: 2 Silicon

The fundamental segment of a solar cell is characteristic silicon, which isn't unadulterated in its normal state. To make solar cells, the crude materials—silicon dioxide of either quartzite rock or pounded quartz—are first put into an electric circular segment heater, where a carbon curve is connected to discharge the oxygen. A Graphite and Thermal separator trap the warmth and keep up the heater at required temperature for gangue (contamination) to shape a slag. The items are carbon dioxide and liquid silicon. Silicon ingot is pulled down from the liquid silicon utilizing seed silicon crystallization and gliding zone system. Passing polluted silicon same way a few times that isolates debasements and tainted end is later evacuated. This procedure yields silicon with one percent polluting influence, valuable in numerous enterprises however not the solar cell industry. Now, the silicon is as yet not sufficiently unadulterated to be utilized for solar cells and requires assist refinement. Unadulterated silicon is gotten from such silicon dioxides as quartzite rock (the purest silica) or pounded quartz.

Step 2 Ingot and Wafer Preparation

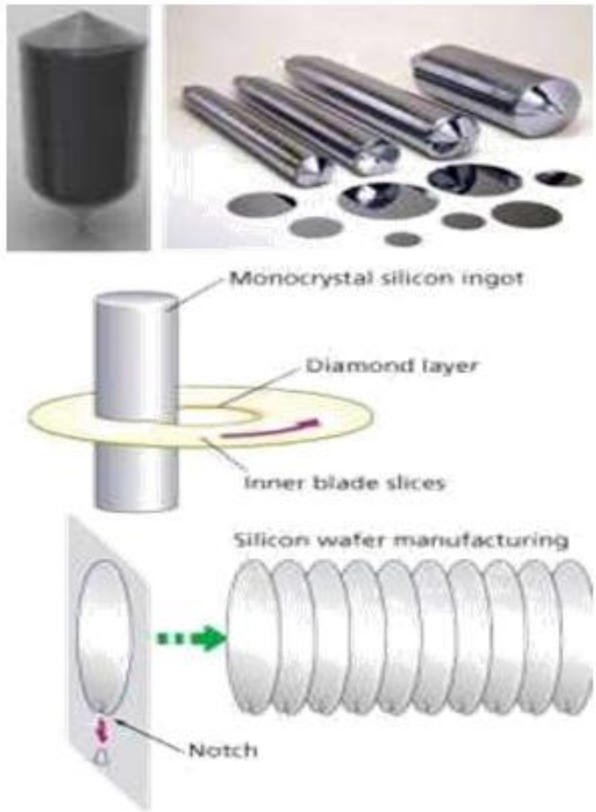

Fig: 3 Ingots and Wafer Preparation

Solar cells are produced using silicon boules, polycrystalline structures that have the nuclear structure of a solitary precious stone. The most regularly utilized process for making the boule is known as the Czochralski strategy. In this procedure, a seed precious stone of silicon is dunked into dissolved polycrystalline silicon. As the seed gem is pulled back and turned, a tube shaped ingot or "boule" of silicon is framed. The ingot pulled back is bizarrely unadulterated, in light of the fact that polluting influences have a tendency to stay in the fluid.

From the boule, silicon wafers are cut each one in turn utilizing a roundabout saw whose internal measurement cuts into the bar, or numerous without a moment's delay with a multi wire saw. Just around one-portion of the silicon is lost from the boule to the completed roundabout wafer—progressively if the wafer is then sliced to be rectangular or hexagonal. Rectangular or hexagonal wafers are now and then utilized as a part of solar cells since they can be fitted together superbly, in this manner using all accessible space on the front surface of the solar cell. The wafers are then cleaned to expel saw marks.

Step 3 Doping

The conventional method for doping silicon wafers with boron and phosphorous is to present a little measure of boron amid the Czochralski procedure. The wafers are then fixed consecutive and set in a heater to be warmed to slightly beneath the liquefying purpose of silicon (2,570 degrees Fahrenheit or 1,410 degrees Celsius) within the sight of phosphorous gas. The phosphorous iotas "tunnel" into the silicon, which is more permeable in light of the fact that it is near turning into a fluid. The temperature and time given to the procedure is deliberately controlled to guarantee a uniform intersection of appropriate profundity. These dissemination forms are normally performed using a group tube heater or an in-line persistent heater. The fundamental heater development and process are fundamentally the same as the procedure steps utilized by bundling engineers.

Step 4 Screen Printing

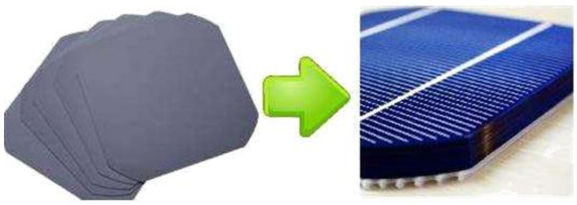

Fig 4 Screen Printing

Electrical contacts are framed through crushing a metal glue through work screens to make a metal matrix. This metal glue (typically Ag or Al) should be dried with the goal that resulting layers can be screen-printed utilizing a similar strategy. As a last advance, the wafer is warmed in a consistent terminating heater at temperatures running from 780 to 900°C. These framework design metal screens go about as authority cathodes that convey electrons and finish the electrical congruity in the circuit.

Step 5 Stringing and Tabbing

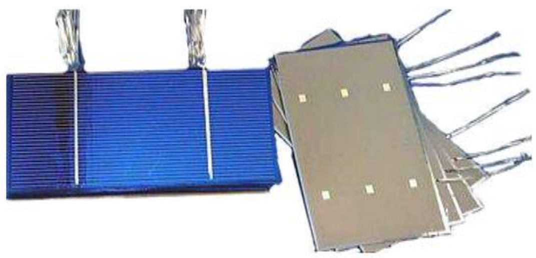

Fig 5 Stringing and Tabbing

Electrical contacts interface each solar cell to another and to the recipient of delivered current. The contacts must be thin (at any rate in the front) so as not to square sunlight to the cell. Metals, for example, palladium/silver, nickel, or copper are vacuum-dissipated After the contacts are set up, thin strips ("fingers") are set between cells. The most generally utilized strips are tin-covered copper.

Stage 6 - Antireflective Coating:

Since unadulterated silicon is glossy, it can reflect up to 35 percent of the sunlight. To lessen the measure of sunlight lost, a hostile to intelligent covering is put on the silicon wafer-generally titanium dioxide, silicon oxide and some others are utilized. The material utilized for covering is either warmed until the point that its particles bubble off and go to the silicon and consolidate, or the material experiences sputtering. In this procedure, a high voltage thumps atoms off the material and stores them onto the silicon at the inverse cathode. However another technique is to enable the silicon itself to respond with oxygen-or nitrogen-containing gasses to shape silicon dioxide or silicon nitride. Business solar cell producers utilize silicon nitride. Another technique to influence silicon to assimilate all the more light is to make its best surface grained, i.e. pyramid formed nanostructures that yield 70% retention that achieves the cell surface in the wake of going through hostile to intelligent covering.

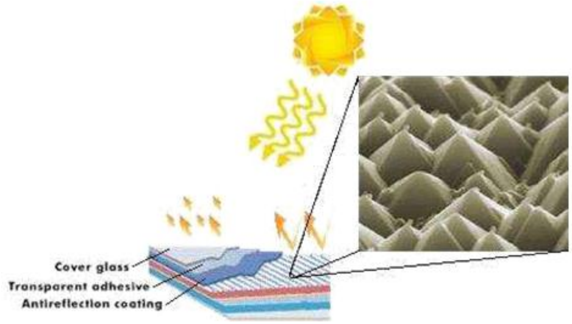

Fig 6 Antireflective Coating

STEP 7 - Module Manufacturing

The completed solar cells are then epitomized; that is, fixed into silicon elastic or ethylene vinyl acetic acid derivation. Solar module gathering as a rule includes binding cells together to create a 36-cell string (or more) and covering it between toughened glass on the best and a polymeric support sheet on the base. The epitomized solar cells are then put into an aluminum outline that has a Mylar or tedlar back sheet and a glass or plastic cover. Edges are generally connected to take into consideration mounting in the field, or the covers might be independently coordinated into a mounting system for a particular application, for example, incorporation into a building.

Solar Energy Facts

The utilization of non-inexhaustible sources like oil, gas and coal is expanding at a disturbing rate. The time has at long last come to take care of some other inexhaustible wellsprings of energy i.e. solar, wind and geothermal energy. Albeit numerous nations have begun using solar energy widely yet at the same time they need to go far to abuse this energy to satisfy their every day interest for energy. Here are couple of realities on solar energy that can enable you to survey the capability of solar energy to meet worldwide necessities.

III. SOLAR POWER ADVANTAGES & DISADVANTAGES

Advantages:

- Solar power is pollution free and causes no greenhouse gases to be emitted after installation
- Reduced dependence on foreign oil and fossil fuels
- Renewable clean power that is available every day of the year, even cloudy days produce some power
- Return on investment unlike paying for utility bills
- Virtually no maintenance as solar panels last over 30 years
- Creates jobs by employing solar panel manufacturers, solar installers, etc. and in turn helps

the economy

- Excess power can be sold back to the power company if grid intertied
- Ability to live grid free if all power generated provides enough for the home / building
- Can be installed virtually anywhere; in a field to on a building
- Use batteries to store extra power for use at night
- Solar can be used to heat water, power homes and building, even power cars
- Safer than traditional electric current
- Efficiency is always improving so the same size solar that is available today will become more efficient tomorrow
- Aesthetics are improving making the solar more versatile compared to older models; i.e. printing, flexible, solar shingles, etc.
- Federal grants, tax incentives, and rebate programs are available to help with initial costs

Disadvantages

- High initial costs for material and installation and long ROI
- Needs lots of space as efficiency is not 100% yet
- No solar power at night so there is a need for a large battery bank
- Some people think they are ugly (I am definitely not one of those!)
- Devices that run on DC power directly are more expensive
- Depending on geographical location the size of the solar panels vary for the same power generation
- Cloudy days do not produce much energy
- Solar panels are not being massed produced due to lack of material and technology to lower the cost enough to be more affordable
- Solar powered cars do not have the same speeds and power as typical gas powered cars
- Lower production in the winter months.

IV. CONCLUSION

This paper reviews about the concept of the solar energy , solar cells , its structure and components and also about the solar power advantages and disadvantages.

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