3.6 TYPES OF SOLAR CELL

The solar cells depending on the type of material used can be classified as

(1) single crystal silicon solar cell,
(2) polycrystalline and amorphous silicon cell,
(3) cadmium sulphide-cadmium telluride cell,
(4) copper indium diselenide cell
(5) Gallium arsenide cell.

3.6.1 Single crystal silicon:

- It is produced from silicon dioxide which is reduced to silica with 1% impurities. Itis first purified to polycrystalline form and then further converted into the single crystal state. The conversion process into single crystal state is very expensive.
- The single crystal p-type silicon is obtained in the form of a long cylindrical block (diameter of about 6-15 cm). The block is sawed using diamond cutter to obtain a number of silicon slices or wafers having thickness of about 300 μm.
- The p-type silicon wafers are then exposed to phosphorous vapour (doping material) in a furnace so that phosphorous can diffuse into the silicon wafer for a short depth, thereby forming n-silicon region over the p-silicon bulk material.
- The efficiency of single crystal silicon is about 22%. It is most efficient and robust. It has two main drawbacks:

  (i) it needs high energy to produce and hence is costly and
  (ii) it requires high intensity of radiation to produce solar electricity.

3.6.2 Polycrystalline and amorphous silicon

- The cells made of these materials are cost-effective but these have lower efficiency compared to a single crystal silicon cell.
- The process to produce polycrystalline silicon cells is similar to that of single crystal silicon except that the costly step of converting polycrystalline state to the single crystal is not required.
- The polycrystalline silicon is directly melted, doped with phosphorous and cooked to

the desired shape and size. This helps in economy of materials and energy consumption for the production of cells.

- Amorphous silicon cells are produced using thin film technology. These cells are a cheaper alternative to single crystal or multicrystallinc cells. The main drawbacks are that they have low efficiency (4-8%) and they degrade easily when used in outdoor applications. These cells are useful for indoor lights, pocket calculator, electronic watches and electronic instruments

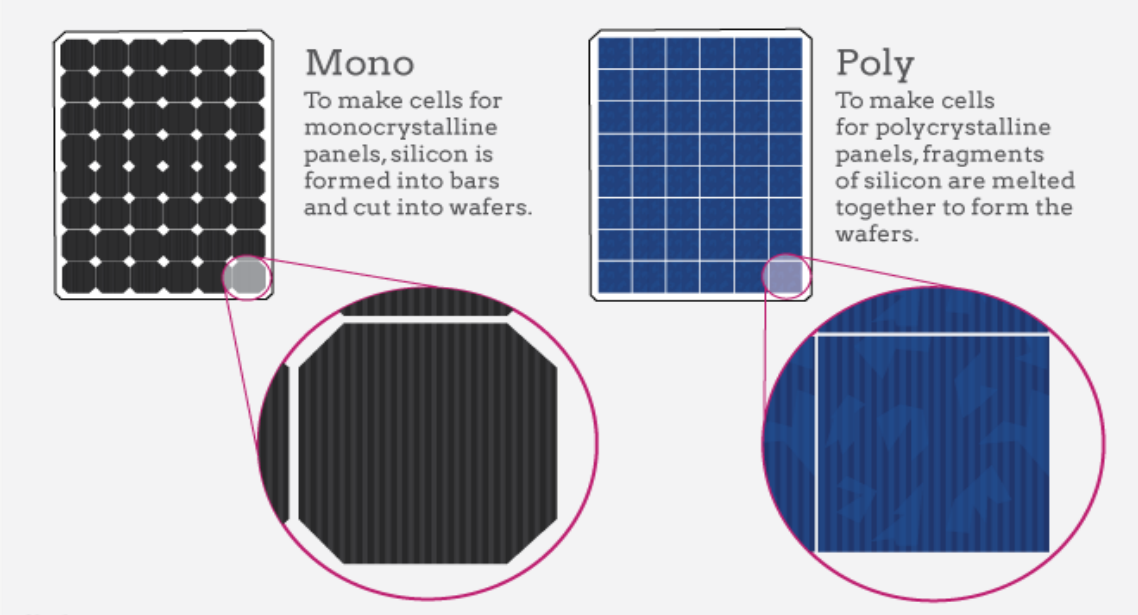

Figure3.6.1

[Source: "Solar Photovoltaics: Fundamentals,Technologies andApplications" by ChetanSingh Solanki, Page: 255]

3.6.3 Cadmium sulphide cadmium telluride cells:

- These cells are also produced using thin film technology. The cells require very less material. In thin film technology, the semiconductor (cadmium telluride) is vapourised and its film (10 μm) is deposited on a thin layer (12 μm) of cadmium sulphide.
- A barrier layer of copper sulphide is then deposited on top of the CdS-CdTecell. The cell consists of n-type CdS and p-type CdTe. The cell has efficiency of 10% and it has no deterioration during outside applications.

3.6.4 Copper indium diselenide:

It is a thin film polycrystalline cell made from copper indium diselenide. It has an efficiency of about 14%. Its properties remain stable. It has an easier manufacturing process.

3.6.5 Gallium arsenide:

- The cell has thin film of n-type and p-type gallium arsenide (GaAs) grown on a suitable substrate. The efficiency of the cell is about 20%, but it has high costof production.
- The cell has high performance in extraterrestrial applications