SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

UNIT-III- Thin film solar cells

Status Of Photovoltaics and The Role of Thin Film Solar Cells

- The large scale production of solar cells during the year 2004 surpassed the symbolic threshold of 1 GWp and the total cumulative worldwide PV capacity installed is above 3 GW.
- Photovoltaic applications range from large scale stand alone/grid connected power stations to low power electronics.
- The photovoltaic (PV) sector has been growing with a compounded annual growth rate of nearly 30 % over the last five years and in 2004 the growth rate even amounted to a breath-taking 60 % .
- Film solar cell technologies and consists of 4 % based on thin film amorphous Si solar cells and 2 % on polycrystalline compound solar cells based on CdTe and CuInSe2

Thin film definition

The reader might remark at this point that the term ‘thin film solar cell technology’ has not yet been defined in the context of this book.

The definition given by Chopra provides a good starting point and also yields a criterion to discriminate the term ‘thin film’ from ‘thick film’.

They define a thin film as a material ‘created ab initio by the random nucleation and growth processes of individually condensing/reacting atomic/ionic/molecular species on a substrate.

The structural, chemical, metallurgical and physical properties of such a material are strongly dependent on a large number of deposition parameters and may also be thickness dependent.

Thin films may encompass a considerable thickness range, varying from a few nanometers to tens of micrometers and thus are best defined in terms of the production processes rather than by thickness.

Thin film definition

One may obtain a thin material (not a thin film) by a number of other methods (normally called thick-film techniques) such as by thinning bulk material, or by depositing clusters of microscopic species in such processes as screen-printing, electrophoresis, slurry spray, plasma gun, ablation, etc.'

The given definition still leaves room for a broad field of technologies to deposit the thin film (plasma, sputtering, evaporation, deposition from the liquid phase, etc.) and to tailor its electrical and morphological properties (crystalline, amorphous and intermediary forms).

These techniques and their relation with the final morphology and the photovoltaic performance will be discussed in the separate chapters dealing with the different thin film solar cell technologies. For the inorganic non-crystalline Si materials and technologies

procedure for making thin film solar cells

Substrate Preparation:

•**Cleaning:** The substrate (usually glass or a flexible material) is thoroughly cleaned to remove any impurities or contaminants.

•**Preparation:** A transparent conductive oxide (TCO) layer, often made of materials like indium tin oxide (ITO), is deposited onto the substrate. This layer serves as the front electrode.

Deposition of Thin Film Layers:

•**Absorber Layer:** The light-absorbing material (CdTe, CIGS, or amorphous silicon) is deposited onto the TCO-coated substrate. Various techniques like chemical vapor deposition (CVD), sputtering, or electrodeposition are used for this purpose.

•**Buffer Layer:** A buffer layer (often made of materials like cadmium sulfide for CdTe solar cells) is deposited on top of the absorber layer. This layer helps improve the efficiency of the solar cell.

Procedure for making thin film solar cells

Patterning:

•**Photolithography:** A photosensitive polymer called photoresist is coated on top of the thin films. A mask is placed over the photoresist, and UV light is used to transfer the pattern of the mask onto the photoresist.

•**Etching:** Chemical etching or plasma etching is used to remove the unwanted parts of the absorber and buffer layers, leaving behind the patterned thin film structure.

4. Back Contact Formation:

•A back contact layer, often made of materials like molybdenum (Mo), is deposited on the backside of the solar cell. This layer serves as the rear electrode.

Procedure for making thin film solar cells

5. Encapsulation:

•The thin film solar cell is encapsulated to protect it from environmental factors such as moisture and oxygen. Encapsulation is usually done using a transparent encapsulant material like EVA (ethylene vinyl acetate) or glass.

6. Testing and Quality Control:

•The solar cell undergoes various tests to ensure its efficiency, voltage, current, and other performance parameters meet the required standards.

7. Module Assembly (Optional):

•If the thin film solar cells are intended for commercial use, they can be assembled into solar modules by connecting multiple cells in series or parallel, depending on the desired voltage and current output.

THANK YOU