Chapter

Introductory Chapter: Thin Films Photovoltaics

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1. Introduction

1.1 Overview on thin films photovoltaic technologies

Currently, the ever-increasing energy demand has put a strain on conventional energy sources resulting in a catastrophic increase in greenhouse gases and their effects a great cause of concern. This rapid growth in the energy-intensive hymen activities and the ill effects of use of conventional energy resources has pushed scientists to explore and use new renewable, non-polluting energies sources to meet the energy demand of society. Among the renewable energy resources are solar energy produced by photovoltaic panels, wind, geothermal, biomass, hydropower, etc. [1–6].

To tap the abundantly available solar energy especially in the tropics, among the variety of the materials employed amorphous thin-film silicon (a-Si) based solar cells has been mainly used [7]. Among other materials, CdTe (heterojunction cadmium telluride, cadmium sulphide), CIS (heterojunction of copper diselenide indium/cadmium sulfide) have also been used [8, 9]. The manufacturing of these materials is carried out largely in automated systems free or with minimal hymen interventions which is suitable for large-scale productions (**Figure 1**).

In addition to the traditional technologies to generate energy from renewable energy sources, many other approaches and avenues are currently opening up, with a lot of uncertainty that which of these may prove to be more effective over the other [10].

At present, crystalline technologies (multicrystalline and monocrystalline) are by far the most widely used. But "thin film" technologies in general and CIS and CdTe in particular, are increasingly developing being employed by more and more people. Whereas other approaches employing dyes or organic materials are still in their infancy. These approaches though promise a bright future for solar energy generation by photovoltaic cells. There are currently three large families/generations of solar cells as follows [11–14].

- Crystalline technologies which use flat cells from 150 to 200 μm, i.e., 0.15 to 0.2 mm thickness, cut from an ingot or a brick obtained by fusion and molding, then connected in series to each other to be finally placed and glued to the rear face of the module's protective glass. The raw material is always silicon to result in monocrystalline silicon, multicrystalline silicon or amorphous silicon.

- For more details on the manufacturing process of the solar cells, thin film solar cells are based on the use of extremely thin layers of a few microns thick and deposited under vacuum on a substrate (glass, metal, plastic, etc.) A thin uniform layer composed of single or more often several materials deposited through vapor phase. The most developed industrially useful materials are CdTe and CIS-based solar cell technologies.

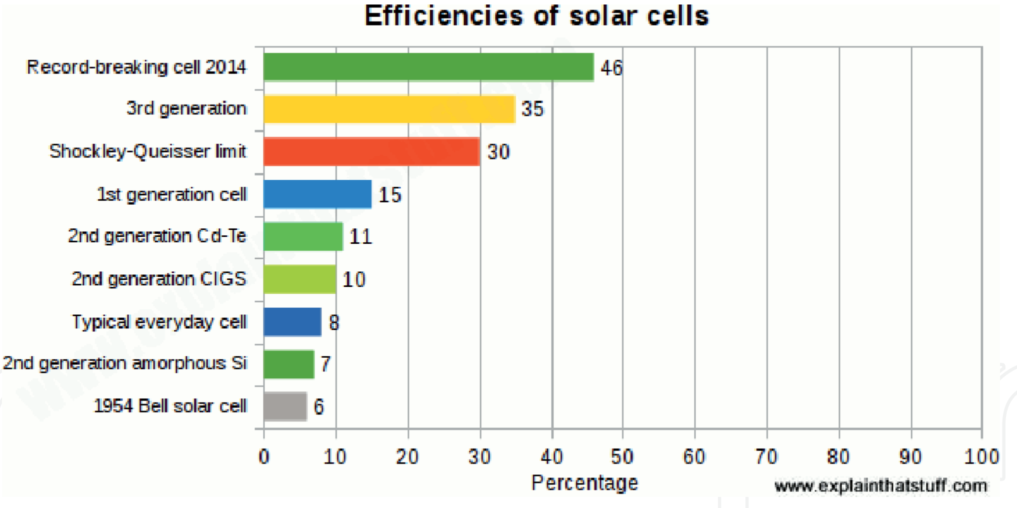

Figure 1.
Efficiencies of solar cells.

- Photovoltaic polymer cells will be mentioned for information as their performance can still only be observed under experimental conditions and they only constitute a long-term alternative. We will also consider concentrators intended for power stations, intended to follow the solar race and permanently expose extremely expensive cells and with very high efficiency.

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References

[1] Salameh ZM, Dagher F, Lynch WA. Step-down maximum power point tracker for photovoltaic systems. Solar Energy. 1991;**46**(5):279-282

[2] Zaidi B, Saouane I, Shekhar C. Simulation of single-diode equivalent model of polycrystalline silicon solar cells. International Journal of Materials Science and Applications. 2018;**7**:8-10

[3] Zaidi B, Saouane I, Madhava Rao MV, Li R, Hadjoudja B, Gagui S, et al. Matlab/simulink based simulation of monocrystalline silicon solar cells. International Journal of Materials Science and Applications. 2016;**5**:11-15

[4] Mrabti T, El Ouariachi M, Kassmi K, Olivié F, Bagui F. Amélioration du Fonctionnement des Systèmes Photovoltaïques suite aux Brusques Variations des conditions Météorologiques et de la charge. Revue des Energies Renouvelables. 2008; **11**(1):107-117

[5] Chisti Y. Biodiesel from microalgae. Biotechnology Advances. 2007;**25**(3): 294-306

[6] Zou Z, Ye J, Sayama K, Arakawa H. Direct splitting of water under visible light irradiation with an oxide semiconductor photocatalyst. Nature. 2001;**414**(6864):625-627

[7] Zaidi B, Belghit S, Shekhar C, Hadjoudja B, Chouial B. Impact of anti-reflective coating on the characteristics of a-Si: H solar cells. Nanosistemi Nanomateriali, Nanotehnologii. 2018;**16**:713-718

[8] Pudov AO, Kanevce A, Al-Thani H, Sites JR, Hasoon FS. Secondary barriers in CdS-$CuIn_{1-x}Ga_xSe_2$ solar cells. Journal of Applied Physics. 2005;**97**:1063

[9] Zaidi B, Zouagri M, Merad S, Shekhar C, Hadjoudja B, Chouial B. Boosting electrical performance of CIGS solar cells: Buffer layer effect. Acta Physica Polonica A. 2019;**136**:988-991

[10] Beaucarne G. Silicon thin-film solar cells. Advances in OptoElectronics. 2007;**2007**:1-12

[11] Available from: http://www.photovoltaique.info/Les-types-de-modules

[12] Zaidi B. Introductory chapter: Introduction to photovoltaic effect. In: Solar Panels and Photovoltaic Materials. Rijeka: IntechOpen; 2018

[13] Zaidi B, Belghit S. Silicon Materials. Rijeka: IntechOpen; 2019

[14] Zaidi B. Solar Panels and Photovoltaic Materials. Rijeka: IntechOpen; 2018