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FUNDAMENTAL PROCEDURES FOR FABRICATING AND BUILDING AN ORGANIC SOLAR CELL

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Abstract:
This paper provides adequate, useful, and detailed information on the fabrication of solar cells, which has been garnering a lot of attention just recently. Among studies discussed were (efficiencies and spectral characteristics), which allowed for a more accurate and critical analysis of the data, as well as electrodes, additive mechanism of action, cell working principles, educational objectives for this work, and the first solar cell database of its kind

Keywords: Organic solar cells (OSCs), active layer, Device Fabrication, Fundamental.

INTERDICTION

Scientific research has been directed in recent years toward obtaining a new source of energy, which is renewable energy (solar and wind energy), as solar energy has become greatly beneficial. Scientists recently demonstrated that solar irradiation (UV- radiation) can be used instead of chemical disinfection.

A Jordanian research team found a rapid decrease in the number of bacteria shortly after exposing water to solar radiation. And they are practically proven. Before drinking water is pumped for use, it must be exposed to sunlight for at least eight hours. One of the advantages of solar energy is that it can be used to treat the water in dams. When water is exposed to sunlight, it reduces pollution and thus eliminates the necessity for filtration or chlorine to sterilize water, which contributes to environmental protection, In addition to the use of visible ultraviolet radiation in the photo catalysis of several dyes, [1,2]. Among the many kinds of solar cells offered, including organic (OSC) and inorganic solar cells (IOCS), silicon cells, dye solar cells (DCS), and peroxide solar cells (PSC), and all of them have a common goal that scientists and manufacturers are interested in Its goal is to better the operating stability of solar cells while increasing efficiency and cutting expenses. Organic solar cells have piqued the interest of scientists. Because of its low material cost, reduced pollution, versatility [3,4,5,6].

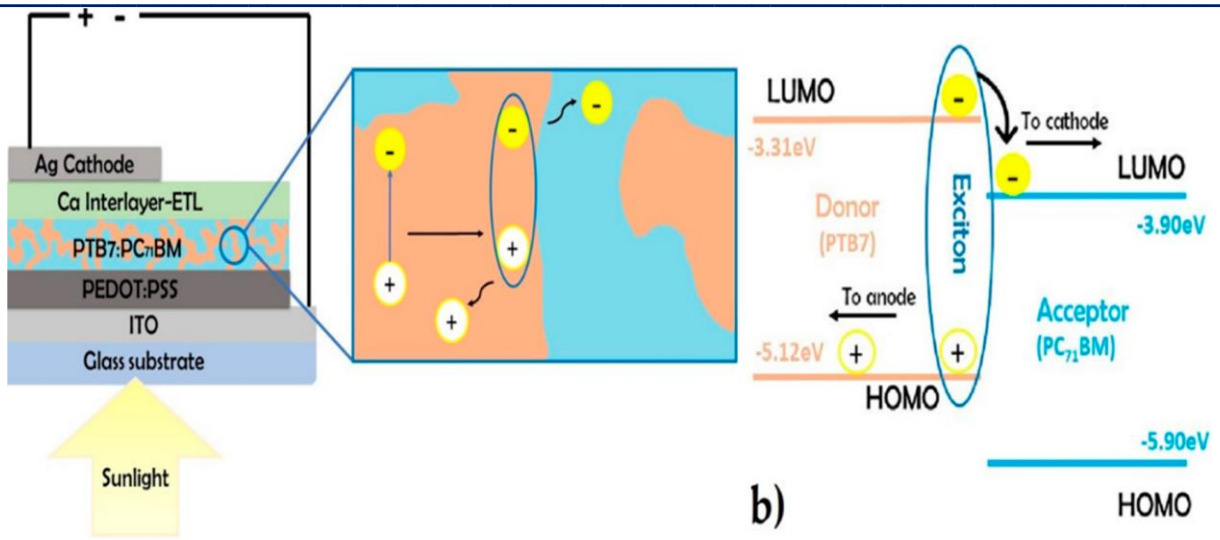
1- Educational principles

This research shows the following educational principles

Find out how to make an organic solar cell, learn about the manufacturing techniques and mechanisms used in the installation and completion of organic solar cells Improving the optical absorbance of the materials used, as well as improving the electrical conductivity of these materials and their morphology, as well as knowing the coefficients to be calculated for the solar cells.

2- Structure and Operation of the Device

A solar cell is made using four basic processes., which she describes in detail: light absorption, charge generation, charge separation, and charge collection [7,8]. The surface layer of an n-type semiconductor material and the base layer of a p-type semiconductor material comprise the solar cell, [9,10] The electrodes on the upper surface are designed in such a way that light can reach the cell's surface; this is known as the anterior ohmic reticulum or grid. The cell's surface is frequently thin in order to allow light to pass through to the contact area (p-n)[11,12], When the two materials come into contact, the majority carriers in both materials begin to diffuse across the joint until their concentrations are equal, While diffusing, the holes near the joint diffuse from the p-type material to the n-type material .Electrons are recombined in the opposite direction, resulting in a large number of carriers being recombined and the formation of a thin layer known as the depletion layer. The n-type material becomes positively charged, resulting in a stable voltage and electric field across the death zone, preventing electron and hole diffusion outside of this region, known as the contact voltage. When solar radiation strikes a solar cell, some photons form (electron-hole) pairs, which generate photocurrent (Iph) [13,14,15] FIG(1)



FIG(1) **Structure and Operation of the Device[13]**

3-Manufacturing steps for solar cells.

To begin, laboratory safety principles such as wearing gloves, laboratory glasses, long pants, masks, safety shoes, and providing adequate ventilation in the laboratory must be followed.

Cleaning 3-1-

Cleanliness of the molding bases used must be considered in the first step in the manufacture of solar cells. We begin by cleaning the glass slides with distilled water and leaving them for 10 minutes inside a container containing pure acetone, after which they are washed with distilled water and left for 5 minutes at a temperature of 70 °C in a hot oven, after which the clean bases are stored in appropriate containers. In addition, ITO glass substrates were cleaned with ultrasonic and ultraviolet (UV) ozone [16], to avoid touching the bases, tweezers were used.

Preparation of solutions. 3-2-

This step prepares solutions of materials used in the active layer of cells, such as polymer-polymer, dye-polymer, and nanoparticle- polymer (Electron transferring materials and electron donor materials). There are conditions that must be met when choosing the material for the active layer; there must be compatibility between the donor and acceptor materials, i.e. the highest filled level of energy and the lowest filled level (HOMO and LUMO) of energy must be compatible in energy, i.e. there should not be a significant difference between them[17].

Hole Transport Layer . 3-3

The layer deposited on the ITO electrode must have high conductivity and low light absorption to allow light to pass through the active layer and transfer the gaps to the anode electrode quickly and efficiently. As a result, we employ the Permian coating method to produce a Nano-thin film and a P-type material. We measure the absorbance of the membrane using an optical spectrometer (UV-Vis) after deposition of the material on the anode electrode, and then we examine it with electron microscopy[18].

Active layer. 3-4

The active layer, which can be polymer-polymer, dye-polymer, or nanoparticle-polymer, is deposited using Spin coating to form a Nano-film that ensures photon absorption and The minimum distance an exaction must travel to reach the donor/acceptor interfaces. Following that, the absorption of the donor and acceptor materials is measured separately[19].

Because it is the component that absorbs photons and generates excitons, the donor material has a high absorbance and a broad spectrum. A UV-Vis spectrometer was used to measure the active layer mixture, (SEM) Optical electron microscopy was also used to examine the active layer[20].

Cathode Electrodes. . 3-5

The cathode layers of the solar cell were deposited, and these layers were composed of aluminum or calcium and silver, taking into account the high work function of these materials and evaporation on the previously described layers by vacuum thermal evaporation. This procedure takes place inside a vacuum chamber in a closed cavity. The metal that would become the coating was laid out above the bore on a known specific base. Mineral globules dissolve and evaporate. particles that have evaporated .The material is superimposed on the substrate, resulting in the formation of a coating. The thickness of the coating is determined by the distance of the substrate from cavity (evaporation source) and the time of electrophorese Using shadow masks, the overlay can be done on specific parts of the substrate. This mask only covers the area[21].

Organic solar cell coefficients calculation. 4-

Using a 1000-watt solar light system, the solar cell constants were calculated by measuring the current versus voltage (JV) density under lighting conditions and obtaining the PV current and power, short circuit current (JSC), open circuit voltage (VOC), and efficiency Energy conversion (PCE.) multiplied by the fill factor (FF). Figure 2 depicts the J-V curve obtained for a photovoltaic device designed using the parameters described in this manuscript. [17].

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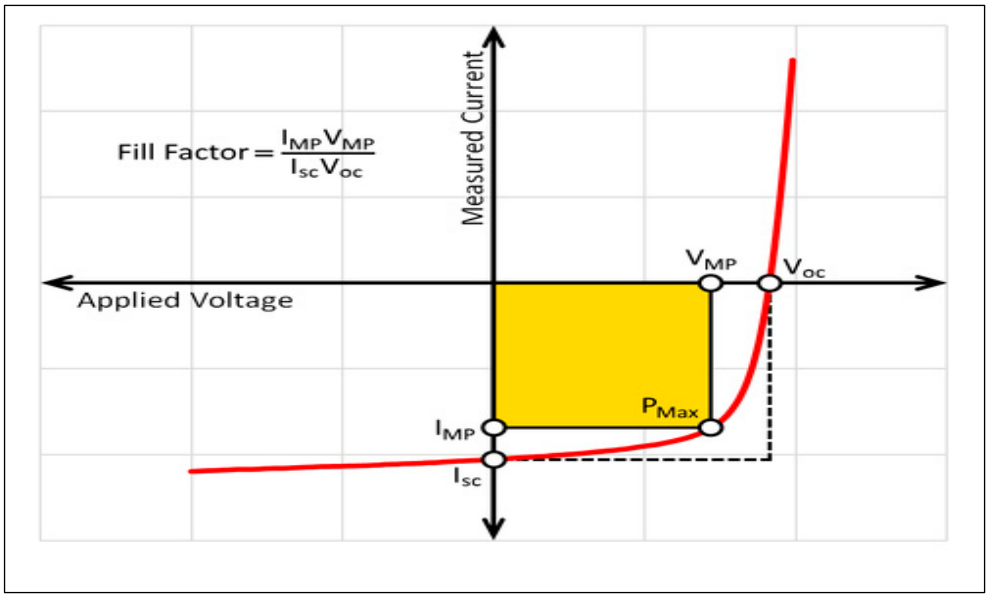

Figure 2 :J-V curve obtained for a photovoltaic device[17]

CONCLUSIONS 5-

The current study covers the fundamentals as well as manufacturing techniques

The solar cell also provides a useful description of device photo electricity, as well as several fundamental techniques for photoelectric device characterization

Each step has been previously described, as well as its significance and physical meaning.Each material's role and selection criteria were investigated. As a result, it serves as a basic guide for teaching undergraduate students about manufacturing processes and characterization. The students not only gained knowledge of the solar device manufacturing process, but they also received, it Learn the basic laboratory methods that will be used during this process. They also have a better understanding of the fundamentals of organic photovoltaic cell operation

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