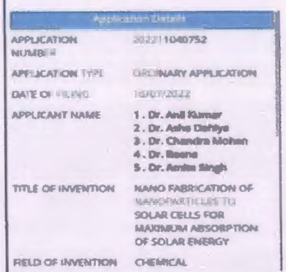
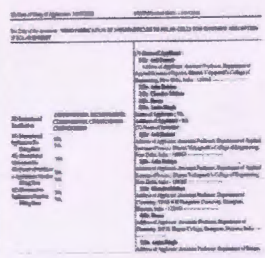
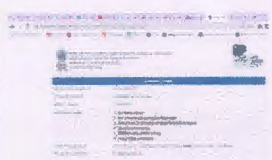
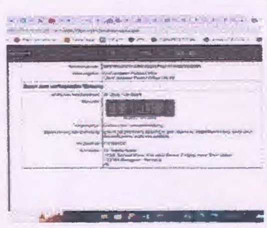
QLM 3.2.

PATENT FILE AND PUBLISHED

3.2.1Number of Patents published/awarded during the last five years (4)						
Name of the Patent published/awarded	**Patent Number**	**Year of Award**	**Faculty Name**	**Nature of Patent**	**Proof**	
Nano fabrication of nanoparticles to solar cells for maximum absorption of solar energy.	2022110407 52 A	2022	Dr.Amita Singh	National		Published
Nano fabrication of nanoparticles to solar cells for maximum absorption of solar energy.	2022110407 52 A	2022	Dr. Reena Singh	National		Published
Motion in the Generalized Restricted Three-Body Defined Problem	2.02211E+11	2022	Dr. Geeta Arora	National		Filled
A Robot System For Weed and Spraying	2022053113 071700DE	2022	Dr. Geeta Arora	Internat ional		Filled

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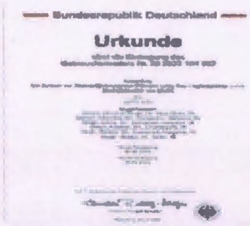
A novel IoT based sustainanle medical waste treatment system	2020221044 68	2022	Dr. Reena	Internat ional		Published
A system for nitrogen fixation of plants under moisture stress by foliar application of KNO3	2020221048 22	2022	Dr.Amita Singh	Internat ional		Published

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(57) Abstract :

Solar Energy is an eco-friendly source of energy that can easily be harnessed. ZnO-based solar cells were produced. There were several methods available for the synthesis of ZnO the co-precipitation method, sol-gel method, and gas-phase reaction method. ZnO was synthesized using the co-precipitation method. It is important to mention here that ZnO particles deposited on the ITO slides were produced using $ZnCl_2$ and NaOH in the presence of De-Ionized Water. XRD and SEM of ZnO particles were obtained, and it is noted that the ZnO sample produced in the lab was in good condition. XRD and SEM of thin films were also obtained and analyzed. With the help of these results, we could learn about the structure of ZnO and the phase purity of the thin film. Similarly, the crystalline size of nanoparticles of ZnO was also calculated by applying the Debye Scherrer Formula to the results of the XRD of thin films. In the end, IV characteristics of the thin films were obtained with the help of a simulator in the presence of light and dark regions.

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NANO FABRICATION OF NANOPARTICLES TO SOLAR CELLS FOR MAXIMUM ABSORPTION OF SOLAR ENERGY

ABSTRACT

Solar Energy is an eco-friendly source of energy that can easily be harnessed. ZnO-based solar cells were produced. There were several methods available for the synthesis of ZnO the co-precipitation method, sol-gel method, and gas-phase reaction method. ZnO was synthesized using the co-precipitation method. It is important to mention here that ZnO particles deposited on the ITO slides were produced using $ZnCl_2$ and NaOH in the presence of De-Ionized Water. XRD and SEM of ZnO particles were obtained, and it is noted that the ZnO sample produced in the lab was in good condition. XRD and SEM of thin films were also obtained and analyzed. With the help of these results, we could learn about the structure of ZnO and the phase purity of the thin film. Similarly, the crystalline size of nanoparticles of ZnO was also calculated by applying the Debye Scherrer Formula to the results of the XRD of thin films. In the end, IV characteristics of the thin films were obtained with the help of a simulator in the presence of light and dark regions.

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CLAIMS

1. Solar cells convert the sun's rays directly on earth into electricity without polluting the environment. Solar power is renewable and, therefore, can be called a "green source" or "eco-friendly."
2. In photovoltaics system design, the amount of radiation falling on solar cells plays a vital role. Therefore, measuring the number of radiations available in a specific area at a particular time is essential.
3. Solar cell works in response to the potential difference created by exposure to visible radiations. Solar cells are made up of semiconductor materials-based layers.
4. Diffusion method process is widely used for producing solar cells. These cells are dominant commercially and use Si with a wide absorption range and higher conversion efficiency.
5. Zinc oxide has been used by me as a semiconductor material for the fabrication of the solar cell along with other materials. It is an inorganic material, and it can be found in the form of white powder.
6. Scanning Electron Microscopy is an electron microscope that uses a beam of electrons to produce an image sample. The sample's surface and composition can easily be found by using this technique.
7. Solar Energy is an eco-friendly source of energy that can easily be harnessed. ZnO-based solar cells were produced. There were a number of methods available for the synthesis of ZnO like the co-precipitation method.

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BRIEF DESCRIPTION OF THE DRAWINGS

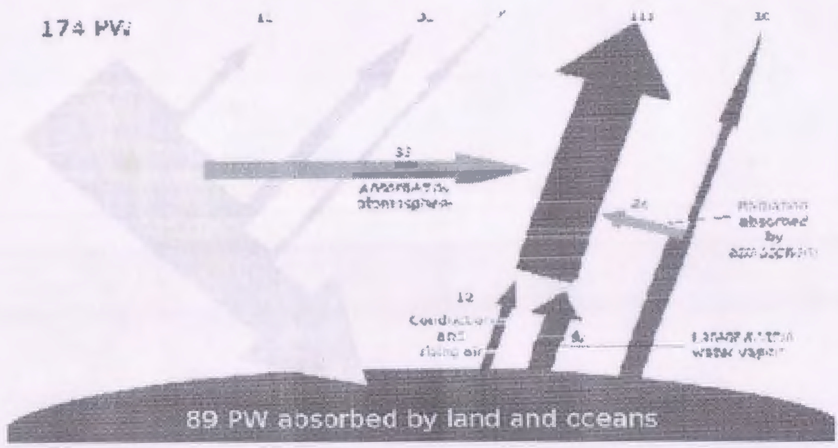

Figure 1: Depicts the Solar Radiation reaching the earth's surface.

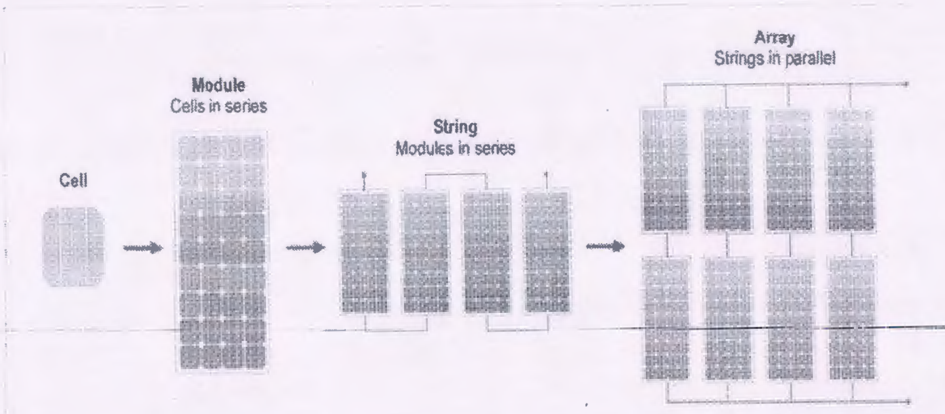

Figure 2: Depicts the Solar Cell to Solar Array.

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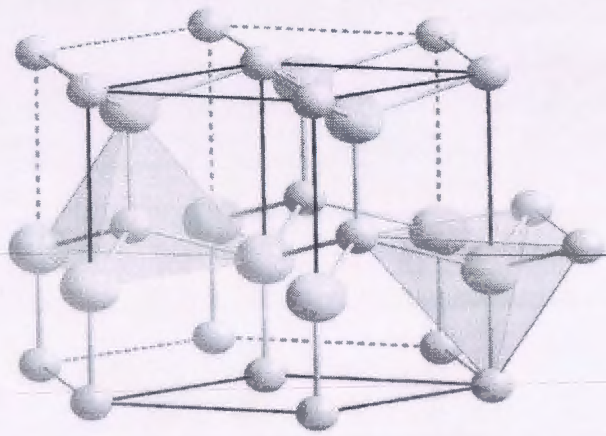

Figure 3: Depicts the Hexagonal Structure (Hexagonal WurtziteZnO).

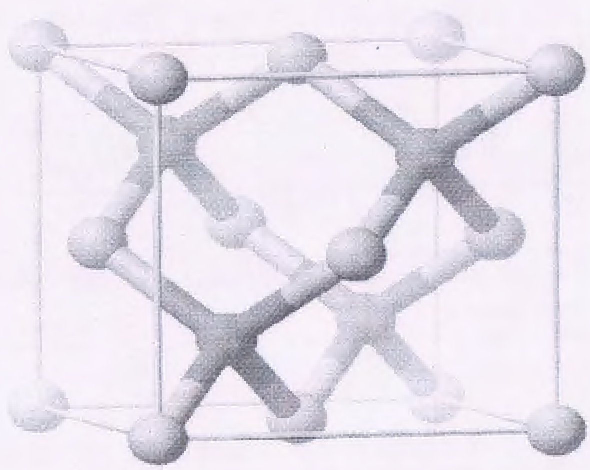

Figure 4: Depicts the Zinc Blend Structure.

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BRIEF DESCRIPTION OF THE INVENTION

Sunlight-based vitality in some frames is the wellspring of almost all types of energy on earth. All life on earth depends on the sun to fulfill its requirements like food and warmth in one form or another. Biomass, wind, and even hydroelectricity are derived from the sun. Solar energy can be harnessed easily by photovoltaics. Photovoltaics is a straightforward and rich strategy for trapping the sunlight. Solar cells convert the sun's rays following directly on earth into electricity without polluting the environment. Solar power is renewable and therefore can be called a "green source" or "eco-friendly." Photovoltaics were initially exclusively utilized as a major power source for various applications ranging from small-sized applications like a calculator battery to medium-sized applications like small homes power by a rooftop arrangement providing an off-grid solution.

Currently, the world's largest photovoltaic power station is established at Longyangxia Dam Solar Park in China, providing about 850 MW of power to the grid. The government of Pakistan is also promoting solar-based applications for off-grid and on-grid arrangements. The largest solar 1000 MW is located in Quaid-e-Azam Solar Park in the District of Bahawalpur. As per the latest reports, the said solar power plant contributes approximately 100 MW to the national grid. The total contribution of solar power in the national grid of Pakistan during the FY 2017-18 is noted as 400 MW. Sun produces a constant amount of energy. The intensity of solar radiation at the sun's surface is about 6.33 X 107 W/m2. It is a known fact that as soon as these radiations spread out from the sun's surface, their intensity becomes less intense and when these rays reach the Earth's edge, they become parallel. Sun rays falling on the earth are mostly absorbed or scattered by the atmosphere. It is important to mention here that roughly half of the radiations were lost in outer space due to the problem of scattering, and the remaining half of these radiations are directed towards the earth from all directions as diffuse radiations. It may be noted that the shortest wavelength of radiation that reaches the earth is about0.29 μm.

It is important to mention that earth receives about 174,000 terawatts (TW) of solar rays from the sun. There is a commonly used term "albedo of the earth earth-atmosphere which defines the fraction of radiations reflected in space due to clouds, scattering, and reflection from the earth's surface and is approximately 0.3 for the earth as a whole. It is a well-proven fact that about half of the world lives in areas where insolation levels are 150-300 W/m2. That translates into 3.5-7.0 kWh/m2 per day. Eart atmosphere, oceans, and land masses absorb approximately 3,850,000 exajoules (EJ) of solar energy per year. Three types of radiation fall on the earth, i.e., Direct Radiation, Diffused Radiation, and Reflected Radiation. Direct radiations come straight from the sun's surface and hit the earth's plans. These types of radiation are very directional. Fig.1 represents the solar radiation reaching the earth's surface.

Diffused radiations are scattered in the atmosphere; luckily, some of these scattered radiations managed to reach the plane of the earth. Reflected radiations are beams and diffused radiations that hit the earth and then reflect onto the plane. In photovoltaics system design, the amount of radiation falling on solar cells plays a vital role. Therefore it is essential to measure the number of radiation available in a specific area at a particular time.

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The two commonly adopted methods for calculating solar radiations falling on the earth's surface are Pyranometer and Reference Cell.

Pyranometer

A Pyranometer is a sort of actinometer utilized for measuring radiations on a planar surface and is intended to gauge the radiations flux density. It may be noted that radiation flux density is measured on W/m2. The wavelength of the spectrum of solar radiations falling on earth may vary from 300 nm to 2800 nm. Pyranometers can be classified into three categories depending on the type of technology.

1. Thermopile Pyranometer
2. Photodiode Pyranometer
3. Photovoltaic Pyranometer

Thermopile Pyranometer:

It is a sensor-based on thermopile; it is intended to quantify the broadband of sun-based radiation flux density from an 1800 field of view edge. It may measure a wide spectrum ranging from 300 nm to 2800 nm. They are usually mounted beside solar panels with a sensor surface on the plane of the panel. They are commonly used in climate change research, PV system, etc.

Photodiode Pyranometer:

It can detect the solar spectrum between 400 nm to 900 nm. It converts the said spectrum at high speed. It comprises the photodiode and a diffuser mounted in a housing dome. The current being generated by the device is directly related to irradiance. It has an output circuit that generates a voltage proportional to the current.

Photovoltaic Pyranometer:

It is the modified form of a photodiode-based Pyranometer. It is a photovoltaic cell working in short circuit conditions. It measures in the range of 350 nm to 1150 nm. They are commonly used in solar simulators.

Reference Solar Cell

It is installed alongside the existing PV system for calculating PV measurements. It is composed of the same type of material as a solar panel. The basic unit of a solar array is a solar cell. Solar cells combine to form a solar module. Solar modules combine to form a solar panel; several solar panels are collectively called a solar array. Solar cells work in response to potential differences created by exposure to visible radiations. Solar cells are made up of semiconductor materials-based layers. Semiconductors act as a conductor at high temperatures as electrons break their covalent bonds and are free to move. The minimum amount of energy required by an electron to break the bond and to participate in conduction is known as a bandgap. When an electron breaks this bond and moves to the conduction band, it leaves behind a space allowing a covalent bond to move from one electron

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to another. Fig.2 shows the solar cell to the solar array. This left space is similar to an electron but with a positive charge. The operation of solar cells is mainly dependent upon the following parameters:

Bandgap

The "generation" and recombination of electrons and holes, When the n-type material is attached to a p-type material, a PN junction is formed. Electrons are the majority carriers in the n-type region, while holes are abundant in the p-type region of a PN junction. A depletion region is formed by the movement of free carriers across the junction. The electrons flow through the circuit when the junction is connected to an external load. Each solar cell generates about 1-2 watts of electricity. To increase power output, cells are connected to a package from a module and then arranged in parallel or series from an array or string.

Solar Cell Parameters:

Following solar cells, parameters are kept in mind while analyzing the IV characteristics of a solar cell.

Short Circuit Current (Isc):

It is an important parameter of the solar cell. It is the amount of current generated when the applied voltage across the cell is zero. It depends on several factors that are listed below:

Area of a solar cell

Incident light spectrum

Absorption and reflection properties of solar cell

Density

Number of Photons

Fill Factor:

In addition to open-circuit voltage and short circuit current, the fill factor also determines the maximum amount of power from a solar cell. Mathematically it is a ratio of Voc and Inc. In actual practices, the fill factor is lower due to losses that were called parasitic resistive losses.

Solar cells can be characterized into the following generations. Silicon and germanium-based solar cells doped with phosphorous and boron consists of single layer PN junction and are known as first-generation solar cells. These cells are capable of generating energy for different wavelengths. The diffusion method process is widely used for the production of these cells. These cells dominate at a commercial ccommerciallycommercially ashas a wide absorption range and higher conversion efficiency. The only disadvantage of these cells is the processing method that requires sophisticated techniques. An ingot growing of a block of steel is a very energetic process. These cells can either be mono-crystalline or multi-crystalline. Second-generation cells are thin film solar cells. Examples of second-generation solar cells are amorphous silicon cells formed from top metal contact to bottom as a glass substrate, transparent contact, P-layer, intrinsic layer and finally N- layer. Polycrystalline silicon solar cells have anti-reflection layers to capture the light waves having wavelengths several times greater than the thickness of the cell wand these cells are mainly composed of grain that is of 1 mm and is separated by boundaries. Copper Indium Diselenide (CIS) cells absorb almost 99% of the light before it reaches 1 micrometer of the cell. They can be homojunction as well as heterojunction but it is noted that hetero junction cell made up of CIS along with cadmium sulfide (CdS) are found to be more stable. It is also noted that thin film solar cells have efficiency in the range of 12-20% while for prototypes this efficiency is decreased to the 7-13%.

Nowadays, the inorganic cells are very popular and it is important to mention here that these cells have high costs the main key factor for this high cost is because high demand for energy for the purification of silicon dioxide and silicon from sand. Third-generation solar cells have the advantage to overcome the Shockey – Queisser limit of 31-41% efficiency for solar cells based in a single bandgap while Graetzel Cells or Dye-sensitized solar cells have the efficiency of about 11%. Nanocrystal substrates are used for the formation of nanocrystal solar cells. Spin coating is commonly used for coating thin films on the anon substrate. Other techniques that were being used for the same purpose are dip coating and doctor blading etc. Fourth-generation solar cells are flexible solar cells composed of polymers and larger molecules whose structure is repeating. Their bandgap is less than or equal to 2eV and has a conversion efficiency of about 5%. Plastic solar cells are also a type of polymer solar cell. They comprise a layer that is either electron or hole blocking and that layer is placed over the layer of ITO conductive glass and that is followed by the electron donor or electron acceptor. It is important to mention here that fourth-generation solar cells are basically organic-inorganic cells.

In recent years, due to rising concerns about the environment and shortage of petroleum, photovoltaic technology has become one of the most chased renewable technology. In the current era, silicon-based crystalline solar cells rule the PV market because of their non-toxic and abundant nature. It is important to mention here that silicon-based PV cells have already achieved their peak efficiency in conversion, and it is difficult to improve much more. Cu2O can be used as a material for terrestrial applications based on solar cells. Researchers are made solar cells using Cu2O as the top cell in cascade cell structure. He noted that starting materials have high resistances. However, the solution has been developed by preparing Cu2O by thermal oxidation. The poor performance of electrodeposited Cu2O cells remains. Copper oxide is also another widely studied and used semiconductor material in photovoltaic applications due to its abundance in nature and its explicit optical properties. It may be noted that using these materials can tune optical and insulating properties from insulating to conduction.

Different oxides can be used to fabricate an n-type layer of suitable bandgap on nanomaterials. The major advantage of depositing oxides over nanomaterials is that oxides do not react with nanomaterials. Cadmium oxide (CdO), Zinc Oxide (ZnO), Indium Oxide (In2O3), and many others can be used for this purpose. One way to improve the solar cell's efficiency is using heterojunction solar cells instead of homojunction solar cells. The lower efficiencies of Cu2O and Cu solar cells are mainly due to potential barriers, and the same can be improved using a heterojunction cell structure. ZnO can also be used as a semiconductor material for solar cells, exhibiting both semiconducting and piezoelectric properties. Several researchers have researched using ZnO as a semiconductor material in solar cells and tried to improve the conversion efficiency.

MATERIALS

Zinc Oxide (ZnO)

I have used zinc oxide as a semiconductor material for fabricating the solar cell, along with other materials. It is an inorganic material, and it can be found in the form of white powder that the reaction of different chemical materials can extract. It is a semiconductor that lies in the II-VI semiconductor group. It is known because of its properties like good transparency, wider bandgap, etc. This kind of property made it a good option to be used for the fabrication of PV devices.

Structure:

Naturally, it occurs rarely in the form of Zincite. In addition to powder form, it also occurs in crystalline form in the form of nanoparticles. In crystalline shape, it occurs either as Hexagonal Wurtzite or as a cubic zinc blend. While comparing these two available crystalline shapes of ZnO, the former one is a more stable form under ordinary conditions, i.e., room temperature. It is important to note that ZnO will be converted to a rock salt motif at relatively higher pressures in the 10 GPa. Both of the crystalline forms have no reflection symmetry. It is important to note that the piezoelectricity of both crystalline polymorphs and pyroelectricity of hexagonal structure is mainly due to this and other symmetry. It is worth mentioning here that the hexagonal structure of ZnO has a 6 mm point group. These structures are shown in Fig.7 and Fig.8.

Band gap Structure:

The bandgap of a semiconductor is an important parameter for material selection. It is the difference between the valence band and the material's conduction band. It may be noted that it is dependent on the temperature. As the temperature of the material increases, it decreases. Therefore, it is suggested that materials with higher band gap energy may be used for higher temperature operations. Zinc Oxide (ZnO) is an example of a material having a wider bandgap having a direct band gap of approximately 3.3 eV at normal temperature. The wider band gap of ZnO makes it suitable for tolerating larger electric fields and allowing higher breakdowns.

Mechanical Properties:

The hardness of ZnO is about 4.5 mohs, making it a relatively softer material. Among the semiconductor materials that have been tetrahedrally bonded, it is noted that either ZnO has the highest piezoelectric effect or is at least comparable with other semiconductor materials of the same nature like GaN, AlN. ZnO has a life as high as 133 ps at 10 K.

Optical Properties:

Nano-particles of zinc oxide are transparent to the visible spectrum of solar radiations. When the ultraviolet spectrum of light falls on the ZnO material, it absorbs almost all of the UV light and acts as a transparent medium allowing visible light to pass through it.

Electrical properties:

ZnO can be used as n-type material for PV devices. It may be noted that it can be doped with group III elements of the periodic table or replaced with group VII elements for controllable n-type doping. For ZnO, P-type doping is challenging. The main problem is because of p-type dopants' low solubility, and it is important to mention here that they have n-type impurities. The maximum achievable electron mobility of ZnO is 2000 cm2/ (V.S) at a temperature of about 80K and varies as the temperature of the environment varies.

Synthesis of Zinc Oxide (ZnO):

As mentioned earlier, ZnO is not available naturally as a white powder. Rather, it can be prepared by the chemical reaction of different materials. Several methods are available for synthesizing the ZnO co-precipitation method, sol-gel me, thou, and gas-phase reaction method. It may be noted that I have used the co-precipitation method for the synthesis of ZnO by keeping in view the controllable factors that affect the synthesis. These factors are PH value, reaction duration, temperature, and precursors. ZnO is prepared by the reaction of 1M ZnCl2and 1M NaOH in the presence of di-ionized water. Several samples have been prepared by varying the amounts of ZnCl2 and NaOH. It may be noted that for the preparation of 1M ZnCl2, about 0.136 g/ml is used, and for 1M NaOH solution, the amount of NaOH used is calculated to be 0.04 g/mol.

Dye: During the fabrication of dye-based solar cells, immersion of a thin-film slide in the dye is one of the important steps as it increases conversion efficiency.

Electrolyte:

Another step is the incorporation of electrolytes in thin-film solar cells to fill the gaps between the nanoparticles deposited on the active and counter electrodes.

ITO:

Indium tin oxide or Fluorine tin oxide may be used as conductive glass slide to complete the circuit as well as to collect the charges. It is basically a low resistive glass slide that can be used for charge collection. It may also be called as a Transparent Conducting Oxide (TCO).

Thin Film Formation:

Following steps have been performed while preparing thin film formation. The detailed description of each step is mentioned below.

Cleaning of ITO:

ITO is the glass slides on which we have to deposit the active material. As it is very sensitive process therefore it is required to clean the ITO slides so that there may be no impurity that later on affects the efficiency of the device. Following steps have been performed for cleaning of slides.

Cleaning with Detergent:

Glass slides of desired dimensions were cut and were cleaned with detergent. The detergent removes the slides' stains, fingerprints, and dust particles left while handling the slides. After cleaning with detergent the slides were sonicated for approximately 10 minutes.

Cleaning with Tap Water:

After the cleaning of ITO pieces with detergent, these pieces were cleaned under tap water and afterwards these pieces were again sonicated for another 10 minutes.

Cleaning with Acetone:

Organic compounds that were present on the slides were removed by the Acetone, which is a volatile chemical.

Cleaning with IPA:

After performing this series of cleaning processes of ITO slides, finally, these slides were immersed in IPA (Isopropyl Alcohol) for almost 12 hours. This removes all the remaining impurities. Now, these slides were dried at room temperature.

Dense Layer and porous Film Formation:

The dense layer, called the compact layer, was formed using MeOH. For ZnO, the nanoparticles obtained after drying the solution from the centrifuge were suspended in vinegar at a concentration of 0.1mg/ 2ml. Now that material was pasted onto the low resistive ITO slide via the balding doctor method; the same ITO slide was kept in the furnace to a high temperature of about 450 OC. In later stages, the slides were masked from the sides for attaching with a back electrode. Afterward, these slides were cooled at temperature, which may take 16-24 hours.

Dye Incorporation:

These ITO slides were incubated in the dye for almost 24-48 hours because by immersing in the dye, the porous gaps between the active materials that were being deposited on the slides were filled. The dye being used for the incubation of thin-film slides was Methylene Blue.

Formation of Back Electrode:

Now, it is time to prepare the back electrode, the cathode. It is important to mention here that the cathode may be carbon-coated so that it may collect electrons emitted from dye-incorporated ZnO nonporous film. The back electrode may be coated with carbon using graphite, a lead pencil, or by the flame of a candle. I coated the back electrode by using the flame of the candle. It is pertinent to mention that carbon coating was done on the conductive side of the ITO slide, and that side was checked using a multimeter.

Electrolyte Injection and Joining of Electrodes:

Both the electrodes, one with active ZnO material with dye and the other with carbon-coated, were joined tightly with the help of paper clips. Before testing IV characteristics, one or two drops of the electrolyte were also injected between the two electrodes.

Characterization Methods:

Different characterization techniques were used, including X-ray diffraction, Scanning Electron Microscopy, and IV Characteristics, to characterize ZnO-based dye-sensitized solar cells.

X-Ray Diffraction (XRD):

X-ray diffraction is the characterization technique. It is, in actuality, an analytical technique being used for phase identification. It also helps in guessing cell dimensions. The cathode ray tube is the major source of these X-ray radiations, which are then filtered to produce monochromatic rays. X-rays hit the sample, and constructive interference is produced, satisfying the below-mentioned condition of "Braggs Law." Using this technique, we can find atoms' size, structure, and thickness in the test compound.

Scanning Electron Microscopy (SEM):

An electron microscope uses a beam of electrons to produce an image sample. The sample's surface and composition can easily be found by using this technique. A resolution better than 1 nm can be obtained by SEM. An electron beam falls on the sample under study and produces a 3D magnified image. It tells about the surface morphology. Two signals originate from SEM, i.e., secondary and backscattered electrons. It uses a narrow electron beam; therefore, micrographs obtained have a large field depth. In standard equipment, an electron beam is emitted from a gun fitted in a cathode. Because of its properties, like a higher melting point, the cathode is made of the tungsten filament. The energy range of the beam may vary from 0.2 keV to 40 keV. The optic used for focusing can be large and coarse. While SE detectors are of quite a small size, i.e., size of the fist and simple detects current. The obtained resolution depends upon instrument and it can be in the range between less than 1 nm and 20 nm.

The testing of solar cell in order to find out its conversion efficiency is basically known as IV characterization of the solar cell. The IV characterization can be done either in outdoor conditions in which solar cell is exposed to sunlight and solar radiations directly fall on the subject solar cell and we measure the reading by the use of multimeter or in indoor conditions in which sample solar cell is exposed to the sun simulator and accordingly readings of the current and voltage are measured. Outdoor measurement method tells us the actual efficiency of the solar cell.

XRD of ZnO Particles:

The result obtained shows that our ZnO particles were 100% phase pure. All the indexed peaks obtained in the XRD of the sample were exactly the same as of reference card peaks and were matched accordingly this also shows that our sample is phase pure.

Bundesrepublik Deutschland

Urkunde

über die Eintragung des
Gebrauchsmusters Nr. 20 2022 104 468

Bezeichnung:
Ein neuartiges IoT-basiertes nachhaltiges System zur Behandlung von medizinischen Abfällen

IPC:
B09B 3/40

Inhaber/Inhaberin:
Barwa, Manjeet Singh, Dr., Delhi, IN
Barwa, Shubhra, Dr., Delhi, IN
Gaikwad, Arun Hari, Dr., Ghulewadi, Maharashtra, IN
Kumawat, Bhawesh, Dr., Udaipur, Rajasthan, IN
Mohan, Chandra, Dr., Gurugram, Haryana, IN
Negi, Vipul, Dehradun, Uttarakhand, IN
Panda, Ramesh Chandra, Prof., Bhubaneswar, Odisha, IN
Ravindran, Sharanya, Dr., Chennai, Tamil Nadu, IN
Saini, Garima, Delhi, IN
Saini, Rita, Dehradun, Uttarakhand, IN
Singh, Reena, Dr., Gurugram, Haryana, IN
Trivedi, Rohit Kumar, Dehradun, Uttarakhand, IN
Veerapandian, Akila, Dr., Chennai, Tamil Nadu, IN

Tag der Anmeldung:
05.08.2022

Tag der Eintragung:
19.08.2022

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Die Präsidentin des Deutschen Patent- und Markenamts

Cornelia Rudloff-Schäffer

Cornelia Rudloff-Schäffer

München, 19.08.2022

DEUTSCHES PATENT- UND MARKENAMT

Bundesrepublik Deutschland

Urkunde

über die Eintragung des
Gebrauchsmusters Nr. 20 2022 104 822

Bezeichnung:
Ein System zur Stickstofffixierung von Pflanzen unter Feuchtigkeitsstress durch Blattapplikation von KNO3

IPC:
A01C 1/00

Inhaber/Inhaberin:
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Tag der Anmeldung:
26.08.2022

Tag der Eintragung:
26.09.2022

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Cornelia Rudloff-Schäffer

DEUTSCHES PATENT- UND MARKENAMT

München, 26.09.2022

[redacted]

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Data for the present operation:

official file reference:	20 2022 104 822.3
Barcode:	20 2022 104 822.3
Type of operation:	Utility model application
Description of the invention:	A system for nitrogen fixation of plants under moisture stress by foliar application of KNO_3
Your mark:	G11764EN
Applicant:	Dr. Amita Singh MS-10/201, Kendriya Vihar, Sector- 56 122011 Gurugram, Haryana IN

Type here to search [redacted]

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