Exemplary Effect of Transition Metal and Rare Earth Alkaline Metal Mixtures Coated SIMPLE PV Cell after Solar Energy Irradiation

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Abstract
Based on the data prospects of solar energy, the possible ways of implementing the latest advanced PV technology is defined here. An empty PV cell can provide only limited amount of power. To increase the power, diverse transition metal Lanthanum nitrate and rare earth alkaline metal Strontium nitrate are coated on the PV cell. The power and efficiency of the PV cell has been compared before and after coating. The results demonstrate an excellent increase in power and efficiency after coating.
***Keywords**: PV cell, lanthanum nitrate, strontium nitrate, coating, solar energy*

Introduction

Solar energy is such a vast energy resource that it can be used for any of our everyday needs, including electrical power, heating and cooling, water heating, industrial process heat, cooking, transportation, fuel production and even environmental cleanup. It come to us as radiation which is pure energy (no mass associated with it), which is the highest form of energy and can be converted to many other forms for our everyday use. Nowadays, peoples' essential need is Energy. It makes sure an enhanced feature of life. Since daily utilize continuous energy has suit inevitability for human race nowadays.

Energy is one of the principal concerns all over the world. We seem for energy resources as its demand is rising piercingly. The world is heartrending towards renewable energy resources which areas you would expectre filled in a moderately little period of time. Since non-renewable energy resources are so pricey and destructive the atmosphere. In addition they are ultimately migration to end in near prospect.

However other forms of renewable energy source are not accessible to all places in the world whereas on the other hand solar has the prospective energy to take over the whole power generation [1], [2-3]. Since more than the centuries, sun is furnishing that energy in both forms as light and heat. These days, electricity has been produced by using solar energy with photovoltaic cells. It is an energy harvesting technology that converts solar energy into useful electricity through a process called photovoltaic effect. It is a specialized semiconductor diode that converts visible light into DC electricity. Large sets of PV cell can be connected together to form solar modules, arrays (or) panels.

The photons present in the solar light that hit the solar panel, so that weak bound electrons to move only in one direction that leads to create electron hole pairs in respective junctions and thus electricity is formed in external circuit.

For various applications such as in the surfaces of windows, front display panels of personal computers and cell phones, and human skin [4-6], transparent or semitransparent solar cells with excellent mechanical flexibility have attracted much attention as next-generation smart solar cells. However, in spite of modern evolution in the manufacture of solar cells [7-8], crucial concerns remain with regard to their realistic applications, such as improving their power conversion efficiency (PCE), optical transparency, flexibility, stability, and scalability. Since most of these issuesentail materials, the growth of new photovoltaic materials with high transparency and mechanical flexibility is essential. The recent development involves the material content of solar cells. University labs at Oxford, Stanford and elsewhere are experimenting with replacing crystalline silicon in photovoltaic solar cell with perovskite, a mineral with semiconductor properties. Researchers at these labs have quickly achieved cell efficiencies of 20-25% matching or exceeding those of silicon solar cells.

The solar electric plate is made from a sand ore called silicon. It converts the red and infrared rays of the sunlight into electricity. Power conversion efficiency of the PV cell can be increased by many methods [9-13]. In this research, we have to increase the power conversion efficiency of PV cell by the way of coating of transition metal and alkaline metal on silicon plate to electrify green and blue rays in solar panels.

In general the transition metal like lanthanum nitrate and rare earth alkaline metal like strontium nitrate has many superior properties like high dielectric constant, large band gap, good thermal stability, a very small lattice mismatch can induces negative charge at the emitter surface of n – type silicon solar cell.

This article reveals that the power is increased when a coating of transition metal and rare earth alkaline metal on the PV cell. The coating consists of transition metal like lanthanum nitrate and rare earth alkaline metal like strontium nitrate. By using different light sources such as sunlight, mercury vapour lamp and sodium vapour lamp, the coated PV cells have tested. The readings were taken at different days at different times. By correlating all the results what we have taken, it is determined that power was increased on the coated PV cell.

Synthesis and Characterisations

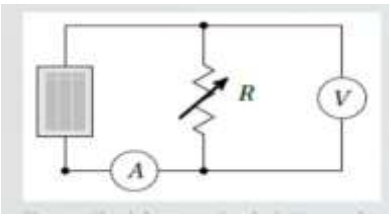
The photovoltaic cell made of, the solar cells can be classified into first, second and third generation cells. The first- generation cells also called conventional, traditional or wafer- based cells- are made of crystalline silicon, the commercially predominant photovoltaic technology. That includes materials such as poly silicon and mono crystalline silicon. Photovoltaic cells generate electricity by absorbing sunlight and using that light energy to create an electrical current. An empty PV cell can provide only limited amount of power. We have increased the power through this study by coating of PV cell with transition metal like lanthanum nitrate and alkaline earth metal like strontium nitrate and mixing of them. The stoichiometric ratio of the materials such as lanthanum nitrate and strontium nitrate were measured and grounded and mixed with dilute HCL. Both the lanthanum nitrate and strontium nitrate required for this study cannot be used intuitively, so the samples are grinded into thin particles. The grinded paste has coated with PV cell. The specimen PV0 denoted as PV cell, specimen PV1 denoted as 100% pure strontium nitrate coated with PV cell, specimen PV2 denoted as 100% pure lanthanum nitrate coated with PV cell, specimen PV3 denoted as 50% lanthanum nitrate plus

50% strontium nitrate with PV cell. Hence, we get four samples namely empty PV cell, PV1 (strontium nitrate: 0.9796613594, HCL:0.00002038), PV2 (lanthanum nitrate :0.994419382,HCL:0.000005580617184) and PV3 (lanthanum nitrate: 0.78070739, strontium nitrate: 0.210530405, HCL:0.0000087625523).

S. No	Name of the specimen	Descriptions
1.	PV0	Empty photovoltaic cell
2.	PV1	100% pure strontium nitrate coated PV cell
3.	Pv2	100%pure lanthanum nitrate coated PV cell
4.	PV3	50%lanthanum nitrate and 50%strontium nitrate mixed coated cell

Characterisations

All the coated samples have dried at sun light for five hours. After that they should take care of safety without any excessive dust. Various light sources like sunlight, mercury vapour lamp and sodium vapour lamp have felled on the specimen. The power of the specimen has been measured using circuit which is shown in the Fig (2.1)



The circuit is measuring the power of a photovoltaic panel, using power law.

P=V*I

V=I*R

P is denoted as power (watt)

V is denoted as volt

I is denoted as amps current

R is denoted as resistance

The voltmeter measures the potential difference across the load resistor; the ammeter measures the current running through the resistor. By using the above formula, the power of the specimen has calculated. Finally, the power of the PV cell has compared to the other three coated cells. (12)

Result and Discussion

Photovoltaic cell converts the solar energy into electric energy by photovoltaic effect. In this study, we have used four specimens namely, Empty photovoltaic cell(PV0), 100% pure Strontium nitrate coated photovoltaic cell (PV1),100% pure Lanthanum nitrate coated photovoltaic cell (PV2), 50%Strontium Nitrate and 50% Lanthanum Nitrate mixed coated photovoltaic cell (PV3). The power of the specimen have measured by using multimeter. Using various light sources such as mercury lamp, sodium lamp and sunlight we took readings and tabulated [Table 3.1].

Table 3.1 Specimen Vs Power Under Various Light Source

S. No	Name of the light source	Name of the specimen	Power (Watt)
1.	Mercury lamp	PV0	0.0046
		PV1	0.0052
		PV2	0.0059
		PV3	0.0066
2.	Sodium lamp	PV0	0.0107
		PV1	0.0119
		PV2	0.0141
		PV3	0.0164
3.	Sunlight	PV0	0.0378
		PV1	0.0401
		PV2	0.0408
		PV3	0.0416

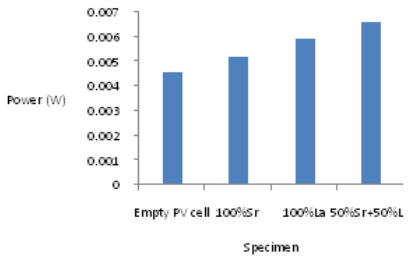
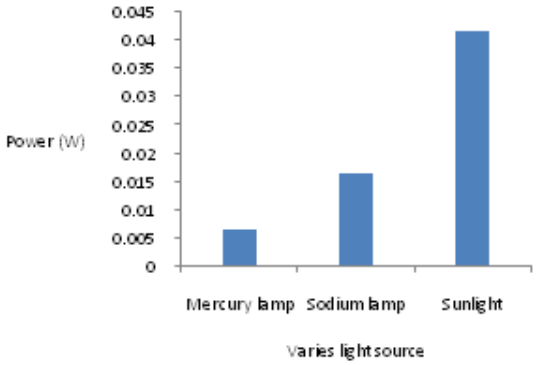


Figure 3.1 Specimen Vs Power under Mercury with Load 1KΩ



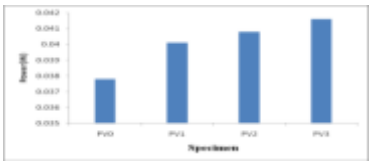


Figure 3.2 Specimen Vs Power Under Sodium Lamp with Load 1KΩ

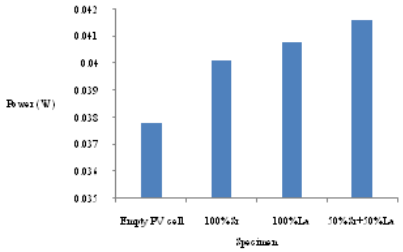


Figure 3.3 Specimen Vs Power under Sunlight with Load 1KΩ

The Specimen Vs Power under mercury lamp, sodium vapor lamp and sun light have shown in the figures 3.1, 3.2 and 3.3 respectively. All the figures shows that, there is an increase in power from PV0 to PV3. That is high amount of power enhanced in PV3 cell irrespective of light sources. PV3 cell made up of coating of PV cell mixed with 50%Lanthanum nitrate and 50%Strontium nitrate. Since lanthanum nitrate and strontium nitrate cause scattering of light. Scattering can redirect photon flux increasing the fraction of light absorbed in the thin active layer of silicon solar cells.

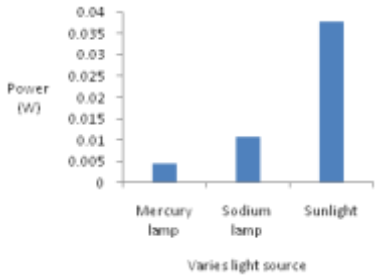


Figure 3.4 Power of PV Cell Vs Various Light Intensity with Load 1KΩ

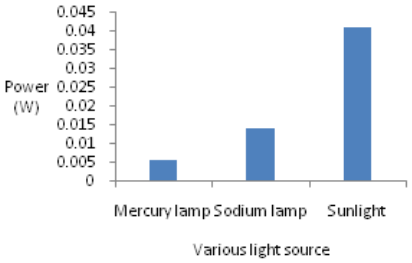


Figure 3.5 Power of PV Cell Coated with 100% Sr Vs Various Light Intensity with Load 1KΩ

Power of prepared samples with various light sources has shown in the figures 3.4 to 3.7. Here, we used various light sources such as mercury lamp, sodium lamp and sunlight. From the figures, we can conclude that, under sunlight we received more power than sodium lamp and mercury lamp. Because sunlight is a potion of the electromagnetic radiation given off by the sun, in particular ultraviolet (100nm-400nm), visible (400nm70nm) and infrared (750m-1mm).

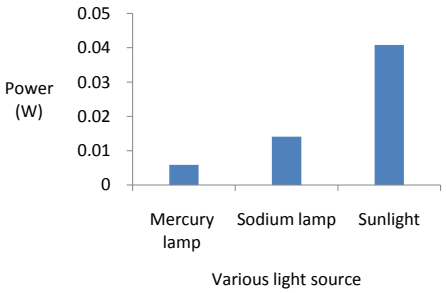


Figure 3.6 Power of PV Cell Coated with 100% La Vs Various Light Intensity with Load 1KΩ

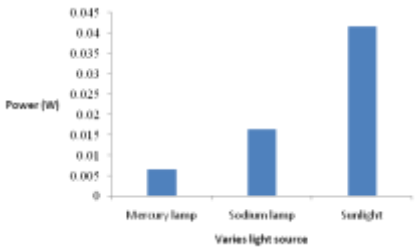


Figure 3.7 Power of PV cell coated with 50%Sr+50%La Vs various

And also we took more measurements for these specimens using sunlight for open circuit and results have tabulated [Table 3.2].

Table 3.2 Specimen Vs Power under sunlight at various date and time

S. No	Date	Time	Name of the specimen	Power
1.	01.02.2020	11.30am	PV 0	0.0022
	05.02.2020	12.30pm		0.0044
	09.02.2020	12.45pm		0.0042
	10.02.2020	12.15pm		0.0025
2.	01.02.2020	11.30am	PV 1	0.0024
	05.02.2020	12.30pm		0.0046
	09.02.2020	12.45pm		0.0043
	10.02.2020	12.15pm		0.0032
3.	01.02.2020	11.30am	PV 2	0.0026
	05.02.2020	12.30pm		0.0050
	09.02.2020	12.45pm		0.0044
	10.02.2020	12.15pm		0.0033
4.	01.02.2020	11.30am	PV 3	0.0032
	05.02.2020	12.30pm		0.0060
	09.02.2020	12.45pm		0.0046

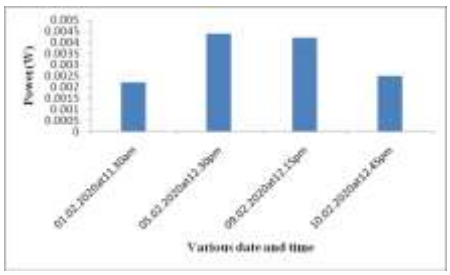


Figure 3.8 Power of PV Cell Vs Various Date and Time under Sunlight

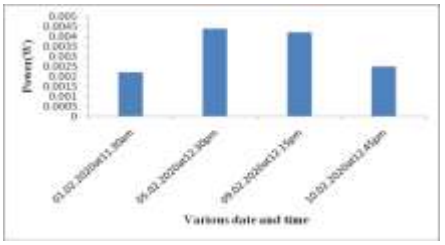


Figure 3.9 Power of PV Cell Coated with 100% Sr Vs Various Date and Time under Sunlight

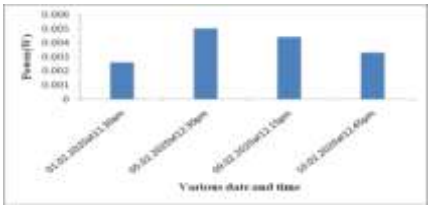


Figure 3.10 Power of PV Cell Coated with 100% La Vs various date and time under sunlight

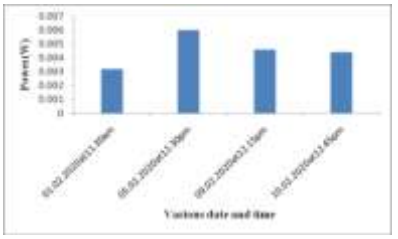


Figure 3.11 Power of PV Cell Coated with 50%Sr+50%La Vs Various Date and Time under Sunlight

Power of prepared specimens under sunlight for various date and time (open circuit) has shown in the figures from fig 3.8 to 3.11. From the figures, we can conclude that, we get more power for various date and time under sunlight for open circuit only at 12.30pm. Since the solar intensity varies with the angle of the sun above the horizon with longer sunlight duration at high latitude at 12.30PM.

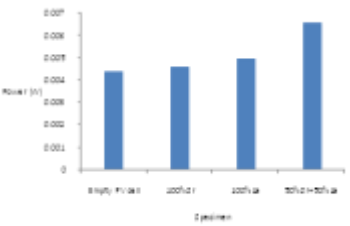


Figure 3.12 Power of PV Cell Coated with 50%Sr+50%La Vs Various

Date and Time under Sunlight

Power of prepared specimens under sunlight for various date and time (open circuit) has shown in the figures from fig 3.8 to 3.11. From the figures, we can conclude that, we get more power for various date and time under sunlight for open circuit only at 12.30pm. Since the solar intensity varies with the angle of the sun above the horizon with longer sunlight duration at high latitude at 12.30PM

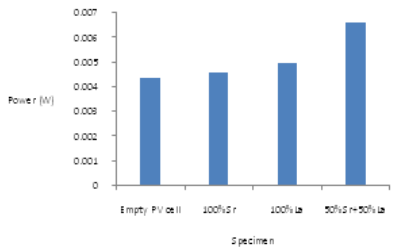


Figure 3.13 Specimen Vs Over Under Sunlight at 12.30pm

Specimen Vs Power under sunlight at 12.30PM is shown in the figure 3.12. From the figure, we get more power in 50%Strontium nitrate and 50%Lanthanum nitrate mixed coated PV cell (PV3) rather than other specimens. Since Lanthanum coated PV cell (PV3) rather than other specimens. Since Lanthanum nitrate and Strontium nitrate cause scattering of light. Scattering can redirect photon flux increasing the fraction of light absorbed in the thin active layer of silicon solar cells.

Conclusion

Lanthanum nitrate and strontium nitrate clearly had a beneficial effect on photovoltaic cell output; at the same time, though, a few additional experiments need to be conducted for longer success. Using various light sources such as sunlight, sodium lamp and mercury lamp, the power of the specimen has measured by using multimeter. We have used four specimens namely, empty PV cell (PV0), 100% Strontium nitrate coated PV cell (PV1), 100% Lanthanum Nitrate coated PV cell (PV2) & 50% Strontium nitrate and 50% Lanthanum Nitrate mixed coated PV cell(PV3). High amount of power enhanced in PV3 cell irrespective of light source. Since lanthanum nitrate and strontium nitrate cause scattering of light. Also, under sunlight more power is received than sodium lamp and mercury lamp. Further we received more power for various date under sunlight only at 12.30pm irrespective of specimens.

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