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Introduction to Hot Solar Cell

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ABSTRACT

The basic principle is simple,instead of dissipating unstable solar energy as heat in the solar cell, all of the energy and heat is first absorbed by an intermediate component,to temperatures that would allow that component to emit thermal radiation. Hot solar cell converts the heat inside the crystal into wavelength of that a solar cell can process. Efficient & can run for more hours a day & can produce some electricity even after the sun goes down.

1. INTRODUCTION

A team of MIT scientists has built a different sort of solar energy device that uses inventive engineering and advances in materials science to capture far more of the sun's energy. The trick is to first turn sunlight into heat and then convert it back into light, but now focused within the spectrum that solar cells can use. While various researchers have been working for years on so-called solar thermophotovoltaics , the MIT device is the first one to absorb more energy than its photovoltaic cell alone, demonstrating that the approach could dramatically increase efficiency.

2. HISTORY

2.1. The photovoltaic effect was experimentally demonstrated first by French physicist "EDMOND BECQUEREL", in 1839 at age of 19.

Fig 2.1

2.2. "WILLOUGHBY SMITH" first descrided the "effect of light on selenium during the passage of an electric current on 20 feb 1873.

Fig 2.2

2.3. 1883 "CHARLES FRITTS" builts the first solid state photoelectric effect discovered by "HENRICH HERTZ" in 1887

Fig 2.3

2.4. In 1905 “ALBERT EINSTEIN” proposed a new quantum theory of light and explained the photoelectric effect on landmark paper,he was awarded by nobel prize in physics in 1921

Fig 3.4

2.5. Now recently in 2017 the Massachusetts Institute of Technology implemented [MIT] “Hot Solar Cell”.

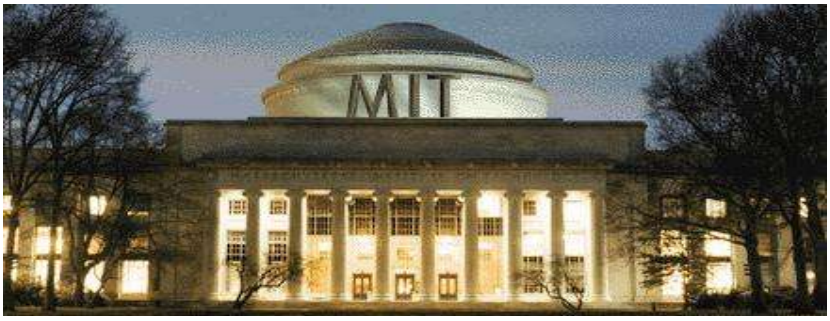

Fig 3.5

3. MATERIALS

4.1. Silicon has special chemical property, it has an atom of silicon has 14 electrons that are arranged in 3 different shell. First two shells have 2 and 8 electrons respectively which is completed. Outer shell has 4 electrons therefore it look for nearly 4 atoms. It takes hand for 4 silicon atom. Each atom has four hands joined that’s form an crystalline structure which is important for PV cell.

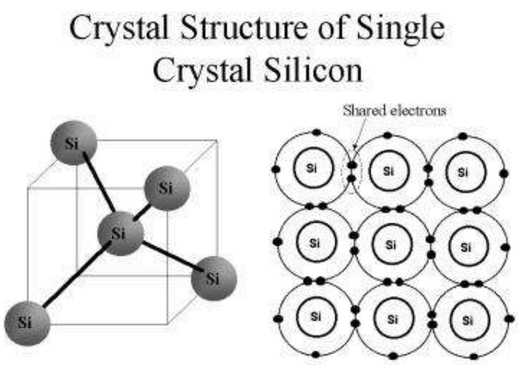

Fig 4.1

4.2. The additional component,an advanced filter,lets through all the desired wavelengths of light to the PV cell,while reflecting back any unwanted wavelengths.

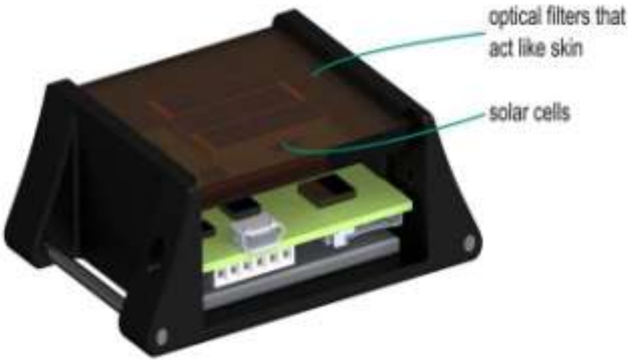

Fig 4.2

4.3. Mirrors or lenses that focus the sunlight,to maintain the high temperature.

Fig 4.3

4.4. Carbon nanotubes are virtually perfect absorber over the entire color spectrum. Once heated, the nanophotonic crystals continue to emit a narrow band of wavelengths of light .

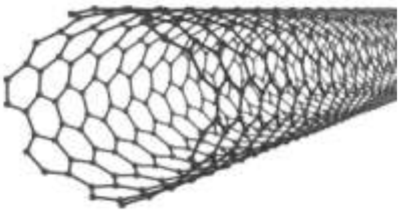

Fig 4.4

5. WORKING

In operation, this approach would use a conventional solar-concentrating system, with lenses or mirrors that focus the sunlight, to maintain the high temperature. An additional component, an advanced optical filter, lets through all the desired wavelengths of light to the PV cell, while reflecting back any unwanted wavelengths, since even this advanced material is not perfect in limiting its emissions. The reflected wavelengths then get re-absorbed, helping to maintain the heat of the photonic crystal. The trick is to first turn sunlight into heat and then convert it back into light, but now focused within the spectrum that solar cells can use.

Instead of dissipating unusable solar energy as heat in the solar cell, it is first absorbed by an intermediate component.This improves the efficiency and reduces the heat generated in the solar cell. The key is using high-tech materials called nanophotonic crystalsOnce heated, the nanophotonic crystals continue to emit a narrow band of wavelengths of light All of the energy of the photons gets converted to heat. Then, that heat gets re-emitted as light but, thanks to the nanophotonic structure, is converted to just the colors that match the PV cell's peak efficiency.

A solar cell, or photovoltaic cell , is an electrical device That converts the energy of light directly into electricity by the photovoltaic effect, which is physical phenomenon.

5.1.ADVANTAGES

1. Maximum efficience ~ 63%

5.2.DISADVANTAGES

1.They don't exists.
2. Completely theoretical to date
3.Lots of computational DFT studies
4.Expect real device soon!

6. APPLICATIONS

6.1. Hot solar cell in satellite.

Fig 6.1

6.2. Hot solar cell in Cars

Fig 6.2

6.3. Hot solar cell Rooftops in houses and industries.

Fig 6.3

7. REFERENCES

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